Effective Systems and Instructional Strategies for Mid-Level Mathematics Achievement

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Dedication

This work is dedicated to the people who have supported me throughout this long and challenging journey. It is because of their love, encouragement, and patience that I have been able to achieve my goals.

To my wife, Amy, who is my constant source of strength and inspiration. Your selflessness and unwavering support allowed me to complete this project to the best of my ability. Your love and sacrifice are the foundation of all of my success in this world. I would be nothing without you.

To my children, Katie and Neil, you are my everything. You have motivated me throughout this process and every single day since you entered my life. I dedicate this work to you, and I hope it will serve as a testament to the value of perseverance and the importance of education.

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Abstract

The Kiski Area School District has faced persistent challenges with low achievement on state standardized mathematics tests, particularly in grades five (5) and six (6). During the 2021-2022 academic year, 5th-grade math scores exhibited the most significant decline within the 3rd through 8th-grade band, showing a 37% decrease in proficiency from 4th to 5th grade. This trend was also observed statewide among participants in the Pennsylvania System of School Assessment (PSSA) exams, which saw a 6.9% decrease in proficiency from 4th to 5th grade for the 2022 testing period. Despite substantial efforts over the past five years to improve mid-level mathematics achievement, the district's results have remained minimal. This study aimed to identify effective strategies employed by high-achieving schools to enhance mathematics proficiency among 5th graders, especially those with learning disabilities and from economically disadvantaged backgrounds.

Utilizing quantitative data from the Pennsylvania Department of Education (PDE), three high-performing schools with at least a 60% proficiency rate on the 5th-grade mathematics PSSAs and a minimum of 20% economically disadvantaged students were selected. Qualitative data was then gathered through semi-structured interviews with school leaders to uncover the methods and processes that contribute to their success. The interviews revealed three key themes critical to improving student achievement in mid-level mathematics: the implementation of a guaranteed and viable curriculum aligned with state standards, a comprehensive assessment system that allows for early identification and remediation of learning deficiencies, and effective communication strategies to engage families in supporting their child's academic progress. These findings suggest that a strategic focus on curriculum alignment, assessment, and family involvement can have a significant impact on mathematical achievement.

CHAPTER I

Introduction

The purpose of this qualitative study is to research mathematical systems and instructional methods that are implemented in schools that have high levels of student achievement on standardized Mathematics assessments at the 5th grade level. State level results for PSSA mathematics have consistently shown that the most significant decrease in proficiency rates among students occurs at the 5th grade level. This data aligns directly with mathematics proficiency in the Kiski Area School District.

Background

Kiski Area is a rural district located in southwestern Pennsylvania that services approximately 3,500 students. It is comprised of three (3) K-4 Primary Schools, one (1) 5-6 Upper Elementary School, one (1) 7-8 Intermediate School, and one (1) 9-12 High School. Although the district has historically performed significantly above the state average for proficiency on English Language Arts standardized tests, it has failed to produce similar results in the area of Mathematics. This has resulted in many changes and initiatives that have had insufficient impact on the achievement of district goals for high levels of student learning.

In 2022, Pennsylvania state-level results for all students in mathematics showed a 6.9% decrease in proficiency from 4th to 5th grade. At Kiski Area, the negative change for this testing year was also the greatest between 4th and 5th grade, but to a much larger degree of 37%. In 2023, state-level results showed a larger decrease in proficiency from 5th to 6th grade at 6.3%, but still a substantial 3.7% decrease from 4th to 5th grade. The decrease among Kiski Area students from 4th to 5th grade was notably improved to 14%,

but still represented the largest decrease in mathematics proficiency across grade levels in the 3-8 student band. State and district data suggests that mid-level mathematics achievement is sub-par at the 5th and 6th grade level, and failure to meet state standards for mathematics has a lasting impact on the overall success of the Kiski Area mathematics department.

Capstone Focus

The Kiski Area Upper Elementary School, has been working with teams of math teachers to develop curriculum, resources, methods of instruction, common formative and summative assessments, intervention programs, and enrichment opportunities in an effort to increase academic achievement at the 5th and 6th grade levels. Although steady progress has been made over a three-year period, achievement in mid-level mathematics continues to fall well-below the state average in grade 5, and continues a decreasing trend in subsequent years. It is reasonable to believe that improvement at this level will significantly impact the mathematical success of students well beyond the 5th grade level. This action may initiate change that could have far-reaching possibilities.

The challenging factors at Kiski Area Upper Elementary School include an increasing special education population, an increasing economically disadvantaged population, and the transition of students from a self-contained classroom model at the primary level to an independent departmentalized secondary model at the upper elementary level. The entity configurations in the Kiski Area School District are unique when compared to many other districts across the commonwealth. While a K-5 primary school model accompanied by a 6-8 middle school is the most prevalent structure, a K-4 primary model accompanied by a 5-6 upper elementary and a 7-8 intermediate school are

employed at Kiski Area. Students from all three primary buildings integrate at the 5th grade level, and change schools for the first time in their academic careers. These two factors create a much more significant gap between 4th and 5th grade levels. Additionally, the large geographic make-up of the district (approximately 102 square miles) creates substantial barriers for professional collaboration across entities.

A research study that focused on high levels of academic achievement of 5th grade students on Math PSSAs took place from August 2023 to June 2024. This was a mixed method study that included quantitative assessment data obtained from the Pennsylvania Department of Education, specifically focusing on 5th grade mathematical achievement of special education students and economically disadvantaged students, as well as qualitative data obtained through formal interviews of school leaders who have obtained high mathematical performance at the 5th grade level.

Research Questions

This capstone study focused on the following research questions:

Question 1: What instructional strategies and methods do high performing schools employ to achieve high proficiency rates in mathematics among all students?

Question 2: What instructional strategies and methods do high performing schools employ to achieve high proficiency rates in mathematics among students who are economically disadvantaged?

Question 3: What instructional strategies and methods do high performing schools employ to achieve high proficiency rates in mathematics among students with learning disabilities?

Expected Outcomes

The capstone study provides the research for district review specific to mathematics curriculum, resources, and philosophy, as well as the evaluation of mathematical instructional practices that lead to high levels of student learning. The literature review provides research, strategies, and evidence-based models that the Kiski Area School District will utilize within the professional learning community process to support the continuous improvement of student achievement in mathematics.

Fiscal Implications

The financial implications of this capstone project were minimal. Pennsylvania System of Student Assessment data was obtained through the Pennsylvania Department of Education website and organized by the researcher. Structured interview questions were scripted and shared with district Superintendents to obtain formal permission to conduct research within the district. The interviews will be conducted with identified building leaders when formal consent is obtained. These in-person interviews should last approximately 20 minutes. There is a cost associated with taking the time to create, conduct, and analyze the data obtained through this study.

Summary

A quantitative review of student results on standardized mathematics assessments led to the examination of schools with historically high achievement in mid-level mathematics proficiency among economically disadvantaged students, students with disabilities, and the overall student population. A structured interview with the principals of these highly-successful schools will assist in obtaining qualitative data specific to the processes, structures, and instructional strategies and methods that are attributed to the

mathematical success of students. The overarching goal of this research study is to obtain relevant data that can be infused in the continuous cycle of improvement process to increase mathematics proficiency in the Kiski Area School District at the middle school level.

CHAPTER II

Literature Review

In 2002, the No Child Left Behind Act was passed by Congress and signed by President George W. Bush in an effort to bolster the competitiveness of the American education system on an international scale (No Child Left Behind, 2002). The result was an increase in the involvement of the federal government in monitoring schools across the nation for the academic achievement of all students. This law was later replaced with the Every Student Succeeds Act (ESSA) in 2015. In order to remain compliant with federal legislation regarding education and remain eligible for federal funding, school districts across the country were required to evaluate students in both mathematics and reading using standardized tests in grades three through eight. In the commonwealth of Pennsylvania, the standardized tests at these levels are called the Pennsylvania System of School Assessments (PSSAs), and the results of these assessments are reported to the state and made available to the general public through the Future Ready PA Index.

In addition to ESSA, the STEM Education Act of 2015 was also enacted to provide more professional development to education professionals related to science, technology, engineering, and mathematics and address the increasing number of STEM-related jobs in the United States at the turn of the 21st century. This has not only resulted in more focus on teaching problem-solving and analytical thinking skills, but it has also led to increased rigor in mathematical testing provided through standardized testing services such as the PSSAs. In turn, school administrators and teacher leaders have concentrated efforts to address K-12 mathematical systems and grade-level instruction to ensure student growth and high levels of proficiency in essential mathematics skills.

This chapter is organized into four main sections based on a review of the literature. First, mathematical instructional practices are analyzed to determine which pedagogical methods produce high levels of student achievement and in which contexts these practices are most effective. Second, district approaches and school systems are explored to determine what strategies currently exist to promote high levels of learning in the area of mathematics. Next, students with disabilities become the focal subgroup of the student population, and contemporary methods such as detracking and full inclusion in the general education curriculum are investigated. Finally, this chapter concludes with an analysis of the economically disadvantaged subgroup of students and the research on why this particular group of individuals is statistically more likely not to achieve in the current educational environment.

Mathematics Instruction

Didactical Suitability

In order to identify effective instruction, one must consider the many factors that impact teachers, students, and schools in which learning takes place. It is difficult to identify any one instructional method or practice that is better than another, mainly because so many teaching practices exist, and those specific techniques vary significantly from one teacher to the next. The instructional method alone does not have the greatest impact on student learning, but the combination of instruction and other essential variables has a much larger influence. The theory of didactical suitability is a holistic perspective that considers the contribution of multiple variables to optimize instruction. These factors include teaching, learning, and content, along with the affective environment and social environment to which students are exposed (Godino et al., 2023,

p. 14). The impact of instruction cannot be solely attributed to the teacher and the instructional practice, but rather all of the components of the teaching environment that formulate each individual child's perception (Brousseau, 1997).

Learning is the outcome desired by all teachers when instruction is provided; however, there are many factors for teachers to consider to obtain optimum results.

> The didactical suitability of an instructional process is the degree to which such a process (or a part of it) meets certain characteristics that qualify it as optimal or adequate to achieve the adaptation between the students' personal meanings (learning) and the intended or implemented institutional meanings (teaching), considering the circumstances and available resources (environment). (Godino et al., 2023, p. 4)

Particularly in the area of mathematics, the optimization of this process is vital not only to ensure that a connection is being made between a child's current reality and the meaning of the lesson but also to engage learners in the educational process itself, thus creating a feeling of satisfaction in doing so.

Pedagogical Practice

Instruction can take on many forms. In any scenario, the teacher must consider multiple factors to determine the approach that will achieve the desired result of student learning. Dell′Olio and Donk (2007) described instructional choices as "a spectrum, with lessons controlled by the teacher, such as direct instruction at one end, and increasingly indirect, open-ended lessons that focus on student exploration, such as the models of inquiry, at the other end" (p. 439). It is the judgment of the teacher or instructional team to decide which instructional model or combination of instructional methods is

appropriate; however, much consideration needs to be devoted to specific factors, including the content being taught, the research base supporting effective models by subject (i.e., math computation, reading comprehension, etc.), critical thinking skills needed, grade-level expectations, and overall student motivation (Dell′Olio & Donk, 2007, p. 440).

Considering the high standards set forth for mathematics in Pennsylvania and the need for increased proficiency in the mathematics discipline, it has never been more critical for teachers to implement the best instructional strategies that meet the needs of their students. Of all variables present in the educational process, teachers have the most control over their method and approach to instructional practice. Especially in the early years of mathematical instruction, it is crucial that teachers use the best pedagogical strategies to ensure high levels of learning and continued student growth. In Hattie and Zierer's (2018) research of over eight hundred performance influencers, the collective efficacy of teachers has the most significant impact on student success (p. 26). Collective efficacy is the shared belief of teachers in their ability to positively affect students. It is critical that teachers combine their knowledge and expertise and collectively decide that they can overcome current obstacles and limitations in the educational setting.

According to Clements et al. (2023), teaching strategies can either be educative or mis-educative based on their effectiveness in helping students obtain new knowledge and preparing them for growth in future experiences.

Knowledge of developmental paths in learning trajectories can enhance teachers' understanding of children's thinking, helping teachers assess children's level of

> understanding and offer instructional activities at the next level and thus offer meaningful and joyful opportunities to engage in learning. (Clements et al., 2023, p. 17)

Regardless of the instructional method chosen, it is critical that teachers have a vast understanding of the content that they teach and the individual needs of their students to ensure success at the current level of instruction, as well as readiness for the next level of instruction.

Guidance, Structure, and Feedback

Guidance and structure are two components of the instructional process that vary significantly from teacher to teacher, lesson to lesson, and student to student. This variance may be arbitrary or based on an informal assessment of student progress, but the intentional utilization of these two elements within an instructional lesson can have a significant impact on results. Horan and Carr (2018) define guidance as:

> The interaction between teacher and students, specifically, the amount of feedback teachers provide in response to students' questions and learning difficulties, the quantity and quality of teachers' responsiveness to students' questions and concerns, scaffolding provided by the teacher, and how often teachers ask students questions that are designed to cause students to think more deeply. (p. 4)

Horan and Carr (2018) go on to define structure as "the purposeful explicitness and organization of the lesson plan, curriculum, or materials for understanding" (p. 6).

In any given lesson, the degree to which students need guidance and structure will vary based on multiple factors. Two significant factors are the students' understanding of

the new information that is being presented, along with each individual's past educational experience and ability to make cognitive connections. Fyfe et al. (2012) specifically noted that teacher feedback in this process plays a central and invaluable role. "Feedback during exploratory problem solving prior to instruction facilitates learning for children with low prior knowledge of a domain. However, children with moderate prior knowledge benefit more from exploring independently without feedback before receiving explicit instruction" (p. 1107).

Feedback is any information provided that relates to student comprehension or performance. Specifically in the area of mathematics, Emily Fyfe and Sarah Brown conducted meta-analytic research on the effects of feedback on students between the ages of 6 and 11 years. The research focused on corrective feedback compared to no feedback when students were presented with math equivalence reasoning in multiple scenarios. The study concluded that

> Feedback had positive effects for low-knowledge learners and negative effects for high-knowledge learners, and these effects were stronger for procedural outcomes than conceptual outcomes. Findings highlight the variable influences of feedback on math equivalence understanding and suggest that models of thinking and reasoning need to consider learner characteristics, learning outcomes and learning materials, as well as the dynamic interactions among them. (Fyfe & Brown, 2018, p. 174)

Every individual continuously uses feedback to make decisions, guide their actions, and form their own reality. This feedback can be verbal, non-verbal, or paraverbal. Paraverbal is a term to describe information that is conveyed through the

tone, pitch, and pacing of verbal communication. From an educational perspective, when feedback is used, how it is used, and the degree to which it is used has a significant impact on student learning. Hattie and Timperley (2007) identified three main feedback questions that can be provided by teachers: "Where am I going? How am I going? Where to next?" These questions are imperative because the answers "enhance learning when there is a discrepancy between what is understood and what is aimed to be understood" (p. 102). Similar to the theory of didactical suitability, in which many variables contribute to effective instruction, feedback also requires much skill and consideration. The effectiveness of feedback

> Does not merely invoke a stimulus-and-response routine but requires high proficiency in developing a classroom climate, the ability to deal with the complexities of multiple judgments, and deep understandings of the subject matter to be ready to provide feedback about tasks or the relationships between ideas, willingness to encourage self-regulation, and having exquisite timing to provide feedback before frustration takes over. (Hattie & Timperley, 2007, p. 103)

Factors that Lead to Effective Learning

Many educators consider the relationships they build with their students to be critical in producing an internal interest in the subject matter, thus leading to higher levels of student achievement in that content area. This theory is often compelling to teachers because it is a major variable that contributes to both the affective environment and social environment that students experience. When considering the nature of the mathematics

discipline, data suggests that positive interactions between students and their teachers may have an adverse effect on the degree to which students enjoy mathematics.

Using the Australian model of Quality of School Life (QSL), which describes "the quality experienced by students in education places where they feel safe, good, and motivated," a study was conducted to determine what specific factors lead to enthusiasm for learning and satisfaction in mathematics (Aliyev & Tunc, 2015, p. 165). Winheller et al. (2013) conducted a detailed analysis of 336 elementary students and 272 high school students in New Zealand to determine if any relationships exists between students' quality of school life perceptions, students' attitudes to mathematics, and their effects on mathematical achievement (p. 49). The study data confirmed that an individual's interest in mathematics as a subject and self-efficacy directly contribute to why a student feels more or less confident with mathematical applications. Additionally,

> Factors of 'satisfaction with' and 'enthusiasm for learning' positively predicted liking of mathematics, while the perception of a caring teacher and positive peer interaction all negatively predicted liking of mathematics. Furthermore, the results showed that liking mathematics itself had negative or zero impact on mathematics performance. (Winheller et al., 2013, p. 63)

These strong correlations refute the notion that positive student-teacher relationships have a significant impact on overall student learning.

Reinvention

The traditional approach to teaching mathematics involves the explicit instruction of a method or algorithm followed by a commonly utilized application for what has been presented. The application is modeled using examples and the student is then expected to

replicate the application repetitively until mastery is achieved. In contrast to this deeply rooted philosophy of math instruction, Lai et al. (2019) explained that a learner-centered approach has proven more effective because it directly relates to the enthusiasm for learning factor, as described in Winheller's study. Lai concluded that "a shift in focus has led to a move away from teaching number computation as presenting algorithms created by teachers to engage students in investigative activities such as problem-solving to construct conceptual understanding for themselves. This shift redirects students learning from merely memorizing computation procedures…to supporting students to construct knowledge of the mathematics that underpins the concept and algorithm for themselves" (Lai et al., 2019, p. 1). She further explained that "the reinvention of mathematics by students is a basis for deeper understanding of the 'why' and also the 'how' of mathematics in solving" (Lai et al., 2019, p. 14).

Summer (2020) came to a similar conclusion when considering mathematical instruction at an early age. Her research emphasized the importance of skilled teachers and a focus on student-centered learning. "Up-to-date mathematics teaching requires teachers to have a profound knowledge of mathematics, didactic knowledge, and an awareness of possible difficulties" (Summer, 2020, p. 117). Summer further explains

> Teachers become active co-designers of future generations through their activities. They create settings in which pupils can transfer mathematical understanding across varied contexts and settings. The student-centered mathematical tasks allow children to develop an understanding of sustainability issues that enable them to take positive action in their daily lives. (Summer, 2020, p. 117)

The development of young mathematical minds through experimentation and inquiry generates enthusiasm for learning within the discipline. Research indicates that teaching for relational understanding also enhances skill development. Instead of spending a lot of time on drills, repeated experiences with various contexts and different types of activities help with generalization and transfer (Clements et al., 2023). When teachers focus on meaningful and enjoyable experiences for children, implemented pedagogical strategies provide the optimal level of guidance and structure, and consider the affective and social environments of the learning setting, they are better equipped to interpret what the child is doing, thinking, and constructing, and provide what is necessary to extend mathematical reasoning.

Mathematical Systems and Strategies

In 2014, the National Council of Teachers of Mathematics (NCTM) identified five interrelated strands that lead to mathematical proficiency. These strands include conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. When students are able to comprehend and connect math concepts, utilize meaningful and flexible procedures to solve problems, think logically, and justify their own thinking, they have "the tendency to see sense in mathematics, perceive it as both useful and worthwhile, believe that steady effort pays off, and see themselves as effective learners and doers of mathematics" (National Council of Teachers of Mathematics, 2014, pp. 7-8).

As discussed in the analysis of instruction that impacts student achievement in mathematics, there are a large number of factors that contribute to effective systems and strategies that have the potential to positively impact mathematical proficiency. This

section will focus on four specific systematic approaches that are commonly implemented with the intent of producing higher levels of student learning. These systems include the adherence to quality professional development, incorporation of instructional coaching, commitment to professional learning communities (PLCs), and the detracking of students based on perceived learning capacity and ability level.

Professional Development

All public schools in the United States of America require that certified teachers hold a bachelor's degree, and many also require the completion of a master's program within the first five years of teaching (All Star Directories, Inc., n.d.). In Pennsylvania, Act 48 of 1999 requires that all Pennsylvania teachers holding a public-school certification participate in ongoing professional education in the form of 180 continuing professional education hours in a five-year period (Pennsylvania Department of Education, 2023a). Additionally, Chapter 49.17 of the Pennsylvania code titled "Continuing Professional Education," requires that for strategic planning, a school must submit a 3-year professional education plan for approval every three years. Before the school board approves and submits the plan, it must be available for the public to review and comment on for at least 28 days. The plan should clearly define terms such as graduate-level courses related to the profession, relevant master's degrees, curriculum development, and professional conferences (Pennsylvania Department of Education, 2019).

It is clear that the professional development of school staff is significantly valued when state requirements of districts, schools, and certified teachers are identified. The collective consensus is that continued learning is essential to providing students with

high-quality teachers and proven instructional practices; however, there is much to be learned about what constitutes effective professional development that leads to sustainable results in the teaching profession.

Garet et al. (2011), based on the results of a two-year study, questioned the cumulative impact of professional development on teacher knowledge and student achievement, specifically on the mathematical topic of rational numbers. The study provided 68 hours of intensive professional development over the course of one year and an additional 46 hours of continued learning in the second year for each participating teacher. Students who received instruction from this selected group of teachers minimally outperformed students who did not receive instruction from trained teachers on a standardized math exam on the topic of rational numbers. The result of this research concluded that the professional development process implemented had no statistically significant impact on teacher knowledge or student achievement (Garet et al., 2011).

Similar to the conclusive results reported in the previous case study, an analysis of two groups of teachers who participated in a 3-day professional development session over the summer proved ineffective in changing the current pedagogical methods of participating teachers. Each session addressed a specific mathematical unit and provided an additional day of professional development prior to classroom implementation. The conclusion of the research suggested that teachers may need "long-term professional development to improve their support for mathematical argumentation practices" (Roschelle et al., 2010, p. 872). Much like the theory of didactical suitability that was described in the review of effective instruction, the impact of professional development

on teacher improvement and student achievement may be dependent on additional factors and circumstances.

Based on the results of the case studies provided, it is difficult to predict the success of a professional development plan based on the overall time devoted to the program. What may be a better predictor of success is the collective ownership, or buy-in, of the new strategies and/or philosophies that are being adopted (Garet et al., 2011). Were teachers and educational professionals involved in the research that led to the interested professional development? Do the professional development goals align with the district and school visions, as well as the beliefs and values of those who will be expected to implement newly attained knowledge? Will time be provided to plan, implement, and reflect on new methodologies addressed? Learning is the first step, but school leaders miss the mark to ensure implementation with a high level of fidelity.

Instructional Coaching

The utilization of instructional coaching in the educational process is a relatively new phenomenon. First introduced in the 1980s by Bruce Joyce and Beverly Showers, they asserted that professional development does not always transfer to classroom implementation. Instructional coaching gained traction at the turn of the 21st century with the passing of No Child Left Behind and the Reading First Initiative (Nugent et al., 2016).

As described in the previous section, professional development alone has shown little direct impact on improved teacher knowledge and increased student achievement; however, there are several studies that suggest instructional coaching may be a viable supplement to effective professional learning and sustainable implementation. For the

purpose of this review, we will focus our research on coaching in the mathematics discipline.

"A mathematics coach is an individual who is well versed in mathematics content and pedagogy and who works directly with classroom teachers to improve student learning of mathematics" (Hull et al., 2009, p. 3). Mathematics coaches fulfill a leadership role and provide assistance to teachers in the areas of professional development, mathematical content, teaching, and curriculum development; however, there is little data to suggest that the incorporation of a mathematics coach produces consistent positive change. The role of the instructional coach is still being examined, but a study by Campbell and Malkus (2011) demonstrated a correlation between higher achievement on standardized mathematics tests among students in schools that employed an elementary mathematics coach. In a period of three (3) years, five (5) school districts of varying demographics in Virginia identified two (2) to four (4) schools within their region to be part of the study. A total of 36 schools were involved in the study, and each school was randomly assigned to have a math coach or be part of the control group with no math coach. When standardized test scores were analyzed at the end of the 3-year period, the students enrolled in schools with mathematics coaches had significantly higher scores than the students in the control group. It was also determined that this difference was more significant in grades four (4) and five (5) than in grades three (3) and six (6). There was minimal correlation between math coach implementation and student achievement in years one (1) and two (2) of the study, suggesting that implementation of this strategy does not produce rapid results (Campbell & Malkus, 2011).

In a study by Russell et al. (2020), an instructional coaching model called the "Tennessee Math Coaching Approach" was analyzed to determine specific coaching practices that led to positive change and sustainable teacher improvement (p. 442). A selected sample of 32 individuals were trained in two different methodologies of instructional coaching, one being the Tennessee approach and the other a more generalized coaching approach for school reform. The Tennessee approach was a process of enhancing teacher skills to implement challenging mathematics tasks that encourage students to think critically about mathematical concepts, while the traditional approach trained coaches to assist teachers in the substitution of new teaching practices over traditional methods. Over a period of two years, all participating coaches received approximately 55 hours of training in their selected coaching model, and a final total of 103 teachers benefited from professional learning with the assistance of the trained instructional coaches. The conclusion of this research did determine that the Tennessee method was more impactful in improved instruction, but there were several factors within this model to which much of the success was attributed. It was determined that "when coaches had deep and specific conversations with teachers in the context of planning specific lessons – including attention to content, pedagogy, and student learning – teachers improved their capacity to maintain the cognitive demand of high-level mathematics tasks" (Russell et al., 2020, p. 459). In general, collaborative planning with an instructional coach, along with one-on-one reflection after implementation, significantly impacted the ability of a coach to build teaching capacity in the area of mathematics. This study produced specific components of effective instructional coaching, but there is additional research that highlights other characteristics.

Hull et al. (2009) identified six characteristics most associated with math instruction in current classrooms. These include teachers as the primary source of information, students as passive listeners, rigid instructional structure, the textbook as the primary curriculum, procedural assessments, and rules and procedures over mathematical reasoning. In contrast, "the desired traits of envisioned, highly effective mathematics classrooms" include empowered teachers, an established and implemented curriculum that is aligned to state standards, the use of multiple instructional strategies, actively engaged students, and frequent and formative assessment that is inclusive of feedback (p. 17).

Coaching is a process by which an experienced individual supports the development of learners to improve performance and reach professional goals. In the education profession, instructional coaching has shown promise in assisting teachers in their growth and progress. According to Knight (2022),

> Coaching is essential for the kind of growth we need to see in schools…workshops, books, and webinars can provide us with an overview of ideas, but we only adopt and internalize these ideas when we apply them to our professional practice…coaches help with each aspect of this kind of learning by partnering with teachers to establish a clear picture of reality, set emotionally compelling, student-focused goals, and learn, adapt, and integrate teaching practices that help teachers and students hit goals. (p. x)

With the proper balance of professional learning and instructional coaching, school improvement and student achievement are attainable.

Professional Learning Communities

> A professional learning community (PLC) is not a program but rather a continuous, never-ending process of conducting schooling that has a profound impact on the structure and culture of the school and the assumptions and practices of the professionals within it...an ongoing process in which educators work collaboratively in recurring cycles of collective inquiry and action research to achieve better results for the students they serve. (DuFour et al., 2010, pp. 10-11)

Professional learning communities involve regular, intentional collaboration of teachers and school leaders in the development of a guaranteed and viable curriculum, the strategic planning of instructional practices, administration and evaluation of common formative assessments, and the use of intervention and/or extension to address students based on proficiency. This is a repeating process that begins with the identification of agreed-upon essential skills by content or subject area and concludes with the extension of learning beyond what is expected or the reteaching of skills to ensure student proficiency (DuFour et al., 2010).

Robert Marzano, an advocate and researcher of professional learning communities at work, identified critical school- and teacher-level factors that impact student achievement. School-level factors include a guaranteed and viable curriculum, challenging goals and effective feedback, parent and community involvement, a safe and orderly environment, and collegiality and professionalism. Teacher-level factors include instruction, classroom management, and classroom curriculum design (Marzano, 2003). Marzano also identified student-level factors that impact achievement; however, many of

the factors, if not all, are beyond the control and influence of the schools and teachers that serve them.

A viable standardized curriculum is one that can be implemented in the time available for instruction. It is virtually impossible for educators to address all state grade-level standards in a single year, so teachers must make a clear distinction between what is essential content and what is supplemental content. Once the viable curriculum is established, teachers must be required to address the identified essential skills so that it is guaranteed for all students (Marzano, 2002).

Similar to Marzano's research in the identification of essential skills in the standardized curriculum, McTighe and Wiggins (2013) describe the importance of essential questions framed to help students come to an understanding of key ideas and processes associated with a concept or topic. This is in contrast to the most common types of questions used in the classroom that merely identify presented information or check for understanding. Although these non-essential questions serve a purpose and are often necessary for formative purposes, they often fail to stimulate further thinking, create discussion or debate, and/or require justification or support (McTighe & Wiggins, 2013).

Professional collaboration is invaluable to the advancement of student learning. It is through this process that curriculum is developed and implemented, essential skills and essential questions are identified and targeted, instructional strategies are created and executed with fidelity, formative assessments are administered and evaluated, student proficiency levels are determined, and targeted interventions can be applied to ensure that

all students learn. DuFour et al. (2010) identified four critical questions to guide this collaborative process:

1. What do we want students to know and be able to do?
2. How will we know if they have learned?
3. How will we address students who have not learned?
4. How will we extend the learning of those students who already know it?

The idea of professional learning communities first came about in the 1960s, and many business organizations across the globe currently use this collaborative model to improve productivity, efficiency, and overall customer satisfaction; however, from the educational standpoint by which the concept emerged, PLCs exist in pockets, and full commitment to this collaborative process is sporadic (Solution Tree, Inc., 2023). This is likely due to the substantial commitment of providing the time and creating a school schedule that allows for a daily focus on the continuous cycle of improvement. Many educational leaders agree that professional teamwork leads to better teaching and learning, but they are unwilling to complete the necessary research and fully implement the strategies required to achieve the results that PLCs offer. Those leaders who have pledged themselves to follow the PLC process with fidelity commit to the development of a new educational culture that focuses on what students are learning rather than what is being taught (DuFour et al., 2010).

Detracking

Detracking can be defined as the placement of students with mixed abilities and academic achievement in the same classes, with the intention of exposing all students to a high-quality curriculum (Culver City High School, n.d.). Teachers and school leaders

have minimal impact on the lives of students outside of the school. They can, however, do much within the school to ensure a level playing field by providing equal access to learning opportunities. Detracking, when implemented with fidelity, can significantly close the achievement gap between those who have access to resources and those who do not (Burris, 2010). Heterogeneous grouping also allows all students of varying ability levels the same access to a guaranteed and viable curriculum and high-quality teachers regardless of their social or economic status (Oakes, 1995).

"More and more educators are recognizing that low-track classes offer a watered-down set of educational opportunities and that denial of educational opportunity is an unacceptable abandonment of core American values" (Welner & Burris, 2006, p. 98). Years of tracking research supports that low-level, non-progressive courses should be phased out. Classes like general math and business English fail to adequately prepare students for postsecondary opportunities and are less effective than standard courses (Gamoran, 2009). "Low-track classes depress student achievement, causing students to fall further and further behind" (Welner & Burris, 2006, p. 93).

In order for detracking to be successful, academic support needs to be considered and provided for struggling learners in heterogeneous classes (Welner & Burris, 2006). The common practices necessary for successful mixed-ability settings are differentiated instruction, teacher response to struggling learners (intervention), and the use of resources to supplement instruction and adjust to the needs of individual students (Gamoran, 2009).

Boaler (2006) coined the phrase "relational equity" in his 2006 case study at Railside School, which is an urban high school in California. The 4-year longitudinal

study produced data showing that students not only increased achievement in mathematics through the use of mixed-ability grouping but also learned to appreciate students from different cultures, social classes, genders, and ability levels. The latter was achieved not through the study of past history and pertinent examples but rather through exposure to different insights, methods, and perspectives resulting from the collective problem-solving process (Boaler, 2006, p. 41).

A similar study was conducted on a much smaller scale at a diverse middle school in South Carolina. The Spartan Middle School services approximately 790 students in grades six through eight, and the sixth-grade math team at this entity piloted a differentiated instructional approach throughout the course of one school year. The class was made up of 18 total students of varying abilities and followed the model of full inclusion as outlined in the Individuals with Disabilities Act (IDEA). In the conclusion of this mixed research, it was determined that the differentiated instruction provided throughout the course resulted in increased student learning as well as positive changes in students' attitudes toward the mathematics discipline. When final exams were administered at the conclusion of the course, 81% of the students showed substantial growth. Additionally, the results of a student survey showed that 87% of the students in the class preferred the new class structure when comparing it to the traditional classes they experienced in the past (Patterson et al., 2009).

Students with Disabilities

Similar to the research on the detracking of students, studies on the effect of curriculum on students with disabilities significantly show that the lack of exposure to high standards of learning and lower expectations of student performance result in lower

levels of student achievement (Blank and Smithson, 2014). Although there is much to consider for students with identified learning deficiencies, their educational experiences have a significant impact on their progress, as well as their access to future opportunities.

Lower Standards

Math instruction for special needs students tends to take on a different focus from the education provided to general education students. Many students are losing out on a meaningful mathematical education because they qualify for special education services. Providing a rudimentary, watered-down curriculum for students with learning disabilities, absent of critical thinking skills and higher-order thinking, is not the best solution for the achievement of basic mathematical skills (Ballin et al., 2022). Instead, educators need to consider resources and professional learning that enable them to instruct a wide range of student learning needs.

"Empowerment Math" is a phrase used by Ballin et al. (2022) to describe access to higher-level thinking. This is the opposite of math instruction as a routine of providing examples, completing problems, reviewing material, and moving on to the next topic. The suggestion is to incorporate ten specific principles into daily math instruction that encourage students to think critically and become intrinsically motivated within the mathematics discipline. These principles are referred to as the "Nine + One Principles:"

1. Find multiple ways of teaching one concept.
2. Use conceptual mathematics instruction in the primary years of education.
3. Remain open to multiple modalities of different learners.
4. Develop a mindset of connections.
5. Integrate complementary concepts and procedures.

6. Choose numbers deliberately to allow easy access.
7. Scaffold to give access and build independence.
8. Affirm students' strengths and address misconceptions.
9. Explicitly teach math language with visuals.
10. Provide professional development to support teachers in this process. (Ballin et al., (2022)

As with any effective instruction, a commitment to student engagement and real-world functionality is essential for creating a mindset of connectivity. This should not be lost when providing the modifications, adaptations, and intervention strategies necessary to meet the needs of students with learning disabilities. It is critical to maintain the perceived value of learning if long-term growth and achievement are to be sustained.

Misconceptions and Inadequate Training

One of the most overlooked aspects of special education is the lack of training that teachers receive in the area of individualized student services (Hutchison, 2018). Considering the onset, the average aspiring teacher has had little exposure to special education in their academic career. It is often an eye-opening experience when these individuals first encounter a clinical experience in which special education students are integrated into the general education classroom and supporting teachers share their responsibilities of following individualized education plans and 504 agreements. Hutchison (2018) states:

> Pre-service teachers often need their tools of the trade sharpened and periodically recalibrated in order to be capable of registering true reality, as opposed to their culturally- or societally-induced realities...because in classrooms all over the

> world, the lives of millions of real students depend on, and are determined by, the perceptions of teachers who often use mids-calibrated instruments to determine their psychological, social, and economic futures. (p. 113)

For this reason, it is critical that the development of young teachers and the continued education of current teachers include an extensive focus on the practices and strategies necessary to address the learning of students with disabilities and the understanding of individualized needs.

Standards-Aligned Curriculum

The importance of a standardized-aligned curriculum that is guaranteed and viable must not be overlooked when considering special education. Blank and Smithson (2014) conducted a research study that included approximately 300 teachers in 50 sample schools across three states in the U.S. The focus was to examine the extent to which each school's curriculum was aligned to the standards required and the fidelity by which each school's instruction aligned to the intended curriculum. The results indicated that at the middle school level, instruction reported by teachers for both general and special education students:

> Did not closely align to state content standards, both in the distribution of instructional time by topic and in the expectations of learning that are emphasized. However, the analysis did show that a greater degree of instructional alignment to standards did have a positive impact on student achievement...which hold for both regular standards and extended standards for students with disabilities. (p. 143)

Additionally, schools that provided inclusive practices for special education students had a positive impact on those students; however, the majority of schools analyzed identified instructional practices in which students with disabilities received less instructional time and more time on test preparation. The result of this was lower achievement on state standardized tests.

Role and Importance of the IEP Team

Even if a school system is in place to provide a standards-based curriculum to all students, inclusive of those with disabilities, there is essential work that must be addressed by those responsible for the education of students in need. Members of the IEP team must examine the general education curriculum to determine what is expected of students and to determine if IEP goals can be constructed to ensure that each student can eventually demonstrate proficiency in those areas. Present levels of academic achievement and functional performance must also be established in order to determine necessary interventions to address gaps in learning. If these items can be addressed appropriately, students with disabilities can benefit significantly from inclusion in the general education classroom (Nolet & McLaughlin, 2005).

The impact of a student's disability on achievement is often obvious and easily addressed; however, "one of the most persistent problems that IEP teams face is that often it is very difficult to separate the direct impact of disability from other factors that impact school performance, such as language, class, previous educational opportunity, culture, or various family factors" (Nolet & McLaughlin, 2005). As a result of this, IEP teams have been encouraged to focus on students' response to intervention (RTI) in the

general education classroom when determining if an evaluation is necessary for special education services.

Determining a special education student's progress in the regular education classroom is most effective when using an individual referencing assessment. Rather than comparing each individual student to the progress of other students in the classroom (norm referencing), it is more meaningful to monitor the progress that the student has made over an educational period.

> Individual-referenced decision making involves systematic comparisons of students' current work with their previous performance. Individual-referenced evaluation often is referred to as 'formative evaluation' because the effects of instruction are evaluated on an ongoing basis rather than after all instruction has been delivered. (Novlet & McLaughlin, 2005, p. 70)

When this is done effectively, members of the IEP team can determine if the student is making progress and, if not, what changes and/or interventions are necessary to produce the desired educational outcome.

Economically Disadvantaged Students

Each fall, Pennsylvania teachers and school leaders finally have the opportunity to review student growth on state-standardized mathematics assessments from the previous academic year. It is this time of year that the Pennsylvania Value-Added Assessment System (PVAAS) releases growth data for each student and school personnel can easily review each student’s progress and the success of the previous year’s instruction on subgroups of students such as minority, special education, and economically disadvantaged status.

The economically disadvantaged subgroup consists of students who qualify for the federal free and reduced lunch program as a result of their family income level. The growth of economically disadvantaged students is a major consideration for teachers and administrators, and it is often used as a measuring stick for the overall effectiveness of the school's instructional programs. These students, along with students in the aforementioned subgroups, are the individuals in most need of the resources and instructional expertise that our schools provide. Moderate to high levels of growth evidence in one or more of these subgroups often correlates with a successful academic year from a leadership perspective.

Family Income and Academic Achievement

Brooks-Gunn and Duncan (1997) concluded that family income has a significant impact on the well-being of children. This factor significantly affects ability and achievement rather than emotional development and stability. There is a distinct correlation between the timing of poverty and how this impacts educational success and school completion. Students who experience poverty early in life have less chance of school completion than those who encounter this situation in the latter stages of their educational experience (Brooks-Gunn & Duncan, 1997). This data suggests that early intervention strategies can have a strong impact on the future success of economically disadvantaged children.

Family intervention can also be impactful in addressing the economically disadvantaged. Although educators rarely consider home life when determining how to address academic success because of its elusive nature, increasing parental involvement in a child's education will likely have a significant effect on the perceptions of children

and the value that they place on their educational experience (Brooks-Gunn & Duncan, 1997). Although this theory of family intervention is not necessarily specific to the student, school districts frequently look at ways to engage families and provide support to members of the community through the comprehensive planning process. Many early intervention programs exist outside of the school district's scope of responsibility, but the preparedness of incoming students at the kindergarten level has a crucial impact on future success. It is reasonable for districts to consider all factors that contribute to the well-being of students, and with strong evidence suggesting that early life poverty is a major predictor of educational success, this phenomenon should not be overlooked.

A meta-analysis conducted on socioeconomic status and academic achievement consisted of over 100,000 students, 6,800 schools, and 128 school districts (Sirin, 2005, p. 432). The results of this study showed a moderate correlation between socioeconomic status and academic achievement at the student and family level and a stronger correlation between status and academic achievement at the school level. Family economic status determines the resources that are available to children in the home and outside of the school environment, the "social capital" necessary for children to succeed in the school setting, and the kind of school to which students have access. School districts with a higher socioeconomic demographic were found to have better instructional arrangements and materials, more qualified and experienced teachers, and a lower student/teacher ratio. Additionally, both family and school impact the quantity and quality of relationships between school personnel and parents of economically disadvantaged students (Sirin, 2005).

Value Assessment

In a study conducted by Hentges et al. (2019), data supported the theory that children of low economic status continuously make value assessments based on their current reality and they tend to perceive learning mathematics as a costly undertaking. This likely contributes to a lower level of student achievement in this course of study. However, economically disadvantaged students do not necessarily have less interest in mathematics or the belief that mathematics is unimportant. Traditional instructional methods for mathematics that do not adhere to the empowerment math philosophy often rely heavily on "skill and drill" for math practice (Ballin et al., 2022). Often this practice takes on the form of frequent and lengthy homework assignments so that students can get additional application practice outside of the school day. In these scenarios, when students have difficulty understanding mathematical concepts, completing homework can be a more than tedious task that requires substantial time and effort with minimal results (Ballin et al., 2022). For this reason, specific interventions that target value perceptions and unguided practice may be the key to engaging underprivileged students in the mathematical classroom and lead to increased overall achievement.

Expectancy Value Theory (EVT) generally refers to the expectancy of successful completion of a task based on the perceived value of the task itself. Guo et al. (2015) attempted to use this theory to examine how variables such as gender and socioeconomic status predict self-concept values and task values. The belief was that these two values have a direct impact on an individual's mathematical achievement and educational ambition. A sample of over 5,000 8th-grade students was surveyed using a student-background questionnaire in which motivational items on the survey were answered

using a four-point Likert scale. The data produced suggested a strong correlation between socioeconomic status and educational aspirations. Students of higher socio-economic status had higher expectations for themselves from an educational perspective, and students of lower socio-economic status had lower standards. There was also significant data to suggest that lower socioeconomic status had more of a negative impact on male students than it did on the female gender (Guo et al., 2015).

Compulsory School Attendance

Pennsylvania mandates that every child between the ages of 6 and 18 must comply with compulsory attendance requirements. Compulsory attendance refers to the mandate that all school-aged children having a legal residence in Pennsylvania must attend a day school in which the subjects and activities prescribed by the standards of the State Board of Education are taught in the English language, except in situations outlined in the Pennsylvania Public School Code (Pennsylvania Department of Education, 2023b). It is generally understood from a legislative and operational standpoint that the presence of students in school is necessary for sustained academic achievement and successful completion of the secondary school experience.

In the study by Morrissey et al. (2014), it was noted that absenteeism is a recurrent characteristic of low-income students that significantly contributes to academic difficulty. This is a common problem that has been identified by schools, teachers, and district leaders and has led to intervention programs aimed at increasing attendance for all students. There is a direct correlation between time devoted to learning and the exposure of students to the curriculum and instructional practices that expand their knowledge and problem-solving capacity. Although the data in this study was inconclusive, it is

reasonable to expect that lower rates of attendance among economically disadvantaged students will contribute to a lack of achievement. Particularly in the mathematics discipline, many applications and processes that are introduced build upon previous knowledge and prerequisite skills. When a child misses school, it is often a priority, especially in mathematics, to provide supplemental instruction to compensate for the time lost and backfill the information that was unobtained by the student during the absence. This becomes a compounding problem when absences are frequent and/or consecutive.

Getting students to the school, supplying them with the basic resources to be healthy, alert, and attentive, providing for their individualized educational needs, and knowing their strengths and values, are the main identified components for the success of economically disadvantaged students (Morrissey et al., 2014). Although it may seem trivial, these identified elements are the first step to ensuring educational equality for those who are underprivileged.

Mixed Results and the Need for Future Study

The conclusions of the research studies in this literature review do not provide a definitive direction for the school leader who desires to make research-based decisions to create the most effective school system and provide the best instructional strategies for the achievement of all students in the mid-level mathematics discipline. While this can create a sense of frustration as school leaders face the increasing demands of government mandates to increase student achievement in a relatively short period of time, there is value in following the leads created by previous researchers and narrowing the focus to a particular area of need.

In Pennsylvania, proficiency scores on state standardized math exams significantly decline from grade four to grade five in the vast majority of schools across the Commonwealth. This trend continues in subsequent years until students cease participation in the Pennsylvania System of School Assessments (PSSAs) and move on to the Algebra I Keystone exams. Furthermore, mid-level mathematical skills are essential for application beyond secondary education and for practical use in job-related fields. With a growing number of STEM-related jobs and careers in the United States, it is crucial to overcome this lapse in mathematical achievement and reset the continuous cycle of improvement with a commitment to mathematical growth and proficiency moving forward.

Summary

This chapter began with an introduction outlining the various reform initiatives by the government that have resulted in frustration for school teachers and leaders who are tasked with increasing student achievement. Although this is an interest in all core content subjects, the English Language Arts, Mathematics, and Science disciplines are of particular concern to district leaders because schools are formally evaluated on the performance of their students on state-mandated standardized assessments. Research-based pedagogical practices and knowledge of developmental paths combined with the appropriate use of guidance, structure, and feedback are viable methods for teachers to provide students with the best possible instruction that schools have to offer. Secondly, a commitment to professional learning communities inclusive of the daily collaboration of teachers and instructional teams, along with meaningful and ongoing professional development, can support a guaranteed and viable curriculum for all students. Third, a

comprehensive understanding of the needs of students with IEPs and the adherence to high learning standards for every student can maximize academic growth regardless of disability. Finally, a concerted effort to provide underprivileged students with resources and help them find value in the daily learning that occurs within our schools will greatly contribute to closing the achievement gap and overcoming the statistical probabilities of future economic success. A commitment to addressing these four critical areas in the education profession will have a substantial impact on the achievement rates of students in a standards-based educational system.

CHAPTER III

Methodology

This chapter describes the design and methods of data collection used to identify high-achieving schools in the area of 5th-grade mathematics proficiency on state standardized tests and determine what school systems and instructional practices are most attributed to success. Public data was obtained and organized to identify elite groups of schools, and demographic information was referenced to select individual schools that most aligned to the researcher's home district. A series of structured interview questions were then created based on the literature review to support the collection of qualitative data from three high-achieving schools. The data was analyzed to determine common themes, practices, and systems that school leaders implement and attribute to high-levels of student proficiency on standardized mathematics assessments.

Purpose

The purpose of this study was to examine the relationship between school systems and instructional methods and their impact on student achievement on state standardized tests for mathematics as measured by the Grade 5 Pennsylvania System of School Assessment (PSSA) in the Commonwealth of Pennsylvania. Further, this study analyzed the impact on the achievement of students identified as economically disadvantaged or having identified learning disabilities. This research is relevant as school districts in Pennsylvania are searching for meaningful systems and strategies to increase student achievement in the area of mid-level mathematics.

The research method utilized in this study was a mixed method strategy aimed to investigate factors influencing 5th-grade mathematics proficiency in Pennsylvania by combining quantitative data from the Pennsylvania Department of Education with

qualitative insights gathered through interviews with principals from three high-achieving schools in the state. The quantitative analysis involved examining state standardized test scores and demographic information to identify high-achieving schools in the area of mathematics among 5th-grade students. Concurrently, qualitative interviews with the principals and leaders of these schools explored perceptions of effective teaching practices, curriculum design, student support systems, and overall school culture that influences high levels of mathematical learning. By triangulating these data sources, the study sought to provide a comprehensive understanding of the factors contributing to mathematics proficiency and offer insights into potential strategies for improvement.

Mathematics proficiency is a critical aspect of a student's education, influencing their academic success and future career opportunities. Recognizing the significance of this, educational institutions constantly seek effective strategies to improve math proficiency among their students. This research project aims to investigate the school systems and instructional strategies implemented by building principals and school leaders to enhance student math proficiency.

This study is relevant to the researcher because mathematics proficiency on standardized tests have been historically low at the 5th-grade level in the Kiski Area School District. This is coupled with the fact that the most significant drop across grade levels historically occurs from the 4th grade level to 5th grade level. The decreased rate of proficiency continues in subsequent grades until the 8th grade year when students are no longer required to take the Pennsylvania System of Student Assessment (PSSA) exams. Table 1 illustrates mathematical proficiency rates in grades 3-8 in the Kiski Area School District on the 2021-2022 PSSA Math exams.

Table 1

Kiski Area School District PSSA Math Proficiency by Grade Level, 2021-2022

2021-2022 Math Proficiency (PSSA Exams)								
3rd Grade			5th Grade			7th Grade		
	Percentage	Total Adv/Prof		Percentage	Total Adv/Prof		Percentage	Total Adv/Prof
Advanced	26.74%		Advanced	7.73%		Advanced	6.02%	
Proficient	38.37%	65.12%	Proficient	24.46%	32.19%	Proficient	16.87%	22.89%
Basic	22.87%		Basic	45.49%		Basic	36.55%	
Below Basic	12.02%		Below Basic	22.32%		Below Basic	40.56%	
Total			Total			Total		
4th Grade			6th Grade			8th Grade		
	Percentage	Total Adv/Prof		Percentage	Total Adv/Prof		Percentage	Total Adv/Prof
Advanced	25.62%		Advanced	7.20%		Advanced	1.16%	
Proficient	42.98%	68.60%	Proficient	17.60%	24.80%	Proficient	20.46%	21.62%
Basic	19.42%		Basic	36.40%		Basic	36.29%	
Below Basic	11.98%		Below Basic	38.80%		Below Basic	42.08%	
Total			Total			Total		

Note. Table 1 shows the largest difference in proficient and advanced scores on the PSSA Math exams occurred between the 4th-grade cohort and the 5th-grade cohort of students. The percentage change in overall proficiency for the 2021-2022 school year was 36.41%. This negative difference continued in grades 6, 7, and 8, but at a much lesser rate.

The Kiski Area School District is made up of three (3) K-4 Primary Schools, one (1) 5-6 Upper Elementary School, and one (1) 7-8 Intermediate School. It has a total district enrollment of approximately 3,384 students, and has a geographic size of 104.96 square miles.

It was noted throughout this research project that this district structure is unique when compared to other district structures across the commonwealth of Pennsylvania. The majority of school districts observed in the research process implemented a system in which 5th-grade students were incorporated at the primary level. Middle school models tended to incorporate 6th-grade students in their youngest grade level.

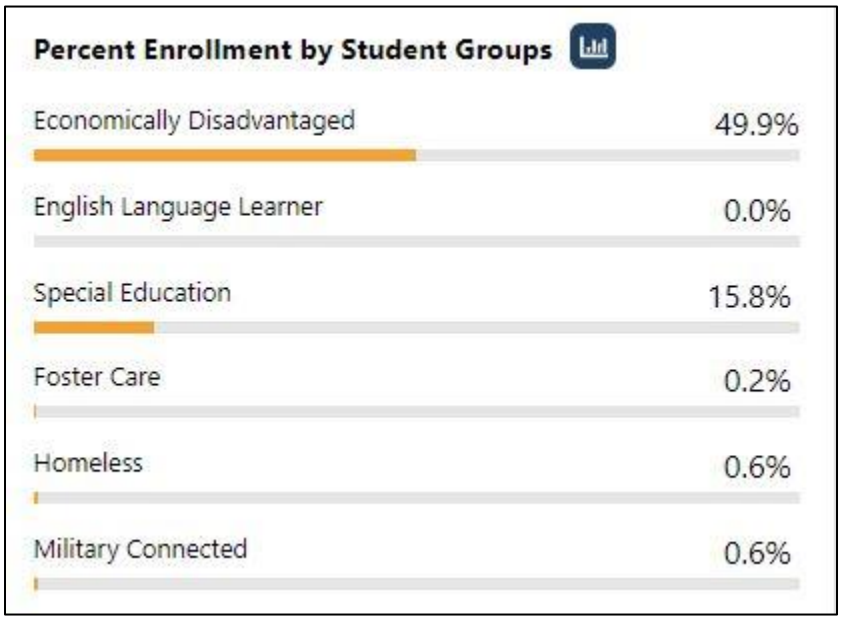
Setting and Participants

The setting of this research study was determined by the demographic make-up of the researcher's home school district. It was essential to identify specific data points such

as total student population, percentage of economically disadvantaged students, and percentage of students with learning disabilities in order to compare student achievement across districts and school entities in a meaningful manner. When high-achieving schools were identified using the yearly results published on the Pennsylvania Department of Education website, the Future Ready PA Index was utilized to identify the demographic make-up of those schools and determine if enough similarity existed to classify those schools as candidates for further research. Table 2 illustrates the percentage of students enrolled in the Kiski Area Upper Elementary School by state-identified subgroups.

Table 2

Kiski Area Upper Elementary School Percent Enrollment by Student Groups, 2023-2024 (Future Ready PA Index, 2023a)



Note. Table 2 shows the significant percentage of students enrolled at Kiski Area Upper Elementary School who are considered economically disadvantaged (49.9%), and the percentage of students receiving special education services at 15.8%.

It was determined by the researcher that the process of school identification should be limited to three (3) specific schools with comparable demographic data to that of the researcher's home district and school. The reason for this was to ensure an in-depth analysis of qualitative data obtained from a limited number of schools rather than a less comprehensive examination of a larger entity sample. It was also determined that meeting demographic parameters set by the researcher significantly limited eligible schools when considering a minimum level of mathematical proficiency that schools must exhibit. This led to the creation of specific criteria that was used to categorize and sort schools that correlated most with the researcher's home district.

The process of school identification was based on the following criteria: 1) The school must service students enrolled in 5th grade. 2) The school must serve an economically disadvantaged population that exceeds 20% of its enrollment. 3) 5th-grade mathematics proficiency must exceed 60% on the 2022-2023 state standardized mathematics assessment. These conditions led to the selection of three elementary schools in the state of Pennsylvania that became the target of qualitative research in this study.

Research was conducted in three elementary schools from three different school districts in Pennsylvania. The subjects of this project were building principals or district leaders who are directly involved in the leadership of student learning in the selected entities. The researcher submitted a plan to each district's superintendent and obtained a written letter of approval to conduct research in the identified schools.

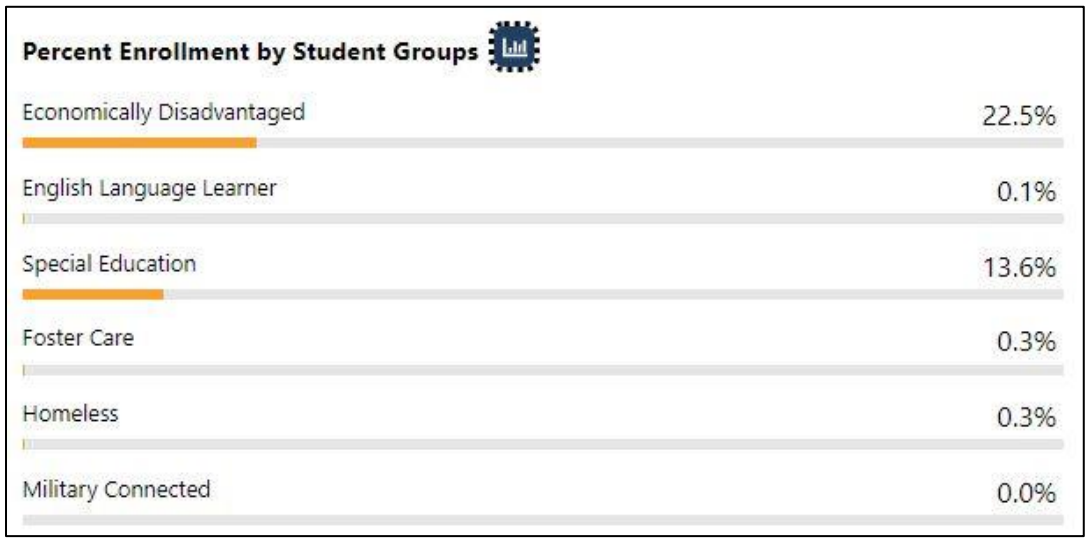
Based on the literature reviewed in Chapter II, student achievement in mathematics is highly impacted by instructional methods and systematic processes that

can vary greatly from one educational organization to another. In order to explore these phenomena across multiple organizations, specific questions were developed that align the information obtained in the literature review process as well as the research questions that are the focus of this study. These questions made up a semi-structured interview proposal that was submitted to Internal Review Board (IRB) of Penn West University and approved for implementation in September of 2023.

The first school (School A) in this study was a K-5 elementary school located in Southwestern Pennsylvania. Although the district in which this school is located has a significantly different socio-economic population when compared to that of the Kiski Area School District, the geographic setting, overall student population, and the percentage of special education students serviced made this school a valid selection, especially considering its historic success in exceeding mathematics proficiency standards at the 5^{th} grade level. School A's district consists of five elementary schools (grades K-5), two middle schools (grades 6-8), and one high school (grades 9-12). It has a total district enrollment of approximately 3,879 students, and has a geographic size of 34.02 square miles. Table 3 illustrates the percentage of students enrolled in School A by state-identified subgroups.

Table 3

*School A Percent Enrollment by Student Groups, 2023-2024 ((*Future Ready PA Index, 2023b)

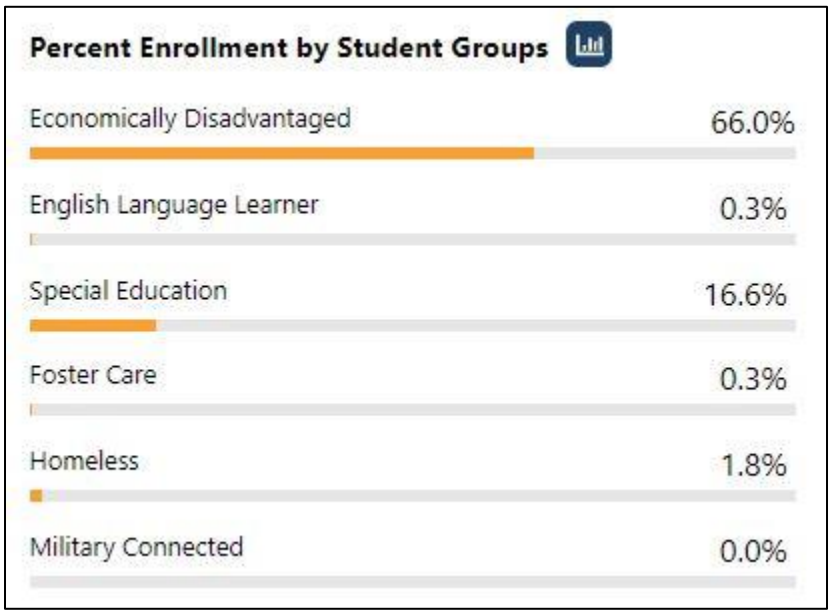


Note. Table 3 shows the percentage of students enrolled at School A that are considered economically disadvantaged is 22.5%, and the percentage of students receiving special education services is 13.6%.

The second school (School B) that was identified for the purposes of this study was another K-5 elementary school located in Western Pennsylvania. Although this school had a significantly smaller population when compared to the Kiski Area Upper Elementary School, the state-identified student groups aligned very closely with that of the researcher's home school, and the geographic setting was also very similar. School B's district consists of one elementary school (grades K-5), one middle school (grades 6-8), and one high school (grades 9-12). It has a total district enrollment of approximately 713 students, and has a geographic size of 11.95 square miles. Table 4 illustrates the percentage of students enrolled in School B by state-identified subgroups.

Table 4

School B Percent Enrollment by Student Groups, 2023-2024 (Future Ready PA Index, 2023c)



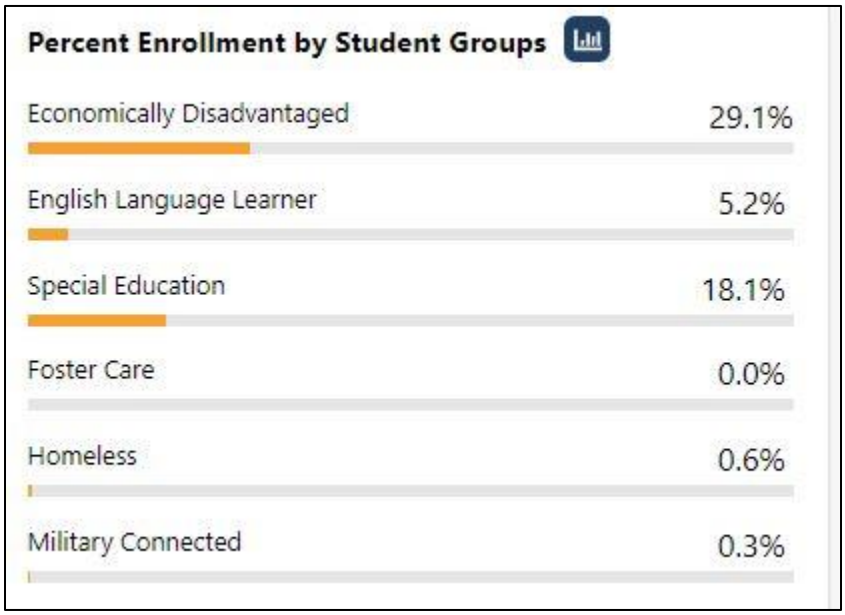
Note. Table 4 shows the percentage of students enrolled at School B that are considered economically disadvantaged is 66.0%, and the percentage of students receiving special education services is 16.6%.

The third and final school (School C) that was identified in this research project was a 2-5 elementary school located in Southeastern Pennsylvania. School C's geographic make-up is the main outlier when compared to Kiski Area Upper Elementary School because it is in a more urban setting; however, socio-economic and special education data aligned effectively with that of the researcher's home district. School C's district consists of one literacy center (grades K-1), one elementary school (grades 2-5), one middle school (grades 6-8), and one high school (grades 9-12). It has a total district enrollment of approximately 4,390 students, and has a geographic size of 6.7 square

miles. Table 5 illustrates the percentage of students enrolled in School C by state-identified subgroups.

Table 5

School C Percent Enrollment by Student Groups, 2023-2024 (Future Ready PA Index, 2023d)



Note. Table 5 shows the percentage of students enrolled at School C that are considered economically disadvantaged is 29.1%, and the percentage of students receiving special education services is 18.1%.

Research Plan

The researcher utilized a mixed method approach to complete the research outlined in this doctoral capstone project and address the identified research questions. The researcher submitted a plan to the Internal Review Board (IRB) of PennWest University and this plan was accepted and approved on September 14, 2023 (Appendix A). The quantitative research in this project involved the collection of state assessment data from the Pennsylvania Department of Education website to identify grade-level

proficiency rates in mathematics proficiency, and determine the most significant change in student achievement across grade levels. Table 6 illustrates a comprehensive view of mathematical proficiency on state standardized math assessments across all schools in the state of Pennsylvania that participated in these assessments during the 2021-2022 school year.

Table 6

2022 PSSA Math Results, Grades 3-8 (Pennsylvania, 2023)

Grade	Total Number	% Advanced	% Proficient	% Basic	% Below Basic	% Proficient and Above
3	114714	20.9	26.9	23.4	28.9	47.7
4	114822	17.0	25.3	26.8	30.9	42.3
5	116489	12.2	23.3	33.5	31.1	35.4
6	115844	13.3	18.9	28.8	38.9	32.3
7	118357	9.7	17.4	30.0	43.0	27.0
8	119039	6.8	15.7	27.1	50.3	22.6

It was observed by the researcher that the 2021-2022 results showed the most significant decrease in proficiency across grade levels occurring at the 5th grade level. Although the last column in the table shows a pattern of decreasing proficiency from each grade level to the next, the 6.9% decrease in the percentage of proficient and advanced students from grade 4 to grade 5 is the most extensive in this data set.

It was also observed at the researcher's home district level that mathematical proficiency at the 5th grade level for state standardized tests has been historically dismal and stagnant over a five-year period of time. Table 7 illustrates the percentage of students proficient and advanced on the yearly PSSA exams from the 2017-2018 school year to the 2022-2023 school year.

Table 7

Kiski Area Upper Elementary Math PSSA Results Since 2018

5th Grade Math PSSA Breakdown (2023)			Overall				
KAUE Overall Proficient/Advanced (2023)							
Proficiency (State):	Students Tested: 249		Yearly Comparison				
	Total Students: 255	% Participation: 98%	% Prof/Adv				
Reporting Category:	Proficiency by RC:	Students Prof/Adv:	2018	2019	2021	2022	2023
Numbers and Operations in Base 10	7	171	55%	49%	28%	50%	69.00%
Numbers and Operations (Fractions)	8	58	38%	52%	23%	18%	23.00%
Operations and Algebraic Thinking	4	151	52%	59%	34%	42%	61.00%
Geometry	4	126	64%	51%	29%	63%	51.00%
Measurement and Data	5	119	40%	37%	19%	36%	48.00%
Total		A+P =	42%	46%	20%	32%	42.97%

Note. Table 7 also shows how the Kiski Area Upper Elementary School breaks down proficiency by each reporting category present on the standardized exam for the 2022-2023 school year. Highlighted values show the tested year along with the overall proficiency rate for that year. It is also notable that a 32% overall proficiency rate was recorded for the 2022 testing year. This falls below the 35.4% average proficiency rate of all 5th grade students in the commonwealth of Pennsylvania that were administered the exam in 2022.

The quantitative data obtained in this process led the researcher to develop research questions surrounding the phenomenon of decreased mathematical proficiency at the 5th-grade level, not only from the comprehensive perspective of the state of Pennsylvania, but also locally within the researcher's home district. Furthermore, the demographic make-up of the researcher's home district contributed to the need for additional inquiry based on a significant percentage of students making up the economically disadvantaged and students with learning disabilities subgroups within the targeted school. The research questions established as a result of the review of literature and the quantitative analysis are:

Research Question 1

What instructional strategies and methods do high-performing schools employ to achieve high proficiency rates in mathematics among all students?

Research Question 2

What instructional strategies and methods do high-performing schools employ to achieve high proficiency rates in mathematics among students who are economically disadvantaged?

Research Question 3

What instructional strategies and methods do high-performing schools employ to achieve high proficiency rates in mathematics among students with learning disabilities?

The final quantitative approach used in the research process was implemented to determine which three (3) schools in the state of Pennsylvania significantly exceeded the average proficiency standards documented by the Pennsylvania Department of Education for the 2021-2022 school year as outlined in Table 6. This was accomplished by downloading the "2022 PSSA State Level Data" spreadsheet that is public and made available on the Pennsylvania Department of Education Website (Pennsylvania Department of Education, 2023c). The data showed the results of all standardized testing for every public school in the state of Pennsylvania that participated in the Pennsylvania System of Student Assessments (PSSAs) for the 2021-2022 school year, and included more than 1,400 schools across the Commonwealth. This spreadsheet was sorted by grade, subject tested, percent proficient overall, percent proficient economically disadvantaged, percent proficient special education, and district name to determine high-performing schools based on those criteria. The PSSA State Level Data spreadsheet was

also valuable in organizing data to determine high-achieving schools among students with low socio-economic status and students with learning disabilities.

Once three schools were selected based on their high levels of achievement in mathematics and similar demographic make-up to that of the researcher's home school and district, the next step was to recruit administrative participants from these schools for participation in a semi-structured interview. The individuals identified in this process were principals and school or district leaders directly involved in the implementation of math curriculum and instruction. The organization and specific questions used in the interview are described in detail in the next section of the methodology, but the main purpose of the interview was to obtain data from each school related to mathematical systems and instructional practices that lead to high levels of student achievement on math standardized assessments. Because the researcher's home school and district achieved results below the state average for mathematical proficiency on the 2021-2022 PSSAs starting in grade five (5), the main goal was to identify similar strategies, programs, and overall operations used by successful schools that could be implemented by the Kiski Area School District to improve student achievement. Success in this area will be measured by a tangible and steady increase in the percentage of students who achieve an advanced or proficient score on the PSSAs in future testing years.

Methods of Data Collection

The method of data collection involved a comprehensive process for obtaining permission to conduct educational research across three (3) distinct school districts in Pennsylvania. As referenced throughout this section, the three (3) schools identified were selected based on their enrollment of 5th-grade students, a population of economically

disadvantaged students that exceeds 20% of this enrollment, and an overall proficiency rate of 60% or higher on the 2022-2023 PSSAs.

On September 5, 2023, formal requests for permission to conduct research were emailed directly to the superintendents of each respective district. Each superintendent granted permission for the research to occur in his district, and on September 11, 2023, the researcher submitted formal letters of approval provided by those superintendents to the PennWest Internal Review Board (IRB) for approval. After securing the necessary approval, building principals of three identified schools within the approved districts were contacted via email to solicit their participation in the research study (Appendix B). This methodical approach ensured adherence to ethical guidelines, proper authorization from relevant authorities, and systematic participant recruitment.

Once contact was established with each identified building principal/school leader, an IRB approved consent form was emailed to each participant for completion, along with the structured interview questions that would be presented at an agreed-upon meeting date and time (Appendix F). The principal of School A in this study returned the signed consent form on February 23, 2024, and the semi-structured interview took place using a Google Meeting platform on March 1, 2024 (Appendix C). The interview lasted approximately 42 minutes and was recorded both visually and auditorily, as well as transcribed using the Google Meeting transcription tool.

The principal of School B returned his consent form the morning of March 25, 2024, and the semi-structured interview occurred using the same aforementioned Google Meeting platform on the afternoon of March 25, 2024 (Appendix D). The interview

lasted approximately 47 minutes, and was also recorded visually and auditorily, and transcribed using the Google virtual meeting platform.

After three attempts to establish a connection with the principal of School C via the email recruitment letter, I received a response from this individual on March 23, 2024. Due to unforeseen family circumstances, the principal directed me to the district's director of curriculum and instruction, as she believed this leader could more than adequately provide responses to the interview questions that were provided in relation to her assigned school. After several attempts to connect with the district's director of curriculum and instruction, he finally returned my email and further directed me to the district's Title 1 coordinator who was a former teacher at School C and heavily involved in the shared leadership of that building. The formal recruitment letter, along with a description of the circumstances for a change of contact, was sent to the district's Title 1 Coordinator on May 15, 2024. This individual returned her consent form on May 16, and a semi-structured interview occurred using the Google meeting platform on the morning of May 17, 2024 (Appendix E). The interview lasted approximately 41 minutes, and was recorded visually and auditorily, and transcribed using the Google virtual meeting platform.

The structured interview questions developed in this research project (Appendix F) were directly formulated from the results of the literature review process outlined in Chapter 2. The qualitative questions presented were categorized into five (5) main sections. These sections included Special Education Students, Economically Disadvantaged Students, External Factors, School Services and Resources, and General questions for school and participant characteristics. Although the questions were created

and provided to the participant prior to the actual interview itself, the interview process was semi-structured. All questions were asked by the researcher and answered by the participant, but additional clarifying questions were posed when necessary, and dialog occurred based on many of the responses that were provided. There were several responses to questions that provided insight, or at times a complete narrative, that was able to be used to achieve data for subsequent questions.

The three schools selected by the researcher using this filtering method were not the schools at the top of each list; however, the chosen schools were those that had both high mathematical achievement and a similar demographic population to the researcher's home district and school. Specifically, one of the schools selected in this study ranked in the top fifteen (15) of the overall standings of 5th-grade proficiency on the 2022 PSSA math exams with a total proficiency rate exceeding 85%. This school did not, however, break the top 50% of schools with high achieving economically disadvantaged and special education populations.

On the other hand, another school selected ranked relatively high in all three data sets reviewed. It was in the top five (5) in Pennsylvania among schools with a high-achieving subgroup of economically disadvantaged students at a proficiency rate which exceeded 74%. It ranked in the top twenty-five (25) among schools with a high-achieving special education subgroup exceeding a proficiency rate of 48%, and in the top 20 in the overall category of schools surpassing an 82% advanced/proficiency rate.

The final school selected was ranked just inside the top one-hundred (100) schools for 5th-grade proficiency on the 2022 PSSAs, but its economically disadvantaged population ranked in the top twenty (20) in Pennsylvania with a subgroup proficiency

rate surpassing 62%. School B also fell just inside the top 50% of schools with a high-achieving special education subgroup.

The qualitative portion of the mixed method research plan focused on the questions that were produced to conduct a semi-structured interview with leaders of three (3) high-achieving schools on 5th-grade standardized mathematics assessments. The creation of these questions was highly influenced by the literature review that was conducted by the researcher and outlined in Chapter II of the capstone project.

The interview was organized into five (5) designated categories and consisted of twenty-two (22) total questions (Appendix F). The first section was titled "General Questions" and consisted of four (4) questions, the second section was titled "Special Education Students" and contained five (5) questions, "Economically Disadvantaged Students" was the middle section of questioning making up five (5) questions, and the final two sections were "External Factors" and "School Services/Resources," consisting of three (3) questions and five (5) questions respectively.

In the first of a series of semi-structured interviews, the researcher engaged in a comprehensive discussion with the principal of a K-5 elementary school located in western Pennsylvania. This is referred to a "School A" throughout the research project. With a tenure spanning 17 years at the school, the principal brought a wealth of experience, having previously served as a high school math teacher. The interview provided insights into the school's notable success in consistently surpassing math proficiency standards within the region at the 5th-grade level.

In the second interview conducted as part of the research project, the researcher engaged with the principal of a school servicing students in grades 2-5. This is referred to

as “School B” throughout this research project. This school leader brought a unique perspective to the discussion, having transitioned from a role as a high school assistant principal to assume leadership at the elementary level. With a background as a special education teacher at the secondary level spanning 12 years, the principal offered insights into the school's approach to achieving mathematical proficiency, particularly among economically disadvantaged students. At the time of this conversation, it was noted that 29% of the school’s student body belonged to the low socioeconomic subgroup.

In the final interview conducted as part of the qualitative analysis, the researcher met with the Title I Coordinator that services “School C”, a K-5 elementary school also located in Western Pennsylvania. Due to extenuating circumstances, the principal of this school was unable to formally participate in the study; however, the researcher was ensured by this individual that the Title I Coordinator had an intimate understanding of the systems and operations in place within this entity, and would be the most knowledgeable candidate for the purpose of the research being conducted. Nonetheless, this district leader was able to provide a more system-rich perspective of 5^{th}-grade mathematics achievement because of her role servicing students from all grades kindergarten through twelve (12).

At the conclusion of each conducted interview, responses to the questions provided were organized into an Excel spreadsheet to compare and contrast the data provided by each building leader. The researcher used a color-coding structure to highlight and categorize similar systems and methods referenced by each participant. The purpose of this categorization structure was to find consistently targeted areas among the three schools and gauge the level of commitment each district allocates to a particular

system or methodology. Table 8 illustrates the method used by the researcher to analyze data and identify themes and commonalities among school leader responses.

Table 8

Foundational Categories of School Systems and Methodologies

Foundational Category	System/Methodology
Curriculum	Vertical Alignment
	Horizontal Alignment
	Curriculum Development/Approach
Instruction/Assessment	Assessment Strategy
	Instructional Strategy
	Lesson Planning Strategy
Professional Learning	Professional Development
	Collaborative Approach
	Coaching Strategy
Resources	Human Resource
	Textual Resource
	Curriculum Resource
	Parent Resource
Student Learning	Growth Strategy
	Retention Strategy
	Intervention Strategy
	Engagement Strategy

Note. Table 8 identifies a general foundational category that is then broken down into more specific systems and methodologies based on the participant's response.

Fiscal implications of this research project were minimal. The research plan involved significant time commitments by the researcher to analyze state assessment data, develop structured interview questions, recruit participants, and organize online,

virtual interviews; however, minimal time was required by each participant to prepare for and participate in the interview process. It was estimated that each interview would take between 45-60 minutes to complete, and each interview fell within that time range.

The costs associated with recommended changes and improvements to the researcher's home district based on findings are, however, outlined in Chapter V of this research study. In order to achieve meaningful and sustainable results in the area of mathematics proficiency on standardized assessments, funds must be allocated to replicate school systems and instructional practices that are correlated most consistently with academic success.

Validity

As outlined in the consent to participate in the research study created by the researcher and approved by the PennWest IRB (Appendices C, D, and E), participating school leaders in this project were required to service 5th-grade students, have an economically disadvantaged population exceeding 20% of their total school population, and have an overall proficiency rate of 60% or higher on state standardized mathematics assessments for the 2021-2022 school year. The purpose of this requirement was to ensure transferability, which is the degree to which research results are applicable to other contexts and other individuals (Hendricks, 2017). It was important to analyze comparable educational settings in order to transfer findings and results into application in the researcher's home district.

It was also outlined in the consent form that participation in the interview process was voluntary and the participant had the right to refuse to answer any question or withdraw any response after the process was completed. A transcript of each interview

was created and provided to the participant upon request for review. All personally identifiable information provided in the interview process was redacted, and participants were informed that names would never appear on research instruments or in the capstone manuscript. Participants were informed that all written and electronic forms and study materials, including audio and video recordings, would be kept secure and password protected, and that any study materials with personal identifying information will be maintained for three years after the completion of the research and then destroyed. The purpose of this structure was to ensure credibility. The researcher utilized this method in an attempt to ensure that interview results were accurate and truthful, and not a scrutiny of specific strategies and techniques supported and implemented by the subject of the interview.

Finally, the researcher attempted to establish credibility, dependability, and confirmability by implementing the process of triangulation (Hendricks, 2017). The research triangulation process began by gathering 5th-grade student math proficiency data from the Pennsylvania System of School Assessments (PSSAs) for the 2021-2022 school year. Three schools were then strategically selected based on their high-levels of student proficiency and comparable demographics to the researcher's home district. Through semi-structured interviews, school leaders from each of the chosen schools provided qualitative insights into the systems and practices they attributed to their success. This multi-faceted approach ensured a comprehensive understanding of factors contributing to student achievement, incorporating both quantitative proficiency metrics and qualitative perspectives from educational leaders, thus enriching the depth and validity of the research findings.

Furthermore, the researcher cross-analyzed results from each selected school to find commonalities among programs, systems, and instructional practices that school

leaders have directly credited to high levels of student achievement. Although it was rare to find direct similarities between specific programs and practices utilized by the schools involved in the study, parallel foundational theories and methodologies were derived through inquiry and discussion in the semi-structured interview process. This additional method of triangulation further supported tangible approaches in results-driven educational entities.

Summary

The purpose of this Methodology chapter was to outline the purpose, setting, research plan, data collection process, and validity of the overall research study. Based on a historical and ongoing lack of student achievement in mid-level mathematics in the researcher's home district, quantitative data was obtained to show a similar trend across many districts in Pennsylvania. The researcher used this data to focus the study on the 5th-grade level, as it statistically showed a defining point in the trend of declining mathematics proficiency, both in the target school and across other schools in the commonwealth of Pennsylvania.

The Literature Review chapter provided invaluable insight on systems and practices utilized for mathematical engagement and achievement, and directly contributed to the formulation of an interview process that addressed instructional practices, demographic make-ups of schools, practices associated with population subgroups, and school systems that contribute to high levels of student learning.

The process concluded with the selection of three (3) target schools that were identified based on their mathematical proficiency on state standardized assessments, specifically considering the performance of their economically disadvantaged student

population, their special education population, and their overall student enrollment. School principals and district leaders were then interviewed utilizing the questions created as a result of the literature review process in an effort to determine the mathematical systems, instructional practices, and other educational factors that led to student success in mathematical operations and applications.

The next chapter will analyze the data and outcomes of this research and explicitly address the findings associated with each of the three research questions outlined in the study. Specific components outlined in this methodology chapter will be highlighted and expanded-upon in the in-depth analysis of results to follow.

CHAPTER IV

Data Analysis and Results

Mid-level mathematics plays an instrumental role in the overall academic success of today's students. The Pennsylvania Department of Education (PDE) outlines specific reporting categories in grades 3 through 8 consisting of numbers and operations, algebraic concepts, geometry, and data analysis and probability. Mastery of these mathematical concepts not only serves as a foundation for advanced mathematical studies, but also enhances critical thinking and problem-solving skills, which are vital across all disciplines. In Pennsylvania, proficiency in mid-level mathematics is closely linked to academic achievement, standardized test performance, and college readiness. Additionally, a solid understanding of these mathematical concepts is essential for students aspiring to pursue careers in science, technology, engineering, and mathematics (STEM) fields, which are increasingly important in our nation's economy. By prioritizing mid-level mathematics education, Pennsylvania can ensure its students are well-prepared to meet the demands of higher education and the modern workforce.

In Pennsylvania, standardized mathematics scores consistently fall below the state standard beginning at the 5th-grade level, with a noticeable trend of decreased proficiency rates in subsequent years. This decline was most significantly pronounced when comparing the 4th-grade cohort to the 5^{th}-grade cohort at the conclusion of the 2021-2022 school year. The drop in proficiency between these two grades was not only apparent at the state level, but also at the local level in the Kiski Area School District, signaling a critical point where students' grasp of mathematical concepts significantly weakens. This pattern suggests a crucial need for intervention and support at this level to address and reverse the declining trend in math proficiency among Pennsylvania students.

The purpose of this qualitative research study was to develop an understanding of instructional practices and educational systems through the shared experiences of school leaders in Pennsylvania public schools. The focus was on schools with an economically disadvantaged population exceeding 20% of their student population and a proficiency rate at or above 60% at the 5th-grade level as measured by the annual Pennsylvania System of School Assessment (PSSA) for mathematics during the 2021-2022 school year.

This chapter will focus on the analysis of qualitative data collected through semi-structured interviews with educational leaders from three different schools across the Commonwealth of Pennsylvania. These individuals had a direct impact on the high-level of mathematical achievement obtained at the 5th-grade level during the 2021-2022 school year. The data will indicate the instructional practices, school systems, and academic programming most attributed to the success of student learning in mid-level mathematics.

Data Analysis and Findings

The first interview conducted in the research process took place on March 1st, 2024 with the principal of School A. During this interview, the principal emphasized the school's collaborative approach among teachers, particularly in the area of mathematics education. One notable strategy highlighted was the flexible grouping of students based on the results of trimester benchmark exams. These exams are created by math teachers using the Pennsylvania Standards Aligned System (SAS) website, in an effort to provide a comprehensive assessment of the standards and eligible content taught over a designated period of time. The results of these exams are reviewed in a team collaborative, and students are grouped so that teachers can tailor instruction to meet the

diverse needs of students, ensuring that each child receives targeted support and challenges appropriate to their level of proficiency. By leveraging the data gathered from these benchmark assessments, the school fosters an environment of individualized learning, promoting both academic growth and student engagement.

Additionally, the interview shed light on the school's data-focused culture, emphasizing the use of assessment data to inform instructional decisions and predict student performance on state-standardized math tests. Through careful tracking of student growth and progress, as evidenced by the benchmark exams, the school has continued to increase its ability to accurately predict student outcomes on standardized assessments. This data-driven approach not only facilitates targeted interventions for struggling students but also assists with the identification of trends and patterns that inform curriculum planning and instructional strategies school-wide. Overall, the interview underscored the principal's commitment to excellence in mathematics education and provided valuable insight into the instructional practices and systems that have led to the school's success in exceeding proficiency standards.

The second interview conducted as part of the research project took place on March 25, 2014 with the principal of School B. This principal of highlighted the significance of building positive relationships with families within the community as a foundation of the school's success. By hosting numerous family engagement sessions throughout the academic year, the school promotes a collaborative partnership between educators and parents, creating a supportive environment that leads to a shared responsibility of student learning. Leveraging Title I goals and available state funding,

these sessions serve as platforms for sharing resources, providing academic support, and strengthening ties between the school and its diverse community.

Furthermore, the principal highlighted the school's commitment to a standardized math resource that has been consistently utilized across all grade levels for the past five years. This continuity ensures alignment of curriculum and instructional practices, promoting vertical curriculum alignment and consistent math instruction school-wide. Additionally, the school integrates various online math programs, both within the school environment and for home use, to cater to students' individual proficiency levels. By offering differentiated learning opportunities tailored to students' needs, the school empowers learners to build upon their mathematical skills in a personalized and engaging manner, ultimately contributing to their academic success.

The third interview in the process took place on May 17, 2024 with a former mathematics teacher at School C, and the current K-12 Title I Coordinator of the district in which School C is located. This individual was highly recommended by both the principal of School C, as well as the district's director of curriculum. In this interview, the coordinator emphasized the crucial role of fostering strong community relations and ensuring the availability of educational resources for both students and parents. She highlighted how active engagement with the community creates a supportive network that enhances student learning and well-being. The coordinator detailed various initiatives, such as parent workshops and community events, designed to empower families with the tools and knowledge needed to support their children's education. Additionally, she stressed the importance of the district's early intervention programs which are free to all district families and available to children at the age of 3. These

programs are fully funded by the district and are inclusive of transportation services to ease restrictions faced by many families within the community.

At the completion of all three (3) semi-structured interviews, the researcher utilized a method of data organization to analyze results across building entities. An Excel spreadsheet was created to categorize systems and methods the were consistently referenced by all participants. This system of data review was referenced in the previous chapter relating to research methodology (see Table 8 – Foundational Categories of School Systems and Methodologies).

The first foundational category identified by the researcher was curriculum. This was broken into three specific sub-categories based on responses provided by participating school leaders. Common themes referenced within this category included vertical curriculum alignment, horizontal curriculum alignment, and approach to curriculum development. Table 9 illustrates the first foundational category and notable findings across all three participating schools.

Table 9

Curricular Systems and Methodologies

		Data Findings		
Foundational Category	**System/Methodology**	**School A**	**School B**	**School C**
Curriculum	Vertical Alignment	K-5 Primary School Setting; 6-8 Middle School Do Not Teach Outside of Grade-Level Standards	K-1 Literacy Center; 2-5 Primary School Setting; 6-8 Middle School	K-5 Primary School Setting; 6-8 Middle School
	Horizontal Alignment	5 Primary Entities Less Collaboration Across Entities Strict District Curriculum Timelines	2 Primary Entities	1 Primary Entity All Students Exposed to Same Curriculum
	Curriculum Development/Approach	Professional Learning Communities Record-Keeping Sheets District-Developed Curriculum Timelines (Math-Strict)	enVision Math Curriculum - 5 years of implementation	5th-Grade Departmentalization

Note. Table 9 identifies specific data from each interview that aligns with the overall system or methodology related to curriculum.

The second foundational category in this study was instruction and assessment. This was divided into three sub-categories based on responses provided by the interview participants. Common themes referenced within this category include assessment strategies, instructional strategies/practices, and lesson planning strategies. Table 10 illustrates the instruction/assessment category and notable findings across all three participating schools.

Table 10

Instruction and Assessment Systems and Methodologies

		Data Findings		
Foundational Category	**System/ Methodology**	**School A**	**School B**	**School C**
Instruction/ Assessment	Assessment Strategy	Teacher-Made Tri-mester Benchmarks (SAS Resource) STAR for Reading Only Benchmarks Build on Content Taught	PSSA Math Coach Assessment iReady Math	iReady Math
	Instructional Strategy	Full Inclusion 70-Minute Math Blocks per Day Learning Support Teachers Assist	Full Inclusion - Co-Teaching with Regular Teacher and Special Education Teacher	Spiral Review (Go Math) 20-30% Special Edu pull-out math - same curriculum/small group
	Lesson Planning Strategy	Departmentalization - Group Students Based on Benchmark Assessment Data Flexibly Group and Adapt Lessons Based on Proficiency Students Move 3 to 4 Times Per Year	4-Teacher Departmentalization (5th Grade Math)	Departmentalization

Note. Table 10 identifies specific data from each interview that aligns with the overall system or methodology related to instruction and assessment.

The third foundational category identified was professional learning/development. This was also divided into three sub-categories based on the responses of interview participants. Common themes referenced within this category include professional development, collaborative approaches, and coaching strategies. Table 11 illustrates the professional learning category and notable findings across all three participating schools.

Table 11

Professional Learning Systems and Methodologies

		Data Findings		
Foundational Category	**System/ Methodology**	**School A**	**School B**	**School C**
Professional Learning	Professional Development	Math Specific PD - Language for Word Problems- Through PDE	PSSA Math Coach Assessment - Professional Development on Assessment Techniques and Data Review	Departmentalized PD
	Collaborative Approach	Professional Learning Communities All 5th-Grade Teachers Teach Math Groups	7 Total 5th-Grade Teachers - 4 Teach Math in a Block System	3 Math Teachers per Grade
	Coaching Strategy	2 Math Coaches in the Past	Elementary Director of Teaching and Learning - Works with Teachers	Title 1 Coordinator - Former ELEM/MS Math Teacher

Note. Table 11 identifies specific data from each interview that aligns with the overall system or methodology related to professional learning.

The fourth foundational category identified was resources. This category was divided into four sub-categories based on the responses of interview participants. Common themes referenced within this category include human resources, textual resources, curriculum resources, and resources for parents. Table 12 illustrates the resources category and notable findings across all three participating schools.

Table 12

Resource Systems and Methodologies

		Data Findings		
Foundational Category	**System/ Methodology**	**School A**	**School B**	**School C**
Resources	Human Resource	SLA - Student Learning Assistants (2)	Director of Teaching and Learning for Elementary - Responsible for Data Review	5 Full-time Special Education Teachers K-5 (including life skills) 3 Math Teachers per Grade
	Textual Resource	All Teacher Created Believe Resources Did Not Fit Math Vision (Too Many Instructional Options) Used EnVision Math in the Past	enVision Math	Go Math (HM)
	Curriculum Resource	Based on State Standards and Eligible Content by Grade-Level	Xtra Math - For Fact Fluency	iReady Math
	Parent Resource	Non-Title 1 Economically Disadvantaged Population Around 20%	Parent/Community Engagement Through Title 1 Ice-Cream Social Teacher-Parent Rapport and Communication	Title 1 - Math/Reading Nights 4 Times/Year Google Classroom Training School Activities Frequent, Consistent, and Open Communication After-School Tutoring - District Funded

Note. Table 12 identifies specific data from each interview that aligns with the overall system or methodology related to resources.

The fifth and final foundational category identified was student learning. This category was divided into five sub-categories based on the responses of interview participants. Common themes referenced within this category were growth strategies, retention strategies, intervention strategies, special education strategies, and engagement

strategies. Table 13 illustrates the student learning category and notable findings across all three participating schools.

Table 13

Student Learning Systems and Methodologies

		Data Findings		
Found. Category	**System/ Method.**	**School A**	**School B**	**School C**
Student Learning	Growth Strategy	Full Inclusion Flexible Grouping Based on Benchmark Assessment Results	Strategically Schedule Students in Groups based on IEP Goals/Similar Learning Profiles for Intervention	Inclusion with SGI for 20-30% of SE Students iReady Math Assessments
	Retention Strategy	Spiral Review - Beginning of School Day	Xtra Math - Fact Fluency Program (10-15 Minutes at the Beginning of Math Lessons	Go Math Spiral Review
	Intervention Strategy	Completed Within The Math Classroom Using the Flexible Grouping Model. Historically Low Performing Students Participate in One-On-One Intervention with a Learning Support Teacher in Addition to Their Regularly Scheduled Math Class Students Can Be Pulled From Specials Classes or Science and Social Studies Classes If Needed For Math or Reading Intervention Homework Club - Monday-Thursday (30 Minutes) - Parents Responsible for Transportation - Teachers Paid By District	120-Minute Block of Additional Math Instruction/Week - Used for Extension and/or Intervention; Re-teaching for IEP Goals Title 1 Math (All Students) - 30 Minutes of Workshop Math During Specials Classes - Once Per 6-Day Cycle After-School Tutoring - One Day per Week Homework Club - One Day per Week No Cost to Parents Transportation Not Provided"	Weekly: Wednesday, Thursday, Friday Math Intervention Periods Early Intervention 0-3 - Once per Month 3-Year-Old Program - Tuesdays/Thursdays (2 Hours/day) Transportation provided for both programs After-School Tutoring - District Funded
	Special Education Strategy	Full Inclusion Students Flex-Grouped by Benchmark Assessment Results	Full Inclusion, But Scheduling is Strategic to Group Students Based on Learning Profiles Co-Teaching Model	Full Inclusion/20-30% Small Group Instruction (Pull-Out Math)
	Engagement Strategy	Teach Students How to Use Calculators Consistently Calculators Used to Check Work, Not Complete	Use a Variety of Resources to Engage Students (iReady Math; Xtra Math; PSSA Coaching Assessment; Targeted Intervention)	Limit Rigor - Focus on Foundational Skills (iReady/Go Math)

Note. Table 13 identifies specific data from each interview that aligns with the overall system or methodology related to student learning.

Data Analysis and Findings of the Research Questions

The semi-structured interview questions developed by the researcher were derived from the results of the literature review process outlined in Chapter II. There were twenty-two (22) total qualitative questions presented, and these questions were categorized into five (5) main sections. These sections included Special Education Students, Economically Disadvantaged Students, External Factors, School Services and Resources, and General questions for school and participant characteristics (Appendix F). Responses to the questions in these categories led to the creation of the foundational categories of school systems and methodologies presented in this chapter.

Research Question 1

The first research question of this qualitative analysis was "What instructional strategies and methods do high performing schools employ to achieve high proficiency rates in mathematics among all students?" This question was addressed generally by reviewing the responses to all questions presented to the participants during the interview process; however, for the purpose of this data review, responses provided for questions from the External Factors, School Services and Resources, and General categories were closely analyzed.

From the data provided, the researcher determined that there were three main themes among all schools represented in the study that school leaders greatly attributed to overall student success on 5th-grade standardized mathematics assessments. These

themes were curriculum, assessment, and systematic extension and intervention strategies.

It was determined by the researcher that high student achievement on standardized math tests is significantly influenced by the implementation of a guaranteed and viable curriculum that is both vertically and horizontally aligned across school entities. A vertically aligned curriculum ensures that the knowledge and skills taught in one grade build seamlessly into the next, promoting a coherent and cumulative learning experience. Horizontal alignment ensures consistency across different classes and teachers within the same grade level, providing all students with equal opportunities to master the required content. This systematic approach reduces gaps in learning and ensures that students are well-prepared for the material assessed in standardized tests, ultimately leading to higher achievement. All three schools analyzed in this research project described the importance of curriculum, and how it needs to be reviewed and structured from a K-12 perspective.

It was also determined that the use of a local system of assessments allows teachers to regularly obtain detailed data on student performance, which they can then use to inform and adjust their instruction. These formative assessments provide real-time feedback on what students have learned and identify areas where they may be struggling. By analyzing this data, teachers can tailor their teaching strategies to address the specific needs of their students, offering targeted support and intervention where necessary. This responsive approach ensures that instructional practices are closely aligned with students' learning needs, leading to more effective teaching and better student outcomes on standardized math tests. Furthermore, assessment data can be used to adjust curriculum,

group students by name and need, and identify specific standards and skills that the majority of students struggle to master. In each school represented in this study, local assessments were utilized to obtain data throughout the school year to better prepare students well before the formal state standardized testing date. Assessments referenced were teacher-created benchmarks to obtain data on student retention over time, diagnostic tests to obtain data on student growth on math skills and content, and common formative assessments used to obtain data on specific units or lessons taught to determine each student's level of proficiency on the skills assessed.

A systematic process for extension and intervention was the final strategy determined by the researcher to be vital in ensuring high levels of mathematical achievement. This strategy typically involves using reliable data to identify struggling students early, then using that data to provide them with additional support through small group instruction, tutoring, or other targeted interventions, and continuously monitoring their progress. Interventions are designed to be flexible and responsive, adjusting to the evolving needs of students as they work to master challenging concepts. By providing timely and appropriate support, the schools identified in this project guaranteed that all students had the opportunity to succeed, thereby improving their overall achievement on standardized math tests. Structured support systems help close achievement gaps and ensure that students do not fall behind, thus contributing to higher levels of academic performance.

Research Question 2

The second research question of this qualitative analysis was "What instructional strategies and methods do high-performing schools employ to achieve high proficiency

rates in mathematics among students who are economically disadvantaged?" This question was addressed by reviewing the responses to all questions presented to the participants during the interview process; however, for the purpose of this data review, responses provided for the four (4) questions from the Economically Disadvantaged category, as well as the five (5) questions from the School Services/Resources category were closely analyzed.

From the data provided, the researcher determined that there were three main themes among all schools represented in the study that school leaders greatly attributed to the success of economically disadvantaged students on 5th-grade standardized mathematics assessments. These themes were curriculum, parent resources, and intervention strategies.

Throughout the interview process, it became glaringly apparent that equal access to a strong curriculum is fundamental in leveling the playing field for economically disadvantaged students. When all students, regardless of their socioeconomic status, have access to high-quality instruction and educational materials, it is much more likely that they can develop the skills and knowledge necessary for academic success. A curriculum that is both aligned to state standards and challenging for students not only provides the necessary skills for mathematical development, but also fosters critical thinking, creativity, and problem-solving abilities. This equity in educational resources helps bridge the achievement gap, enabling disadvantaged students to compete on an equal platform with their more affluent peers. Each school leader in this project described a culture in which all students were held to a high standard. Regardless of status,

disability, or previous success, students have the opportunity to take courses that are both relevant to their interests and challenging to their abilities.

Family engagement practices and parent training opportunities play an important role in supporting economically disadvantaged students in the three schools identified in this research project. When schools actively involve parents in their children's education and offer training on how to support learning at home, it creates a collaborative environment that boosts student achievement. Educated and engaged parents are better equipped to help with homework, advocate for their children's needs, and reinforce the importance of education. This partnership between home and school is especially critical for disadvantaged students, as it can provide the additional support and motivation they need to succeed academically and socially. A word that was frequently used when addressing school/community relations was trust. Each of the three school leaders recognized the value of a strong, working partnership between parents and the school itself.

Early intervention programs provided by the schools and districts represented in this study proved essential for addressing the unique challenges faced by economically disadvantaged students. These programs, which include preschool education, tutoring, and specialized services, aim to identify and address learning and developmental delays as early as possible. Early intervention ensures that students receive the support they need before falling too far behind, improving their chances of long-term academic success. By investing in these programs, districts can mitigate the impacts of economic disadvantage and help all students reach their full potential, leading to a more equitable and just educational system.

All participating schools in this study shared formal intervention programming for families outside of the school day. In most cases, this was directly tied to Title 1 funding and the requirement for school/family engagement; however, School C, which is the school in this study with the largest percentage of economically disadvantaged students, shared an early intervention structure that was very robust and fully accessible. All district families have free access to two different early intervention programs, inclusive of transportation services to and from the school. School C's zero to three (0-3) early intervention program takes place throughout the school year once per month for students that are three years of age and under. Also, any child within the district that is between the ages of three (3) and five (5) can attend a two-hour program on Tuesdays and Thursdays each week throughout the school year. Furthermore, after-school tutoring is available four (4) out of five (5) days each week for students in grades K-5. All three programs are fully funded by the district and are well-attended on a yearly basis.

Research Question 3

The third and final research question of this qualitative analysis was "What instructional strategies and methods do high-performing schools employ to achieve high proficiency rates in mathematics among students with learning disabilities?" This question was also addressed by reviewing the responses to all questions presented to the participants during the interview process; however, for the purpose of this data review, responses provided for the four (4) questions from the Special Education category, as well as the five (5) questions from the School Services/Resources category were closely analyzed.

From the data provided, the researcher determined that there were three main themes among all schools represented in the study that school leaders greatly attributed to the success of learning support students on 5th-grade standardized mathematics assessments. These themes were instructional strategies, curriculum resources, and intervention strategies.

Each participating school in this research project referenced a high level of inclusion among students with learning disabilities into the general classroom setting. This was also followed by the belief that small group instructional settings should continue to follow the agreed upon curriculum that was developed by the school and district. With this as a prerequisite, instructional strategies play a crucial role in fostering high mathematical achievement among students with learning disabilities. By providing tailored teaching methods that accommodate the diverse learning needs of all students and not just learning support students, student engagement and learning can take place at a much greater rate. These strategies often include differentiated instruction and/or flexible grouping where teachers have the ability to modify content, processes, products, and learning environments based on data and the individual learning profiles of their students. Techniques such as visual aids, manipulatives, and interactive activities can be utilized among targeted groups of students to help them grasp abstract mathematical concepts more concretely, and explicit instruction, where teachers use clear, direct teaching methods and provide step-by-step demonstrations, can significantly enhance understanding and retention of mathematical principles among groups of students that benefit from this level of support. By using specialized strategies, teachers can create a

more inclusive classroom environment that supports the unique learning profiles of all students regardless of their learning challenges.

Curriculum resources proved equally vital in supporting high mathematical achievement among the participating schools in this project. The resources referenced include adaptive software, classroom materials, and supplemental supplies designed to align with students' learning abilities and styles. Adaptive software, such as Xtra Math, iReady Math, and enVision Math, offered personalized learning experiences that adjust to the student's pace and level of understanding, providing immediate feedback and practice opportunities to assist in the process of academic growth. Specialized classroom materials such as Go Math textbooks or teacher-generated resources that use adaptive language, visual supports, and scaffolded problems can make complex mathematical concepts more accessible. Additionally, integrating real-world applications and problem-solving activities into the curriculum helps students with learning disabilities relate to and understand mathematical content more effectively, thereby enhancing their engagement and motivation.

Targeted intervention strategies also came to the forefront for school leaders when addressing specific learning challenges and ensuring that students with learning disabilities reached high levels of mathematical achievement. These interventions included one-on-one instruction, small group instruction, and co-teaching learning environments that address learning goals and provide specific supports for students in the regular education classroom. The use of progress monitoring through multiple assessment strategies were also apparent in all three settings and directly tied to targeted intervention for all students. Whether through the use of frequent common formative assessments,

quarterly benchmark assessments, or recurrent diagnostic testing, available data enables educators to identify areas where students are struggling and adjust their teaching methods accordingly. Each school also shared scheduled time within their schedules to provide extension and/or intervention for students outside of the regular math setting. By implementing these practices, teachers have the ability to identify struggling learners at many different points throughout their instruction, and can intervene in a timely manner to ensure that no students fall behind in meeting educational benchmarks throughout the school year.

Summary

Through the identification of three schools in Pennsylvania that met specific demographic and achievement criteria for mathematics, the researcher was able to categorize similar responses and triangulate data to identify key components that were attributable to high levels of student achievement. This method assisted the researcher in developing a comprehensive understanding of the factors that contribute to mathematical proficiency and provided the researcher with insight on potential strategies for improvement as described in the data analysis and finding for each identified research question.

Although there are many components that may contribute to the academic success and overall achievement of student groups in mid-level mathematics, the results of this research project show a substantial alignment between high proficiency rates on state standardized math tests and three specific components within school systems.

A guaranteed and viable curriculum that is accessible to all students is essential for achieving high levels of learning in mid-level mathematics because it ensures

consistency and equity in educational opportunities. Such a curriculum is aligned with educational standards and goals, providing a clear roadmap for what students need to learn and achieve. It is designed to be achievable within the school year, allowing teachers to teach all necessary material without overwhelming students. Moreover, by being accessible, the curriculum accommodates diverse learning styles and needs, ensuring that every student, regardless of background or ability, can engage with and understand the content. This inclusivity fosters an environment where all students can build a strong mathematical foundation, develop critical thinking skills, and progress together, ultimately leading to higher overall achievement in mathematics.

Assessment programs that measure student growth, proficiency of essential skills, and retention of material over time are fundamental for achieving high levels of learning in mid-level mathematics. These programs are essential to obtain valuable data that can help educators understand how well students are grasping key concepts and skills and how they are progressing over time. By regularly assessing student performance, teachers can identify areas where students are excelling and where they may need additional support. This ongoing monitoring allows for timely interventions and instructional adjustments, ensuring that learning gaps are addressed before they widen. Furthermore, assessments that measure retention help ensure that students are not only learning the skills outlined in the agreed-upon curriculum but also retaining these essential skills for future use, which is vital for building a strong mathematical foundation. Ultimately, effective assessment programs support a cycle of continuous improvement, enabling students to achieve and sustain high levels of proficiency in mathematics.

Finally, guaranteed time for targeted intervention during the school day that is separate from the regular instruction and learning activities provided within the regular math classroom is critical for helping students achieve high levels of learning in mid-level mathematics. This dedicated intervention time allows educators to provide personalized support tailored to the specific needs of each student, addressing learning gaps and reinforcing foundational skills without disrupting the flow of regular classroom instruction. It ensures that students who require additional help receive focused, individualized attention, which is often difficult to provide within the constraints of the standard classroom environment. By having a distinct period for intervention, teachers can employ specialized strategies and resources that cater to diverse learning needs, fostering a more inclusive and effective learning experience. This structured support helps students build confidence and competence in mathematics, ultimately leading to higher achievement levels and better long-term retention of mathematical concepts.

CHAPTER V

Conclusions and Recommendations

Mid-level mathematics is vital for the academic success of students, as outlined by the Pennsylvania Department of Education (PDE) state standards for grades 3 through 8, consisting of numbers and operations, algebraic concepts, geometry, and data analysis and probability. Mastery of these areas enhances critical thinking and problem-solving skills, which are foundational for advanced studies and essential across disciplines. In Pennsylvania, proficiency in mid-level mathematics is linked to overall academic achievement, career and college readiness and is crucial for students pursuing various STEM careers that are abundant in the economy; however, standardized math scores consistently fall below state standards starting in 5th grade, with the most significant decline occurring between the 4th and 5th-grade cohorts during the 2021-2022 school year. This phenomenon is not only present in the Kiski Area School District, but it is an overall trend across school districts in the Pennsylvania for the 2021-2022 standardized testing period.

This project addressed three key questions about the school systems and instructional practices that contribute to academic proficiency in 5th-grade mathematics. The literature review offered an in-depth look at instructional methodologies and school factors associated with high student achievement at the primary and middle school levels. Data analysis and results provided a detailed view of current practices in three specific districts in Pennsylvania that achieved high student proficiency on state standardized math tests for the 2021-2022 school year. The criteria for these three schools included having an economically disadvantaged population exceeding 20% and a proficiency rate

of 60% or higher in 5th-grade mathematics, as measured by the Pennsylvania System of School Assessments (PSSAs) for the 2021-2022 school year. The research findings in this project linked the research questions, literature, and collected data.

This chapter will present the research conclusions, including the potential applications of the findings and their perceived importance to educational leaders. It will also discuss the research limitations and conclude with recommendations for future studies.

Conclusions

The research study analyzed qualitative data gathered through semi-structured interviews with educational leaders from three distinct schools in Pennsylvania. The subjects in these interviews had a high degree of influence on the high level of mathematical achievement of 5th grade students during the 2021-2022 school year because of their leadership roles within their buildings. The data will highlight the instructional practices, school systems, and academic programs most credited with fostering student success in mid-level mathematics. Multiple tables will be used throughout this chapter to display the emergent themes for each research question based on their perceived degree of impact and alignment to existing literature.

Research Question 1

The first research question of this qualitative analysis was, “What instructional strategies and methods do high-performing schools employ to achieve high proficiency rates in mathematics among all students?” Table 14 highlights the themes that emerged in the analysis of this question when looking at the foundational categories of school systems and methodologies created by the researcher.

Table 14

Themes Supporting High-Performance Among All Students

All Students		
Research Question	**Foundational Category**	**System/Methodology**
RQ1: What instructional strategies and methods do high-performing schools employ to achieve high proficiency rates in mathematics among all students?	**Curriculum**	Vertical Alignment
		Horizontal Alignment
		Curriculum Development/Approach
	Instruction/Assessment	Assessment Strategy
		Instructional Strategy
		Lesson Planning Strategy
	Professional Learning	Professional Development
		Collaborative Approach
		Coaching Strategy
	Resources	Human Resource
		Textual Resource
		Curriculum Resource
		Parent Resource
	Student Learning	Growth Strategy
		Retention Strategy
		Intervention Strategy
		Special Education Strategy
		Engagement Strategy

Note. Table 14 identifies the themes that emerged through the interview process specific to research question 1. Foundational categories and system/methodology themes that emerged are highlighted in yellow.

All three of the schools represented in this study were primary schools serving students in grades 2-5. For the purpose of this study, 5th-grade achievement data was specifically analyzed due to the notable discrepancy between 4th and 5th-grade

proficiency scores on state-standardized math tests during the 2021-2022 school year. Since 5th grade was the final grade in these schools, vertical alignment became a focal point, allowing teachers to collaborate across grade levels within the same building. Moreover, with the exception of School A, two of the three schools participating in this study had two or fewer primary schools in their district structure. This setup enabled 5th-grade teachers to access and collaborate with their grade-level colleagues daily, significantly enhancing their ability to align curriculum and instruction horizontally within their respective schools.

School A, however, has devoted much time and resources to the development of a vertically aligned curriculum over the past five (5) years. The principal of School A explained that her district employed two instructional coaches over this time period who were specifically delegated to review the mathematics curriculum in grades three through eight (3-8) and assist teachers in creating and implementing a plan that was both aligned to state standards and local expectations. Although school A does not utilize this model at the current time, it was apparent that teachers of mathematics at the primary and middle school levels take much pride in both the vertical and horizontal alignment of their curriculum in the area of mathematics. The principal of School A attributed much of this success to the two individuals serving as data and instructional coaches across early grade levels.

A mathematics curriculum that is aligned to Pennsylvania state standards and vertically integrated with previous and future grade-level curricula ensures a cohesive and comprehensive educational experience for students. This alignment ensures that students build upon their knowledge systematically, leveraging previous skills to support

higher levels of learning and minimizing gaps and redundancies. Collaboration among grade-level teams is vital for the curriculum's effective implementation, as it fosters consistency, shared best practices, and a unified approach to teaching. When implemented with fidelity, such a curriculum assures that all students within the grade level receive equitable and high-quality instruction, promoting fairness and equal opportunity for academic success across diverse classrooms.

Robust local assessment strategies were also noted in all three schools represented in this study. Assessment strategies in education are crucial for understanding student progress and identifying areas for improvement. All three schools in this research project referenced local assessment methods to measure student growth, retention of essential mathematical skills, and proficiency with high-level, integrative questions.

The utilization of formative assessments, such as weekly quizzes and student self-assessments, to regularly monitor and track student progress and retention of key mathematical concepts was a key commonality among the schools represented in this study. Additionally, they incorporated performance-based tasks that required students to apply multiple mathematical principles to real-world problems, comprehensively evaluating their depth of knowledge and ability to integrate various skills. Furthermore, these schools utilized program resources that provided diagnostic tests to assess academic growth in mathematical reporting categories so that instruction could be tailored to meet students' individual needs. Through these multifaceted assessment strategies, the schools have been able to gain a detailed understanding of student achievement, ensuring that all students receive the support necessary to excel in mid-level mathematics.

The final theme that emerged related to research question one (1) was a school-wide system to address struggling learners. One of the critical questions in the collaborative process of student achievement is how we will address students who have not learned (Dufour et al., 2010). In each interview conducted in this research project, concrete systems were identified to address this question. The principal of School A described a system of intervention that occurs organically within math classes throughout the school year. Teachers administer quarterly benchmark exams created using the Standards Aligned System (SAS) website to ensure that questions are aligned to state standards for math and that they require a higher depth of knowledge for students to show proficiency. Students in School A are then flexibly grouped for periods of time based on results so that instruction can be differentiated according to their needs and current level of proficiency on the essential skills that are a part of the curriculum scope. In addition to this method of group intervention, teachers in School A have the ability to access students during their elective periods to provide more targeted interventions on identified mathematical deficiencies. This strategy has been implemented as both small-group remediation and one-on-one intensive intervention.

The principal of School B described a similar process of identifying students in need of support based on data obtained using a program called Xtra Math. This program is a fact fluency assessment that can be administered at the beginning of each unit of instruction or at the beginning of each lesson. Teams of grade-level math teachers review results and determine which students are in need of additional support to reach a higher level of proficiency on a specific skill or set of skills. Principal B described a flexible building schedule that allows thirty (30) minutes per day for targeted math intervention,

also utilizing elective class time as described in School A. Additionally, School B offers after-school tutoring in mathematics one day per week to all interested students at no cost to the family. Principal B described the intervention system that is in place as invaluable to the success of struggling learners.

The intervention strategy implemented by School C was a bit different than the other schools represented in this study; however, the core value of addressing struggling learners remains a priority among the teachers and staff. Local formative assessments are frequently administered by teachers within the regularly scheduled math classes in which students are heterogeneously grouped in a full-inclusion model. Twenty to thirty (20-30) percent of the schools special education population is scheduled into smaller groups for math instruction; however, the curriculum taught is the same in terms of scope and sequence within those identified math sections. The interventions provided based on the results of formative assessments occur three times each week as a thirty-minute math remediation period that is built into the master schedule for all students. The Title 1 coordinator of School C also described a program called “Go Math Spiral Review” that is implemented by all math teachers with fidelity on a recurring schedule to address previous skills taught and ensure retention of mathematical concepts throughout the school year.

The three common themes described by the leaders of each school represented in this project relative to math achievement are:

- The vertical and horizontal alignment of curriculum
- The utilization of effective formative assessment strategies

- The implementation of an agreed-upon system of targeted intervention for struggling learners.

A guaranteed and viable curriculum ensures that math instruction is consistent and coherent across different grades and classrooms, allowing for a seamless progression of mathematical skills and concepts. Formative assessment strategies provide teachers with real-time feedback on student learning, enabling them to adjust instruction as needed to reach more students at their individual level of understanding. Additionally, these schools implement intervention strategies to support students who struggle with math, offering personalized assistance and resources to help them catch up and succeed. Together, these practices create a strong framework for math education that promotes high achievement and continuous improvement among all students.

Research Question 2

The second research question of this qualitative analysis was, “What instructional strategies and methods do high-performing schools employ to achieve high proficiency rates in mathematics among students who are economically disadvantaged?” Table 15 highlights the themes that emerged in the analysis of this question when looking at the foundational categories of school systems and methodologies created by the researcher.

Table 15

Themes Supporting High-Performance Among Economically Disadvantaged Students

Economically Disadvantaged Students		
Research Question	**Foundational Category**	**System/Methodology**
RQ2: What instructional strategies and methods do high-performing schools employ to achieve high proficiency rates in mathematics among students who are economically disadvantaged?	**Curriculum**	Vertical Alignment
		Horizontal Alignment
		Curriculum Development/Approach
	Instruction/Assessment	Assessment Strategy
		Instructional Strategy
		Lesson Planning Strategy
	Professional Learning	Professional Development
		Collaborative Approach
		Coaching Strategy
	Resources	Human Resource
		Textual Resource
		Curriculum Resource
		Parent Resource
	Student Learning	Growth Strategy
		Retention Strategy
		Intervention Strategy
		Special Education Strategy
		Engagement Strategy

Note. Table 15 identifies the themes that emerged through the interview process specific to research question 2. Foundational categories and system/methodology themes that emerged are highlighted in yellow.

Addressing students of low socio-economic status produced a different set of themes than that of the other student groups analyzed in this project. When the questions related to economically disadvantaged students were addressed, it became clear that engaging this sub-group of students was of the utmost importance for sustained growth and achievement.

All three schools in this study have made concerted efforts to improve the learning outcomes of economically disadvantaged students by providing access to a high-level curriculum, engaging parents in the educational process, and ensuring free accessibility to resources outside of school hours. By ensuring that all students, regardless of their economic background, have access to rigorous and challenging coursework, these schools are intentional in their efforts to bridge the achievement gap. They also foster strong parental involvement through regular family events and frequent communication, creating a supportive community where parents are active participants in their children's education. Additionally, each school offers comprehensive after-school tutoring programs that are free for all students, providing extra academic support and reinforcing classroom learning.

A standout feature across these schools is their dedication to engaging parents in the school process. They organize various family-oriented events and maintain consistent communication with parents to keep them informed and involved. This approach helps build a cohesive support network, ensuring that parents feel empowered and connected to their children's educational journey. The schools also make educational resources accessible beyond regular school hours, further supporting students' academic growth and development.

Particularly notable is School C's strong commitment to early intervention strategies. There is a distinct correlation between the timing of poverty and how this impacts educational success and school completion. Early intervention can strongly impact students' future success (Brooks-Gunn and Duncan, 1997). School C epitomizes this concept by offering a robust early intervention program that provides free services to

children within the school district starting at a very early age. Specifically, children ages 0-3 have the ability to attend educational programming at the school once per month, and children ages 3 and older benefit from bi-weekly sessions lasting two hours each. This early intervention is substantial in laying a solid foundation for future learning and addressing educational needs from a young age. School C also includes free transportation for families in the community, ensuring that all students can participate regardless of their financial situation. In addition to these early interventions, School C offers free after-school tutoring for all students, demonstrating a comprehensive approach to supporting economically disadvantaged students both during the school day and outside of school hours.

The results associated with improving the learning outcomes of economically disadvantaged students centered on the theme of enhancing student accessibility to various school services. Success in this area hinges on:

- Access to a high-level curriculum
- Engaging parents through family events and frequent communication
- Offering free resources outside of the school setting.

Schools must ensure that all students benefit from rigorous coursework and foster strong parental involvement to create a supportive community. These efforts collectively help bridge the achievement gap and promote educational success for economically disadvantaged students.

Research Question 3

The third and final research question of this qualitative analysis was, “What instructional strategies and methods do high-performing schools employ to achieve high

proficiency rates in mathematics among students with learning disabilities?" Table 16 highlights the themes that emerged in the analysis of this question when looking at the foundational categories of school systems and methodologies created by the researcher.

Table 16

Themes Supporting High-Performance Among Students with Disabilities

Students with Learning Disabilities		
Research Question	**Foundational Category**	**System/Methodology**
RQ3: What instructional strategies and methods do high-performing schools employ to achieve high proficiency rates in mathematics among students with learning disabilities?	**Curriculum**	Vertical Alignment
		Horizontal Alignment
		Curriculum Development/Approach
	Instruction/Assessment	Assessment Strategy
		Instructional Strategy
		Lesson Planning Strategy
	Professional Learning	Professional Development
		Collaborative Approach
		Coaching Strategy
	Resources	Human Resource
		Textual Resource
		Curriculum Resource
		Parent Resource
	Student Learning	Growth Strategy
		Retention Strategy
		Intervention Strategy
		Special Education Strategy
		Engagement Strategy

Note. Table 16 identifies the themes that emerged through the interview process specific to research question 3. Foundational categories and system/methodology themes that emerged are highlighted in yellow.

Although similar themes developed when addressing this question as compared to research question 1, the mathematical achievement and success of students with learning disabilities came with a higher focus on instructional and intervention strategies in this scenario. Similar to students of low socio-economic status, access to the highest level of education through a guaranteed and viable curriculum also became a recurring theme throughout the research process.

Nolet and McLaughlin (2005) described the importance of the individualized education (IEP) team in writing student goals, evaluating present levels of proficiency, and providing intervention strategies to address learning gaps throughout a child's education. If these items can be addressed appropriately, students with disabilities can benefit significantly from inclusion in the general classroom setting.

All three schools in this research project shared a commitment to providing students with learning disabilities the opportunity to engage in a rigorous and relevant curriculum that aligns with grade-level math standards. Each school referenced full inclusion within the mathematics classroom, implementing strategies to deliver targeted interventions based on data and proficiency assessments of essential skills. Although the leader at School C described the utilization of small group math instruction for twenty to thirty percent (20-30%) of the special education population, she was adamant that the mathematics curriculum was not altered in these classrooms, and students had the same exposure to a high level of rigor and relevance in these classrooms. A student with a specific disability in math or reading at any of the three schools studied does not result in a diluted curriculum or a slower-paced experience, which could lead to learning gaps over time. Instead, all students are exposed to high-level questioning and practical

mathematical applications, with embedded intervention processes to address learning difficulties and remediate essential math skills.

When discussing the benefit of external resources to aid in curriculum delivery and instructional practices, both School B and School C placed a significant emphasis on additional programs tailored to support learning at each student's level of mastery. Both schools employ comprehensive technology programs that use diagnostic testing to assess students' competency in specific math concepts, offering engaging practice and activities based on their proficiency levels. School B uses the online program Xtra Math, whereas School C utilizes a math resource called iReady Math. These programs can be used independently by students and families or facilitated directly by teachers in classroom or remedial settings. While School A did not detail specific programming for this purpose, the principal emphasized that data from the school's benchmark testing allows teachers to provide similar remediation through collaboration and collective planning.

As discussed in research question 1, all three schools demonstrated the importance of using data to identify proficiency levels in math skills and concepts for students with learning disabilities. Frequent formative assessments, summative assessments, and benchmark assessments were important in determining which students needed remediation or intervention in essential learning skills. Concrete examples of this support include School A's flexible grouping strategy, School B's daily 30-minute math intervention sessions, and School C's three weekly 30-minute targeted math remediation sessions. These strategies underscore the importance of providing support to help students stay on track for high levels of mathematical achievement.

Based on the findings related to research question three (3), in order to foster high rates of mathematical achievement among special education subgroups, schools must provide these students with:

- Access to a guaranteed and viable curriculum at their grade level
- Frequent assessments in which the data is used to tailor instruction and provide targeted intervention
- Meaningful resources that assist in the learning process and promote growth among individual students

When students are provided the necessary resources and supports, learning can occur at high levels regardless of the presence of learning disabilities.

Limitations

There were several limitations that could have a significant impact on the overall results of this project. The first limitation of this comprehensive research study is the small sample size, as only three schools were analyzed. While these schools met the criteria of having a 60% or higher proficiency rate on state standardized math tests and an economically disadvantaged subgroup of at least 20% for the 2021-2022 school year, the limited number of schools restricts the generalizability of the findings. A larger sample size would have provided a more detailed data set, allowing for a more comprehensive analysis and increasing the reliability of the study's conclusions. The small sample also limits the ability to capture the variability and nuances across different schools, which could affect the overall interpretation of the effectiveness of educational systems and strategies.

Another limitation pertains to the researcher's interactions with school administrators. Ideally, the researcher aimed to speak directly with the principals of each identified school to gain insights into their leadership and instructional strategies; however, the principal of School C was on medical leave, necessitating an interview with the school's Title I coordinator instead. This substitution might have resulted in a different perspective, potentially lacking the depth of knowledge or strategic vision a principal might offer. Additionally, the principal of School B was new to his position despite having prior involvement with the school at the district level. This recent transition could mean that the principal was still in the process of implementing or adapting strategies, possibly affecting the consistency and depth of information gathered regarding the school's performance and approaches. A potential approach that may have avoided this limitation would be to include small teams of school leaders rather than depending on one building administrator in the formal interview process.

A third limitation is that the percentage of student subgroups for each school in the study varied significantly. Variations in the demographics and sizes of these subgroups can influence the comparability of the schools and the study's overall findings. For instance, one school might have a higher percentage of economically disadvantaged students compared to another, affecting resource allocation, teaching methods, and student outcomes. These demographic differences can confound the results, making it challenging to attribute differences in proficiency rates solely to the educational strategies and school systems implemented. A more uniform distribution of subgroup percentages would have enabled a more controlled comparison and clearer insights into the factors contributing to academic success.

Finally, this research study relied heavily on the results of the Pennsylvania System of School Assessments (PSSAs) for mathematics proficiency, introducing another limitation. Many other quantitative data sources exist such as local formative assessments, student course grades, benchmark assessments, and content diagnostic tests; however, the researcher chose to focus the quantitative portion of this study to standardized test results because this data transcended the largest number of schools in the state of Pennsylvania. It is also notable that the effectiveness of schools and districts is primarily judged based on the performance of those entities and organizations based on their performance on state standardized assessments.

Recommendations for Future Research

The results of this study provide much insight into the methods and practices that can lead to higher levels of student achievement in mid-level mathematics, particularly among economically disadvantaged students and students with specific learning disabilities; however, there are three recommendations for future research that may provide a more comprehensive, in-depth analysis of this phenomenon.

The first recommendation is to broaden the scope beyond a single snapshot view of mathematics proficiency rates. Instead of relying solely on data from the 2021-2022 school year, researchers could incorporate a longitudinal approach, considering multiple years of data to identify schools with consistent historical success in mathematics proficiency. This longitudinal analysis would provide a more comprehensive understanding of schools' performance trends over time, allowing for the identification of factors contributing to sustained academic achievement. By examining trends across

multiple years, researchers can better assess the stability and effectiveness of educational practices within high-achieving schools.

Secondly, future research could delve deeper into the specific implementation of enrichment and remediation practices within high-achieving schools. Rather than focusing solely on proficiency rates, researchers could investigate the strategies and interventions used by schools to support student learning and achievement. It became glaringly clear in this research project that effective intervention strategies were perceived as crucial in overall student achievement. By examining the specific practices identified by each school, researchers can gain insights into the effectiveness of different instructional approaches and interventions. This detailed examination can inform best practices for promoting mathematics proficiency and address any gaps or inconsistencies in current educational strategies.

Finally, by exploring student cohorts within a specific school system over two to three years, growth and achievement in mathematics can be tracked across multiple grades, and strategies and practices can be monitored more systematically. Researchers can identify critical factors influencing academic outcomes by analyzing variables that contribute to students' overall success or lack thereof during this time period. This longitudinal analysis would provide valuable insights into the effectiveness of instructional practices, curriculum alignment, teacher effectiveness, and other school-level factors in promoting student learning and achievement in mid-level mathematics. By focusing on specific cohorts, researchers can also account for individual differences and better understand how student characteristics interact with educational practices to influence academic outcomes over time.

Summary

The purpose of this mixed method research study was to identify three high-achieving schools based on their performance in 5th grade on state-standardized math assessments. The study aimed to uncover the instructional practices and systems that contributed to these schools' success, particularly focusing on the general student population as well as special education and economically disadvantaged subgroups. Through an in-depth analysis, the researchers selected schools with an economically disadvantaged subgroup representing at least 20% of their student population and a proficiency rate of at least 60% or above on the 5th-grade standardized math assessment for the 2021-2022 school year.

Three specific themes emerged from this study that were considered critical by each participant in the overall success of their high-achieving schools. First, each school implemented a guaranteed and viable curriculum aligned with state standards for mathematics. This curriculum was consistent horizontally across different classrooms and vertically across grade levels, ensuring that all students, regardless of their backgrounds, had access to high-quality mathematical instruction. The alignment facilitated a seamless educational experience and minimized gaps in learning progression from one grade to the next.

Second, the schools had established robust assessment systems that enabled teachers and staff to pinpoint learning deficiencies early and often. These systems provided critical data that informed the development and application of targeted intervention strategies. By addressing learning gaps promptly, each school was able to

prepare students effectively for subsequent levels of instruction, fostering continuous academic growth.

Lastly, the study highlighted the importance of engaging students and families within the community. Schools created processes to ensure that families were aware of available resources and understood the strategies being implemented to support their children's academic success, specifically in the area of math education. This community involvement proved essential in reinforcing educational efforts and promoting a supportive learning environment for all students within their schools as well as in their home environments.

Based on the results of this study, and as an administrative leader in the Kiski Area School District, the researcher will devote more time and effort to the development of community engagement strategies as well as the administration and data analysis of local assessment approaches. The data provided in this project strongly supports that improvement in these areas can lead to higher levels of math achievement among economically disadvantaged students and students with learning disabilities. By implementing the data-supported strategies outlined in this study, the Kiski Area School District can assist students within identified subgroups and improve overall mathematics achievement at a pivotal time in the developmental process.

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APPENDICES

Appendix A

IRB Approval

PennWest UNIVERSITY

Institutional Review Board
250 University Avenue
California, PA 15419
instreviewboard@calu.edu
Melissa Sovak, Ph.D.

Dear Brian Swartzlander,

Please consider this email as official notification that your proposal titled "Effective Systems and Instructional Strategies for Mid-Level Mathematics Achievement" (Proposal #PW23-007) has been approved by the Pennsylvania Western University Institutional Review Board as submitted.

The effective date of approval is 09/14/2023 and the expiration date is 09/13/2024. These dates must appear on the consent form.

Please note that Federal Policy requires that you notify the IRB promptly regarding any of the following:

(1) Any additions or changes in procedures you might wish for your study (additions or changes must be approved by the IRB before they are implemented)

(2) Any events that affect the safety or well-being of subjects

(3) Any modifications of your study or other responses that are necessitated by any events reported in (2).

(4) To continue your research beyond the approval expiration date of 09/13/2024, you must file additional information to be considered for continuing review. Please contact instreviewboard@calu.edu

Please notify the Board when data collection is complete.

Regards,

Melissa Sovak, PhD.
Chair, Institutional Review Board

Appendix B

Participant Recruitment Email

Research Project – Recruitment Email

Dear Sir/Madam,

I am a doctoral candidate at Penn West University and the current principal of Kiski Area Upper Elementary School in the Kiski Area School District.

Based on public data obtained through the Pennsylvania eMetric website, your school district has achieved high performance in mid-level mathematics among economically disadvantaged students (or students with disabilities) during the 2022-2023 school year. Congratulations! I am writing because I would very much like to interview you or an identified school leader in your building to obtain information on your mathematical systems and instructional practices related to mathematics. My study focuses on the identification and analysis of "Effective Systems and Instructional Strategies for Mid-Level Mathematics Achievement." Your assistance in this process would be invaluable.

Participation in this study is completely voluntary, and should you agree to participate, all questions will be provided to you prior to a scheduled formal interview. The interview itself will take approximately 45-60 minutes to complete and can be done in person, virtually, or by phone.

Please respond to this email (brian.swartzlander@kiskiarea.com), or feel free to contact me directly at 724-727-3421 if you need more information or clarification.

Thank you very much for your time and consideration!

Sincerely,

Brian W. Swartzlander, Jr.
Kiski Area Upper Elementary Principal
Penn West University Doctoral Candidate

Appendix C

Principal A Consent to Participate in the Research Study

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Title:	Effective Systems and Instructional Strategies for Mid-Level Mathematics Achievement
Investigator:	Brian W. Swartzlander, Jr., Researcher Penn West University brian.swartzlander@kiskiarea.com 724-882-8189
Advisor:	Dr. Mary A. Wolf, Faculty Capstone Committee Advisor College of Education wolf@pennwest.edu 814-229-7769
Source of Support:	This study is being performed as partial fulfillment of the requirements for the doctoral degree in Educational Leadership at Penn West University.
Purpose:	One identified individual is being asked to participate in a research project that seeks to investigate how school teams maximize rates of Mathematics proficiency among a student population comprised of economically disadvantaged students and students with learning disabilities. To qualify for participation, the identified individual must be a principal, curriculum director, or mathematics department head in an elementary or middle school in Pennsylvania serving an economically disadvantaged student population exceeding 25% of enrollment or a building Pennsylvania System of School Assessment Mathematics proficiency exceeding 60% during the 2022-2023 school year. The names of potential participants in this study have been provided to the researcher by the supervising building principal.
Participant Procedures:	To participate in this study, you will be asked to allow the researcher to interview you using audio and video recording software. Recordings will be transcribed by the researcher. The semi-structured interview should take 45-60 minutes to complete. To participate in this study, you will also be asked to complete the following: 1. Review research study questions (attached). Please note that there will likely be follow-up questions based on your initial responses to the provided questions, should you agree to participate. 2. Complete and submit the electronic consent form described in the recruitment letter. 3. Participate in a 45–60-minute semi-structured interview conducted using audio and video recording software. The interview will be transcribed by the researcher. These are the only requests that will be made of you.
Risks and Benefits:	There are minimal risks associated with this participation, but no greater than those encountered in everyday life.
Compensation:	There will be no compensation for participation in this study. Participation in the project

Compensation: There will be no compensation for participation in this study. Participation in the project will require no monetary cost to you.

Confidentiality: Your participation in this study and any personal information that you provide will be kept confidential at all times and to every extent possible. Where needed, personal identifiers will be redacted.

Your name will never appear on any survey or research instruments or in the capstone manuscript. All written and electronic forms and study materials, including audio and video recordings, will be kept secure and password-protected. Any study materials with personal identifying information will be maintained for three years after the completion of the research and then destroyed.

Right to Withdraw: You are under no obligation to participate in this study. You have the right to refuse to answer any question for any reason in addition to the right to withdraw entirely from the study without negative consequences. Please review the provided questions prior to signing this consent form. Please note that there may be follow-up questions based on your responses to the provided questions.

Summary of Results: A summary of the results of this research will be supplied to you, at no cost, upon request.

Voluntary Consent: I have read the above statements and understand what is being requested of me. I also understand that my participation is voluntary and that I am free to withdraw my consent at any time, and/or refuse to answer any individual questions, for any reason. On these terms, I certify that I am willing to participate in this research project. I understand that should I have any further questions about my participation in this study, I may call Brian Swartzlander at 724-882-8189 or email at brian.swartzlander@kiskiarea.com.

Omitted for Confidentiality 2-23-24

Participant's Signature Date

Brian W. Swartzlander, Jr. 2/23/2024

Researcher's Signature Date

Recording Consent: I affirm permission to be recorded using both audio and visual means.

Omitted for Confidentiality 2-23-24

Participant's Signature Date

Brian W. Swartzlander, Jr. 2/23/2024

Researcher's Signature Date

Appendix D

Principal B Consent to Participate in the Research Study

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Title: Effective Systems and Instructional Strategies for Mid-Level Mathematics Achievement

Investigator:
Brian W. Swartzlander, Jr., Researcher
Penn West University
brian.swartzlander@kiskiarea.com
724-882-8189

Advisor:
Dr. Mary A. Wolf, Faculty Capstone Committee Advisor
College of Education
wolf@pennwest.edu
814-229-7769

Source of Support: This study is being performed as partial fulfillment of the requirements for the doctoral degree in Educational Leadership at Penn West University.

Purpose: One identified individual is being asked to participate in a research project that seeks to investigate how school teams maximize rates of Mathematics proficiency among a student population comprised of economically disadvantaged students and students with learning disabilities.

To qualify for participation, the identified individual must be a principal, curriculum director, or mathematics department head in an elementary or middle school in Pennsylvania serving an economically disadvantaged student population exceeding 25% of enrollment or a building Pennsylvania System of School Assessment Mathematics proficiency exceeding 60% during the 2022-2023 school year.

The names of potential participants in this study have been provided to the researcher by the supervising building principal.

Participant Procedures: To participate in this study, you will be asked to allow the researcher to interview you using audio and video recording software. Recordings will be transcribed by the researcher. The semi-structured interview should take 45-60 minutes to complete. To participate in this study, you will also be asked to complete the following:

1. Review research study questions (attached). Please note that there will likely be follow-up questions based on your initial responses to the provided questions, should you agree to participate.
2. Complete and submit the electronic consent form described in the recruitment letter.
3. Participate in a 45–60-minute semi-structured interview conducted using audio and video recording software. The interview will be transcribed by the researcher.

These are the only requests that will be made of you.

Risks and Benefits: There are minimal risks associated with this participation, but no greater than those encountered in everyday life.

Compensation: There will be no compensation for participation in this study. Participation in the project

will require no monetary cost to you.

Confidentiality: Your participation in this study and any personal information that you provide will be kept confidential at all times and to every extent possible. Where needed, personal identifiers will be redacted.

Your name will never appear on any survey or research instruments or in the capstone manuscript. All written and electronic forms and study materials, including audio and video recordings, will be kept secure and password protected. Any study materials with personal identifying information will be maintained for three years after the completion of the research and then destroyed.

Right to Withdraw: You are under no obligation to participate in this study. You have the right to refuse to answer any question for any reason in addition to the right to withdraw entirely from the study without negative consequences. Please review the provided questions prior to signing this consent form. Please note that there may be follow-up questions based on your responses to the provided questions.

Summary of Results: A summary of the results of this research will be supplied to you, at no cost, upon request.

Voluntary Consent: I have read the above statements and understand what is being requested of me. I also understand that my participation is voluntary and that I am free to withdraw my consent at any time, and/or refuse to answer any individual questions, for any reason. On these terms, I certify that I am willing to participate in this research project. I understand that should I have any further questions about my participation in this study, I may call Brian Swartzlander at 724-882-8189 or email at brian.swartzlander@kiskiarea.com.

Omitted for Confidentiality

Participant's Signature — Date: 3/25/2024

Brian W. Swartzlander, Jr

Researcher's Signature — Date: 3/10/2024

Recording Consent: I affirm permission to be recorded using both audio and visual means.

Omitted for Confidentiality

Participant's Signature — Date: 3/25/2024

Brian W. Swartzlander, Jr

Researcher's Signature — Date: 3/10/2024

Appendix E

School Leader C Consent to Participate in the Research Study

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Title:	Effective Systems and Instructional Strategies for Mid-Level Mathematics Achievement
Investigator:	Brian W. Swartzlander, Jr., Researcher Penn West University brian.swartzlander@kiskiarea.com 724-882-8189
Advisor:	Dr. Mary A. Wolf, Faculty Capstone Committee Advisor College of Education wolf@pennwest.edu 814-229-7769
Source of Support:	This study is being performed as partial fulfillment of the requirements for the doctoral degree in Educational Leadership at Penn West University.
Purpose:	One identified individual is being asked to participate in a research project that seeks to investigate how school teams maximize rates of Mathematics proficiency among a student population comprised of economically disadvantaged students and students with learning disabilities. To qualify for participation, the identified individual must be a principal, curriculum director, or mathematics department head in an elementary or middle school in Pennsylvania serving an economically disadvantaged student population exceeding 50% of enrollment and a building Pennsylvania System of School Assessment Mathematics proficiency exceeding 60% during the 2022-2023 school year. The names of potential participants in this study have been provided to the researcher by the supervising building principal.
Participant Procedures:	To participate in this study, you will be asked to allow the researcher to interview you using audio and video recording software. Recordings will be transcribed by the researcher. The semi-structured interview should take 45-60 minutes to complete. To participate in this study, you will also be asked to complete the following: 1. Review research study questions (attached). Please note that there will likely be follow-up questions based on your initial responses to the provided questions, should you agree to participate. 2. Complete and submit the electronic consent form described in the recruitment letter. 3. Participate in a 45–60-minute semi-structured interview conducted using audio and video recording software. The interview will be transcribed by the researcher. These are the only requests that will be made of you.
Risks and Benefits:	There are minimal risks associated with this participation, but no greater than those encountered in everyday life.

Compensation: There will be no compensation for participation in this study. Participation in the project will require no monetary cost to you.

Confidentiality: Your participation in this study and any personal information that you provide will be kept confidential at all times and to every extent possible. Where needed, personal identifiers will be redacted.

Your name will never appear on any survey or research instruments or in the capstone manuscript. All written and electronic forms and study materials, including audio and video recordings, will be kept secure and password-protected. Any study materials with personal identifying information will be maintained for three years after the completion of the research and then destroyed.

Right to Withdraw: You are under no obligation to participate in this study. You have the right to refuse to answer any question for any reason in addition to the right to withdraw entirely from the study without negative consequences. Please review the provided questions prior to signing this consent form. Please note that there may be follow-up questions based on your responses to the provided questions.

Summary of Results: A summary of the results of this research will be supplied to you, at no cost, upon request.

Voluntary Consent: I have read the above statements and understand what is being requested of me. I also understand that my participation is voluntary and that I am free to withdraw my consent at any time, and/or refuse to answer any individual questions, for any reason. On these terms, I certify that I am willing to participate in this research project. I understand that should I have any further questions about my participation in this study, I may call Brian Swartzlander at 724-882-8189 or email at brian.swartzlander@kiskiarea.com.

Omitted for Confidentiality dotloop verified 05/16/24 11:20 AM EDT DB8G-MGIH-RKBZ-QLUS

Participant's Signature Date

Brian W. Swartzlander, Jr. 5/15/2024

Researcher's Signature Date

Recording Consent: I affirm permission to be recorded using both audio and visual means.

Omitted for Confidentiality dotloop verified 05/16/24 11:21 AM EDT T2A4-MLV7-VERE-DT9R

Participant's Signature Date

Brian W. Swartzlander, Jr. 5/15/2024

Researcher's Signature Date

Appendix F

Structured Interview Questions

Qualitative perceptions of successful mathematical instructional strategies and mathematical systems in high-performing schools will be researched by interviewing a principal, curriculum director, or mathematics department head in those identified high-performing schools. The following interview questions will be used:

Qualitative Interview Questions
General Questions (4)
1. Discuss the educational mission and vision of your school district. 2. How many years have you been in your current position? 3. Describe the role data plays in informing instructional decisions within your school. 4. Describe your background and experiences with mathematical instruction/ Discuss your overall approach to mid-level mathematics (grades 2-5).
Special Education Students (4)
1. What are your experiences in working with special education students? 2. What is your school's approach to educating students in the area of mathematics who have specific mathematical learning disabilities? 3. Do you implement an adapted mathematical curriculum for specific special education students? If so, how do you determine which students will receive this curriculum? If not, how do you ensure that students receive the supports and services that they need related to mathematical instruction? 4. Describe the capacity of your school to provide intervention to students demonstrating developmental delays in mathematics.
Economically Disadvantaged Students (4)
1. What are your experiences in working with economically disadvantaged students? 2. Does your school utilize any strategies to engage economically disadvantaged families with mathematical instruction? 3. Discuss the mindset of staff in working with economically disadvantaged families. 4. Discuss the knowledge of your staff in recognizing the challenges faced by economically disadvantaged families.

External Factors (2)
1. Tell me about common occurrences of childhood trauma faced by students at your school. 2. Tell me about the local community, discussing major economic drivers, housing, and other scenarios contributing to the financial well-being of families.
School Services/Resources (5)
1. Describe the presence of wraparound services, early interventions, and after-school programs within your school. 2. Discuss professional development initiatives and responsibilities in your school related to math instruction. 3. Discuss the process for adopting instructional materials within your school. 4. What mathematical resources do your teachers utilize for students and/or families? Do these differ across grade levels (particularly grades 3-6)? 5. What type of evaluation tools do teachers utilize for progress monitoring, student achievement/retention, and/or student growth and development?
Miscellaneous (1)
Is there any additional information you would like to share?