Increasing Mathematics Proficiency and Growth Through Focused, Data-Driven, Professional Learning

Joye Camille Cullen

University of Mississippi

Follow this and additional works at: https://egrove.olemiss.edu/etd

Recommended Citation
https://egrove.olemiss.edu/etd/2671

This Thesis is brought to you for free and open access by the Graduate School at eGrove. It has been accepted for inclusion in Electronic Theses and Dissertations by an authorized administrator of eGrove. For more information, please contact egrove@olemiss.edu.
INCREASING MATHEMATICS PROFICIENCY AND GROWTH THROUGH FOCUSED, DATA-DRIVEN, PROFESSIONAL LEARNING

A dissertation presented in partial fulfillment of requirements for the degree of Doctor of Education in the Department of Leadership and Counselor Education The University of Mississippi

by

JOYE CULLEN

August 2023
ABSTRACT

In this dissertation, I aimed to improve elementary teachers’ mathematical instruction by enhancing their content knowledge and skills through the implementation of professional learning communities (PLCs) and professional development. The research design consisted of multiple evaluation steps conducted over time with a collaborative action plan the leadership team, mathematics specialist, and teachers developed. Quantitative and qualitative data were collected from participating classrooms and were analyzed at different phases of the program evaluation.

The scope of the study addressed the lack of content knowledge among elementary teachers, which led to gaps in instruction and difficulties in explaining to students advanced mathematical concepts. The research justified a mixed methods approach to capture accurately the effectiveness of the interventions and the use of surveys, observations, anecdotal notes, and various quantitative data sources (e.g., common assessments, state test data, and benchmark data). A control group was used to measure the impact of the applied research action plan.

The results indicated positive changes in teachers’ perceptions of the effectiveness of PLCs in addressing instructional challenges. Improvements were observed in collegial support, belief in every student’s ability to learn, ease of communication within the PLC, and the impact of PLC time on daily instruction. Observations and learning walks supported the conclusion of the mathematics PLCs and professional development initiatives to address effectively instructional challenges in classrooms.

The teachers who participated in mathematics professional development demonstrated
increased frequency of high-quality instructional practice (HQIP). They exhibited enhanced self-efficacy, used manipulatives, engaged in regular practice, facilitated understanding of word problems, provided small group instruction, used data to drive instruction, and used resources effectively. Overall, participating in mathematics PLCs and professional development appears to affect positively instructional practices and student achievement in elementary mathematics.

Keywords: professional learning communities, professional development, teacher efficacy, student achievement, elementary mathematics, mixed methods study
DEDICATION

I dedicate this dissertation to the cherished memory of my beloved grandparents, Reginald M. Cullen, Sr. and Ollie Ester Cullen. They were not only my source of inspiration, but also esteemed educators who instilled in me a deep love for knowledge and learning. Their unwavering commitment to education continues to guide me on this scholarly journey.

Furthermore, I pay homage to my esteemed ancestors who paved the way for me. Ned Wicks, who embarked on a journey to Mississippi in the 1800s, and Dennis Wicks, Sr., who astutely acquired 330 acres of land in 1910, played pivotal roles in shaping our family’s legacy. Their vision and determination laid the foundation for my great-grandfather (four times removed), Zacharias Wicks, Sr., who established “The Wicks Normal School” and fostered a thriving community centered around education.

With immense gratitude, I recognize I am the product of a lineage filled with proud educators and passionate proponents of knowledge. It is with humility and a sense of responsibility I embark on this scholarly endeavor. I hope, through my work, that I have honored the sacrifices and achievements of my ancestors and made them proud. May their wisdom, guidance, and everlasting love continue to inspire and guide me throughout my academic journey and beyond.
LIST OF ABBREVIATIONS AND SYMBOLS

HPES – High Point Elementary School
HQIP – high-quality instructional practice
HQMI – high-quality mathematics instruction
MAAP – Mississippi Academic Assessment Program
MLSC – Mathematics Learning Study Committee
MPD – mathematics professional development
MPLC – mathematics professional learning communities
NCTQ – National Council on Teacher Quality
NMAP – National Mathematics Advisory Panel
NRC – National Research Council
PLC – professional learning communities
STEAM – science, technology, engineering, art, and mathematics
SY – school year
USDOE – U.S. Department of Education
VCSD – Vitality Collective School District
ACKNOWLEDGEMENTS

I am deeply grateful to all the people who have supported me throughout the journey of completing this dissertation. Without their guidance, encouragement, and unwavering support, this work would not have been possible.

First and foremost, I would like to express my heartfelt appreciation to my committee members, who played a crucial role in shaping this body of work. I am immensely grateful to Dr. Dennis Bunch, my dissertation chair, for his invaluable contributions. His countless hours of reading, editing, and providing insightful advice have been instrumental in refining this research. I am indebted to his unwavering support and encouragement throughout the entire process.

I would also like to extend my sincere gratitude to Dr. Wilner Bolden for his honesty, support, and for being an invaluable member of my committee. My committee member’s expertise and guidance have greatly enriched this study. Additionally, I express my deepest thanks to Dr. Jill Cabrera-Davis and Dr. Hunter Taylor for their willingness to serve on my committee and for providing valuable, constructive feedback which have also significantly strengthened this dissertation.

To my family, who have been my constant pillars of support, I am forever grateful. Mom, Mildred W. Cullen-Dillon, your unwavering presence, listening ear, and contagious laughter have provided solace and motivation during challenging times. Your delicious meals, prepared with love, have nourished me and allowed me to focus on my studies. Dad, Reginald M. Cullen, Jr., an educator par excellence, your words of encouragement and daily check-ins have kept me
motivated and reminded me of the importance of pursuing my dreams. Your unwavering belief in me has been a source of strength.

To my oldest brother, Reginald M. Cullen III, thank you for continuously pushing me to challenge myself and strive for excellence. Your unwavering support and belief in my abilities have been invaluable.

Engrim Cullen, my brother, your prophetic words from more than 20 years ago have come to fruition. Thank you for believing in me and inspiring me to reach for the highest of aspirations.

To my little sister, Meranda H. Lee, your intelligence, charm, and resilience have been a constant source of inspiration. Thank you for being a shining light in my life.

Last, but certainly not least, I want to express my deepest gratitude to my biggest cheerleader, my daughter, Jasmine. Your unwavering belief in me and your constant encouragement have been instrumental in keeping me focused and determined throughout this journey. I am immensely proud of the remarkable young lady you have become.

To all the individuals, friends, and mentors who have supported me along the way, your belief in my abilities and your words of encouragement have motivated me to persist and overcome challenges. I am grateful for the collective impact you have had on my academic and personal growth.
# TABLE OF CONTENTS

ABSTRACT ......................................................................................................................... ii

DEDICATION ...................................................................................................................... iv

LIST OF ABBREVIATIONS AND SYMBOLS .................................................................. v

ACKNOWLEDGEMENTS ................................................................................................... vi

LIST OF TABLES ................................................................................................................. xiii

LIST OF FIGURES ............................................................................................................. xiv

CHAPTER 1: INTRODUCTION ......................................................................................... 1

  Statement of the Problem .............................................................................................. 1
  Description of the Context ............................................................................................ 5
  Justification of the Problem .......................................................................................... 7
  Audience ....................................................................................................................... 9
  Purpose Statement ....................................................................................................... 10
  Research Questions ..................................................................................................... 11

CHAPTER 2: LITERATURE REVIEW ................................................................................. 13

  Introduction .................................................................................................................. 13
  Professional Learning Communities ............................................................................. 14
  Mathematics Professional Learning Community ......................................................... 16
  Professional Development ........................................................................................... 19
  Mathematics Professional Development ..................................................................... 21
  Efficacy .......................................................................................................................... 22
CHAPTER 3: DESIGN AND METHODS ................................................................. 29

  Introduction ........................................................................................................ 29

  Development of the Action Plan ......................................................................... 31

  Action Plan Overview .......................................................................................... 36

    Element 1: Mathematics Professional Learning Communities ......................... 37

    Element 2: Mathematics Professional Development ......................................... 38

    Element 3: Mathematics Teacher Efficacy ......................................................... 39

  Program Evaluation of the Action Plan .................................................................. 39

  Evaluation of Mathematics Professional Learning Communities ....................... 39

  Evaluation of Mathematics Professional Development ....................................... 40

  Evaluation of Mathematics: Teacher Efficacy ..................................................... 41

  Data Collection Plan ............................................................................................ 41

  Data Analysis ....................................................................................................... 42

  Coding ................................................................................................................... 45

  Analysis ................................................................................................................ 45

CHAPTER 4: RESULTS ......................................................................................... 47
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>47</td>
</tr>
<tr>
<td>Research Question 1</td>
<td>49</td>
</tr>
<tr>
<td>Research Question 2</td>
<td>62</td>
</tr>
<tr>
<td>Observations and Learning Walks</td>
<td>64</td>
</tr>
<tr>
<td>September 1, 2022, Observations</td>
<td>65</td>
</tr>
<tr>
<td>October 28, 2022, Observations</td>
<td>65</td>
</tr>
<tr>
<td>November 29, 2022, Observations</td>
<td>66</td>
</tr>
<tr>
<td>Conclusion</td>
<td>66</td>
</tr>
<tr>
<td>Research Question 3</td>
<td>67</td>
</tr>
<tr>
<td>Third Grade 2021–2023</td>
<td>67</td>
</tr>
<tr>
<td>Fourth Grade 2021–2023</td>
<td>70</td>
</tr>
<tr>
<td>Fifth Grade 2021–2023</td>
<td>73</td>
</tr>
<tr>
<td>Research Question 4</td>
<td>75</td>
</tr>
<tr>
<td>Research Question 5</td>
<td>77</td>
</tr>
<tr>
<td>Part I of the Survey</td>
<td>78</td>
</tr>
<tr>
<td>Part 2 of the Survey</td>
<td>84</td>
</tr>
<tr>
<td>Research Question 6</td>
<td>93</td>
</tr>
<tr>
<td>Preliminary Data for 2023</td>
<td>95</td>
</tr>
<tr>
<td>Conclusion</td>
<td>96</td>
</tr>
<tr>
<td>CHAPTER 5: CONCLUSION</td>
<td>98</td>
</tr>
<tr>
<td>Introduction</td>
<td>98</td>
</tr>
</tbody>
</table>

x
Program Evaluation Standards .................................................................................................................. 99

Element 1: Mathematics Professional Learning Communities .......................................................... 100

Element 2: Mathematics Professional Development ........................................................................... 102

Element 3: Mathematics Teacher Efficacy ......................................................................................... 104

Recommendations .................................................................................................................................. 106

Conclusion ................................................................................................................................................ 107

REFERENCES ......................................................................................................................................... 1098

APPENDICES ......................................................................................................................................... 124

APPENDIX A: LEARNING WALK SCHEDULE 2021–2022................................................................. 124

APPENDIX B: MATHEMATICS MONTHLY FOCUS ........................................................................... 126

APPENDIX C: TEACHER PROFESSIONAL LEARNING COMMUNITY SURVEY ........................................... 127

APPENDIX D: TEACHER BELIEFS SURVEY ......................................................................................... 128

APPENDIX E: HIGH POINT ELEMENTARY SCHOOL ACTION PLAN .............................................. 133

APPENDIX F: PERMISSION TO PRACTICE ACTION RESEARCH ...................................................... 136

APPENDIX G: TEACHER EFFICACY INTERVIEW QUESTIONS ............................................................ 137

APPENDIX H: BOOK STUDY SCHEDULE AND DISCUSSION TOPICS ............................................. 139

APPENDIX I: PROFESSIONAL DEVELOPMENT SURVEY ................................................................. 142

APPENDIX J: PROFESSIONAL LEARNING COMMUNITY SCHEDULE .............................................. 143

APPENDIX K: WEDNESDAY PROFESSIONAL DEVELOPMENT SCHEDULE ...................................... 144

APPENDIX L: PROFESSIONAL DEVELOPMENT CALENDAR 2021–2022 ................................. 149
APPENDIX M: PROFESSIONAL DEVELOPMENT CALENDAR 2022 – DEC

2022 ........................................................................................................ 152
Education ..................................................................................................... 154
Professional Experience ............................................................................. 154
Honors, Recognition, and accomplishments ............................................. 155
Research Experience .................................................................................. 156
Presentations and Invited Lectures ............................................................. 157
Professional Training .................................................................................. 157
Professional Affiliations ............................................................................ 160
Certifications .............................................................................................. 160
Computer Skills .......................................................................................... 161
References .................................................................................................. 161
LIST OF TABLES

Table 1 Research Questions, Data Collections Tools, and Explanation Alignment ..................44

Table 2 Anova: Single Factor Analysis for Question 1 .............................................................51

Table 3 Anova: Single Factor Analysis for Question 2 .............................................................52

Table 4 Anova: Single Factor Analysis for Question 3 .............................................................53

Table 5 Anova: Single Factor Analysis for Question 4 .............................................................54

Table 6 Anova: Single Factor Analysis for Question 5 .............................................................55

Table 7 Anova: Single Factor Analysis for Question 6 .............................................................56

Table 8 Anova: Single Factor Analysis for Question 7 .............................................................57

Table 9 Anova: Single Factor Analysis for Question 8 .............................................................58

Table 10 Anova Single Factor Analysis for Question 9 ............................................................59

Table 11 Anova: Single Factor Analysis for Question 10 ..........................................................60

Table 12 Anova: Single Factor Analysis for Question 11 ..........................................................61

Table 13 Mathematics Professional Development Correlation ..................................................64

Table 14 Tukey Third-Grade Comparisons ............................................................................70

Table 15 Tukey Fourth-Grade Comparisons ..........................................................................72

Table 16 Tukey Fifth-Grade Comparisons ..............................................................................75

Table 17 HPES Overall End of Year School Mathematics Data ..............................................96
LIST OF FIGURES

Figure 1. Guskey’s Theoretical Framework ................................................................. 20
Figure 2. Pedagogy Model ............................................................................................ 26
CHAPTER 1: INTRODUCTION

Statement of the Problem

My teaching background ranges from preschool to eighth-grade mathematics. In lower elementary school, a heavy focus was placed on teaching students the phonemes, phonics, and word recognition of English. In the intermediate school setting, a heavy focus was made on reading comprehension and preparing students to navigate successfully the state tests. Eventually, best practices for reading for Grade 4 and beyond were strategies I mastered in conveying them to my students. Concerns regarding my students learning mathematics and science skills grew because I wanted to prepare the students for a variety of choices in career fields. During the mid-2000s, schools began to focus on science, technology, engineering, art, and mathematics (STEAM). To develop elementary mathematical pedagogy, teachers have had to find ways to grow and develop their own self-efficacy.

Elementary teachers have numerous professional development opportunities to improve literacy and comprehension achievement. Opportunities for elementary education teachers to become better mathematics instructors are few. These professional development opportunities would help teachers to learn more about how students learn mathematics and how to facilitate learning more effectively in the classroom. In my personal experience as an elementary school teacher, I sought to learn strategies to teach mathematics more effectively by researching university outreach programs. Eventually, I discovered Project Prime, which was being offered at the University of Mississippi. Through this program, I learned new strategies to become a
more effective mathematics educator, which resulted in my training of teachers in my school. In the 2012–2013 school year (SY), my school’s overall proficiency in mathematics increased by an average of 8.4% through the use of professional learning communities (PLCs) focused on mathematics instruction.

Later in my career, I taught middle school mathematics. The time I spent teaching middle school allowed me to better understand there are certain elementary-level, mathematic skills necessary to the success of a middle schooler. Prior to being employed at High Point Elementary School (HPES, a pseudonym), the mathematics proficiency level of the middle school was 29.9%. The mathematics faculty collaborated on mathematical instruction and the flow of lessons. We also helped teachers learn to become data-driven instructors. In two years at the middle school, the mathematic proficiency increased to 49.7%, which moved the school to a Level B, according to the Mississippi Accountability system. This amounted to a 66.2% growth rate over the two-year period.

Currently, I work in an elementary school with Pre-Kindergarten (Pre-K) through Grade 5 as an assistant principal. The middle school experience has given me a perspective most elementary school teachers do not have. This insight pertains to mathematical proficiency and growth. The middle school experience has made me aware of the expectations of students in Grades 6–8. The vertical alignment of what students need to know and the exposure to concepts and skills to be successful in middle and high school is clear. I have a sense of urgency to make learning mathematics equally as important as learning reading.

The comprehensive, benchmark student data at HPES indicated a drop in mathematical proficiency starting at Grade 2 and gradually declining through Grade 5. Mathematical courses serve as gatekeepers for students seeking entrance to college. Approximately 40% of students who enroll in college in the United States of America enter community colleges. The graduation
rates are low at community colleges, particularly those of economically disadvantaged students, minority students, and students with disabilities (Aud et al., 2012; Choy, 2002; Provasnik & Planty, 2008). A research team led by J. Harackiewicz at the University of Wisconsin Madison found that disadvantaged students were more likely to abandon degrees in STEM fields (science, technology, engineering, and math) after struggling in a challenging introductory course (Chang, 2018). Mathematics is one of the key barriers to college advancement for students entering college. Additionally, Bromberg and Thetas (2016) conducted a large-scale study from 2009–2013 for the Education Trust, examining high school transcripts, showing that many students leave high school with a diploma in hand, but have no clear path forward. Bromberg and Thetas (2016) also indicated that only 8% of high school graduates completed an entire college and career preparation curriculum, specifically including mathematics courses through Algebra II.

According to the U.S. Department of Education’s (USDOE) National Mathematics Advisory Panel (NMAP; 2008),

A strong grounding in high school mathematics through Algebra II or higher correlates powerfully with access to college, graduation from college, and earning in the top quartile of income from employment. Students who complete Algebra II are more than twice as likely to graduate from college compared to students with less mathematical preparation. The value of such preparation promises to be even greater in the future. (pp. xii–xiii)

Data from the National Assessment of Educational Progress (2019) was collected through the 2019 assessment indicated, over the past decade, no significant change in mathematical scores had occurred for low-performing students. According to the 2018–2019 SY data from the Mississippi Succeeds Report Card (Mississippi Department of Education, 2019), approximately 47% of Mississippi students were proficient in mathematics. These scores had increased from
43.2% the previous school year, an 8.8% increase. This data and increase in scores indicated students’ understanding of mathematics has been increasing. Nevertheless, substantial work must yet be done to ensure all students become proficient in mathematics. Tier 1 mathematics instruction should adequately support the needs of 80% of all students. Tier 1 instruction must be strengthened to achieve higher levels of proficiency.

According to the National Council on Teacher Quality’s (NCTQ; as cited in Greenberg & Walsh, 2016) review of undergraduate, elementary teacher, preparation programs, 13% of the 860 programs examined covered critical mathematical topics, including numbers and operations, algebra, geometry, in addition to data and probability. NCTQ reviewed graduate programs in 2018 and found only one percent of 201 programs covered these topics. Elementary teachers need content knowledge in areas such as algebra, data analysis, and probability. These topics are usually associated with middle school, high school, and college mathematics. However, good mathematical instruction for young students builds the foundations for higher level mathematics in the upper grades and college. Elementary teachers must understand the topics taught and where the content is headed in future grades. Knowing how to develop students’ understandings and thinking patterns is essential so elementary teachers can equip students for later learning in mathematics.

Learning to read and complete mathematical problems is not a natural process for any student; both are learned processes. When students learn mathematics, teachers must know mastery and understanding involve more than rote memory. To understand completely the mathematical process, students need different representations, meaningful discourse, and efficient practice (Smith & Stein, 2018). Elementary school teachers have not been provided opportunities “to dive deep” into learning strategies to help to teach mathematics while keeping students engaged. Providing professional development and helping teachers to develop collective
efficacy will enable teachers to provide differentiation and interventions, as well as to meet the students’ needs.

**Description of the Context**

HPES is located in Prosperity, Mississippi (a pseudonym) and is one of six elementary schools in Vitality Collective School District (also a pseudonym). HPES is a Title I school which serves approximately 365 students, ranging from Pre-K to Grade 5. Thirteen percent of the enrollment is from the preschool program at the school. HPES is a Title I school, serving predominately African American students (88%); the remaining students are Caucasian (8%) and Hispanic (4%). All students receive free lunch. HPES employs provisionally certified teachers in addition to teachers who have less than four years of experience (37%). Several of these teachers did not major in elementary education. In fact, only 78% of the teachers held an elementary certification during the 2020–2021 SY and the remaining 22% of teachers held an emergency or provisional license (Personal communication, HPES Principal, Spring, 2021).

In 2005, HPES was one of the highest performing schools in the state. Over the past decade, school leaders within the school have consistently changed as has the format of state testing. School leaders changed in 2006 at which time the school’s scores dropped. The school was labeled as “At Risk of Failing” under the No Child Left Behind Act of 2001 accountability standards and ratings. Within the next three years, the school earned a “Successful” rating. The school leaders changed again in 2012, the school was labeled a Level D school under the No Child Left Behind Act (2001) accountability model. In 2014, the school grew to a Level C, and then dropped back to a Level D, and since 2016, has remained at this level (Personal communication, K. Benton, 2021).

Teachers have the most significant impact on student learning (Hattie, 2012). The current principal of HPES has served the school for nearly three years. The majority of her career has
been serving high school students. Since the transition to an elementary setting, she has learned a tremendous amount of information about serving an elementary school and meeting the needs of the teachers in the new environment. Several teachers and paraprofessionals at HPES either attended the school as a child or their child was a product of the school. Seven paraprofessionals on staff have nearly 20 collective years of experience at HPES. Additionally, the school has had a new assistant principal consecutively for the last four years, including me as the fourth assistant principal in only three years. HPES has some great teachers, but it has been difficult to attract highly qualified teachers over recent years, which is problematic for students in low, socioeconomic areas which are in need of teachers with a high level of instructional proficiency and self-efficacy.

To address the demands of a Title I school, teachers must collaborate. It has been found teachers have a misconception about planning meetings and PLCs (Kushnir, 2017). The first PLC meeting held this school year with the staff was not a proper PLC meeting. Each teacher was asked to talk about what they taught the particular day and how they thought their lessons went. In contrast, a typical PLC meeting should focus on four areas (DuFour et al., 2008):

1. What do we want our students to learn?
2. How will we know they are learning?
3. How will we respond when they do not learn?
4. How will we respond when they do learn?

PLCs develop teachers through collaboration. Teachers assemble in small groups and meet regularly to explore concepts and share expertise and insights from their teaching experiences. The essential questions promote teacher engagement in problem solving, inquiry, and reflection. Effective PLCs build knowledge and allow teachers to identify what they need to learn to promote valued student outcomes. Essentially, the leaders and teachers are working to enhance
teacher efficacy by building a collaborative culture within our school. Learning from the practices of one another will drive the pedagogical improvements needed to move HPES forward. The school leaders want to facilitate interdependent work toward a common goal.

The teachers at HPES need the administrative team to expose them to a variety of strategies to increase their repertoire. Students in a Title I school need effective Tier 1 lessons and Tier 2 interventions. New and provisional teachers need the skills and strategies to deliver the various modes of intervention. Veteran teachers provide interventions with more ease. Typically, Tier 2 intervention strategies become a learned behavior of teachers. To improve the culture of HPES, the school leaders must facilitate the learning teachers need for student success. The students at HPES have differing needs; therefore, the students respond appropriately to differing interventions.

HPES started the 2020–2021 SY in a virtual setting because of the COVID-19 pandemic. The lack of in-person teaching and learning has affected the students. The lack of face-to-face instruction has created a larger learning gap for some students. These students would be much farther ahead in their learning if instructional circumstances had been different. Creating a culture of learning among our students and teachers is essential. Teachers do not have the luxury of saying the student should remember instruction from the previous year. Teachers are deployed to focus on student data and results, provide interventions, and close learning gaps. Teachers need to build efficacy by aligning their practices to the curriculum. The desire of the school leaders and teachers is to create a collaborative culture at HPES where students flourish as learners.

**Justification of the Problem**

Hattie (2012) states, “the single greatest issue was the need for the teachers to develop a common understanding of progress.” He believes many teachers strive to meet the needs of
students. Teachers question themselves, worry about which students are not making appropriate progress, seek evidence of successes and gaps, and seek help when needed in their teaching. This self-examination is defined as teacher self-efficacy. The teachers’ beliefs in their ability to handle effectively the tasks, obligations, and challenges related to their professional activity play a crucial role in influencing critical academic outcomes and well-being in the working environment (Barni, 2019). Teachers’ self-efficacy is parallel to teaching effectiveness and instructional practices for students’ academic achievement (Klassen et al., 2009; Klassen & Tze, 2014).

Teachers with high self-efficacy might seek help through professional development; however, having a PLC within the school has been proven to be more effective. PLCs address areas of improvement needed in the school community by targeting the specific needs of students as well as of the school community. Well-functioning PLCs are individualized, for the teachers’ strengths and needs (a) are grounded in the principles of adult learning theory, (b) are sustained and supported through implementation with coaching and follow-up, (c) are consistently monitored and assessed to evaluate the impact of the PLC on student learning, and (d) are adjusted when necessary (Moir, 2015). Bandura (1997) termed collective efficacy as “a group’s shared belief in its conjoint capability to organize and execute the courses of action required to produce given levels of attainment” (p. 477). Collective efficacy in schools is not a new topic. Collective teacher efficacy had been used, and instruments had been developed to measure it (Goddard, 2002). In a meta-analysis of studies related to collective efficacy and achievement in education, Eells (2011) demonstrated the beliefs teachers hold about the ability of the school are “strongly and positively associated with student achievement across subject areas and in multiple locations” (p. 110). Hattie (2012) cited collective efficacy as the most prominent influence on student achievement.
Collective efficacy, implemented through PLCs, helps instructional leaders to develop expert teachers. Marzano (2010) believed that a classroom teacher has the most powerful influence on student achievement. Effective teachers boost student achievement. Wright et al. (1997) noted that the implications are to improve education by improving the effectiveness of teachers. Effective teachers appear to be effective with students of all achievement levels, regardless of the levels of conglomeration in their classroom. The “holy grail” of education is most likely to be found between students and their teachers (Mansell et al., 2008).

Elementary schools are focused heavily on building teachers’ capacity to teach English language arts. A balanced focus on teacher capacity to teach mathematics is needed in an effort to build a solid mathematical foundation. It is highly beneficial for students to master previous mathematical concepts, applications, and skills prior to learning algebra and other higher level mathematical courses. Mastering elementary and middle-level mathematics before learning algebra increases students’ chances for success when taking an algebra course. Elementary teachers are in dire need of professional development will result in educators with a solid mathematical foundation. Elementary educators should strive to assess students’ understanding prior to instruction and should meet the students’ needs at their own actual level versus at their assigned, current grade level.

**Audience**

The action plan was implemented in this research was designed improve the implementation of PLCs with the goal of improving student achievement. This research was a tool for school district leaders, administrators, instructional coaches, lead teachers, and other classroom teachers to transform the school community’s culture. The practice used in this research was intended to improve the efficacy of lower and upper elementary instructional practices applied to facilitate mathematics instruction.
I expected the teachers, instructional coaches, and administrators who participated in the program would benefit from the process and outcomes of this applied research. Through this program, the school leadership team aimed to equip teachers at HPES as professional learners with the knowledge, approaches, and tenacity necessary to improve instructional practices to meet the needs of the students in their classroom. Through the implementation of the action plan, we aimed to improve the skills and knowledge of educators through collaborative study, knowledge exchange, professional dialogue, and improving the educational ambitions, achievement, and attainment for students through decisive leadership and teaching. Teachers were trained to question, re-evaluate, refine, and improve frequently teaching strategies and knowledge.

Throughout the applied action research program, the school principal also gained knowledge about effectively facilitating PLCs. The principal of HPES does not carry a background in classroom teaching. Instead, the principal has a background in business, political science, and guidance counseling, which limits this principal’s classroom experience. Additionally, most of the principal’s years in education were spent in a high school setting, further removing the principal from the knowledge of the foundational needs in elementary education.

**Purpose Statement**

The purpose of this applied research study was to improve mathematical instructional practices by enhancing collective teacher efficacy through purposeful PLCs within the school. In this research design, are several evaluation steps were conducted over time. Most of the steps were implemented in the classroom. The leadership team, elementary mathematics specialist, and teachers collaboratively developed an action plan to accomplish the objective. Both quantitative and qualitative data were collected from the classroom participating in the study and were
analyzed in different phases of the program evaluation. The qualitative data types consisted of surveys, observations, anecdotal notes, feedback, and quantitative type data as common assessments, state test data, and benchmark data. The mixed methods study was justified because the goal was to grasp an accurate snapshot of this body of work by building a rapport with the teachers and collecting mixed data sets in the evaluation process and determining the program’s success. HPES used data from a control group in this applied research action plan. The action plan will be assessed using program evaluation.

**Research Questions**

- Essential Question: What instructional practices do the teachers, who are involved in the MPLCs, report as changes in their beliefs about teaching mathematics and student ability?

1. Are the instructional challenges teachers report as obstacles in their classrooms addressed through MPLCs and professional development?

2. Do MPLCs and professional development have an impact on student achievement?

3. What was the impact on teachers’ content knowledge and resulting student achievement by the offering of specialized professional development?

4. What was the impact on teachers’ classroom practices and resulting student achievement by the offering of specialized professional development?

5. Do teachers who participate in MPD develop stronger self-efficacy beliefs about teaching mathematics than do teachers who do not participate?

6. Do teachers who participate in MPD increase the frequency of high-quality instructional practices (HQIP)?
Overview

In Chapter 1, I introduce the research and justification for the program implementation. Additionally, in Chapter 1, I thoroughly detail an analysis of the problem, statement of the purpose, and research questions confer the focus of the research on building elementary teachers’ mathematics instructional knowledge and self-efficacy. The literature provided in Chapter 2 details the history and continuation of research of the questions and a supportive structure for this research study through a presentation of relevant research. The literature was focused on the structure of PLCs, professional development, teacher efficacy, and high-quality instruction. The literature review created a framework for the action plan that is presented in Chapter 3, which describes the development, implementation, and evaluation of the action plan. Chapter 4 presents the results of the applied research study, which includes an analysis of the evaluation of the action plan to answer the research questions presented in Chapter 1. Finally, in Chapter 5, the research study results are discussed regarding the literature provided in Chapter 2, as well as limitations and implications for future research.
CHAPTER 2: LITERATURE REVIEW

Introduction

Each year the state department of education looks at data from standardized testing to determine the rating of schools by assigning a letter grade for the schools’ achievements. Schools use the data from these tests to help close the achievement gap for their students. In recent years, mathematics test scores have improved faster than English language arts scores at many schools. However, at HPES, mathematics scores continue to lag behind with low literacy scores. Building the content knowledge of teachers in mathematics can have a positive impact on mathematical student achievement.

In this literature review, I aim to examine the research on PLCs, professional development for teachers, and collective efficacy. I focus Section 1 of this chapter on PLCs for teachers. I focus Section 2 on professional development as a tool to increase teachers’ content knowledge and instructional strategies. In Section 3, I study the properties of collective teacher efficacy and its impact on student achievement. A plethora of research exists on these topics; however, I narrowed this literature review to focus on mathematical content knowledge and student achievement as much as possible.

Research on mathematics PLCs (MPLCs) and mathematics professional development (MPD) led to the design of the Mathematical Professional Learning and Development Program at HPES. Literature reviews on effective mathematical instructional practices and their impact on student achievement support the action plan developed to implement the research design.
Research on Mathematics Learning Community was conducted by Sandra Mayrand and her team with the Massachusetts Department of Education. “It is a great program and a wonderful way to have teachers as a group analyze student work, discuss the mathematics thinking and move forward in their practice” (Personal communication, S. Mayrand, 2021).

**Professional Learning Communities**

Rosenholtz (1985) wrote about effective teachers’ schools in low socioeconomic settings. Rosenholtz differentiated between ineffective practices and effective practices. Rosenholtz also noted the need for new teachers to build their capacity for professional knowledge through collegial groups. Collegial groups that are focused on academic strategies and ways to meet students’ academic needs positively affect student learning. Later, Rosenholtz studied 78 elementary schools’ problems and successes, finding a similarity in successful schools and noting the level of collaboration among teachers is vital to school success. Teachers were encouraged to collaborate, to share ideas and solutions to problems, and to learn about educational practice. As teachers’ practice improves, student achievement improves.

Senge’s (1990) research was intended for the corporate world, but it was also aligned with the educational community’s values. Senge formulated a five-component model of a learning organization to facilitate change: systems thinking, personal mastery, mental models, building shared vision, and team learning (p. 3). Senge promoted personal mastery, which would align with self-efficacy, for mental mode connects to teacher mindset, shared vision, and team learning. Each of these areas are components of successful schools and teachers.

McLaughlin (1992) identified seven attributes of strong professional communities: (a) shared norms and beliefs, (b) collegial relations, (c) collaborative cultures, (d) reflective practice, (e) ongoing technical inquiry regarding effective practices, (f) professional growth, and (g) mutual obligation. McLaughlin and Talbert (1993) stated,
Teachers’ responses to today’s students and notions of good teaching practice are heavily mediated by the character of the professional communities in which they work . . . schools differed strikingly from one another in the strength or their professional communities – reporting clear differences, even within the same districts, in levels of collegiality, faculty innovativeness, and learning opportunities as perceived by teachers.

(p. 8)

In the Professional Learning Community Model, DuFour and Eaker (1998) embed the same sense of collective knowledge into an organization’s structure and encouraged staff to focus on practices and organizational behaviors. DuFour (2004) claimed,

When teachers work together to develop curriculum that delineates the essential knowledge and skills each student is to acquire, when they create frequent common assessments to monitor each student’s learning on a timely basis, when they collectively analyze results from those assessments to identify strengths and weaknesses, and when they help each other develop and implement strategies to improve current levels of student learning, they are engaged in the kind of professional development that builds teacher capacity and sustains school improvement. (p. 63)

PLCs are vital components of creating growth, developing collective efficacy, and changing the culture of education within a school community. Kruse et al. (1994) believe PLCs are the best format for cultivating learning and discourse among teachers and administrators who seek to improve learning outcomes. Additionally, Kruse et al. cited the following five critical components of PLCs: (a) reflective dialogue, (b) focus on student learning, (c) interaction among teachers and colleagues, (d) collaboration, and (e) shared values and norms.

According to Hord (1997), PLCs are necessary for contemporary, school change and improvement. School improvement, which results from the establishment of PLCs, necessitates
the unification of staff for the purpose of a collaborative and collegial response to improve student outcomes (Blase & Blase, 2003). The catalyst for PLCs was developed as a platform for teachers to collaborate consistently and effectively and to have the capacity to convert organizations into learning environments that are dedicated to continuous improvement (Stoll & Seashore Louis, 2007).

PLCs have become standard practice today in educational settings as a primary tool to increase student achievement and, according to DuFour et al. (2008) are classified as educators committed to working collaboratively in ongoing processes of collective inquiry and action research to achieve better results for the students they serve. PLCs operate under the assumption that the key to improved learning for students is continuous, job-embedded learning for educators. (p. 14)

**Mathematics Professional Learning Community**

A growing consensus among researchers points to the need for coordinated, classroom-focused and content-focused professional development, linking challenging learning standards and curriculum to solve the specific problems, hindering the advancement of students of mathematics (Bransford et al., 2000; Cohen & Hill, 2000; DuFour & Eaker, 1998; Kennedy, 1998; National Research Council [NRC] & Mathematics Learning Study Committee [MLSC], 2001; Smith, 2001; Wiley & Yoon, 1995).

Learning researchers Bransford et al. (2000) suggest new ways to introduce students to traditional subjects such as mathematics, making it possible for most students to develop a deep understanding. Teachers must work collaboratively and share their expertise because they cannot master multiple subjects alone. Community-centered environments involve norms, encouraging collaboration and learning (Bransford et al., 2000). An important approach to enhancing teacher learning is to develop communities of practice that involve collaborative peer relationships and
teachers’ participation in educational research and practice (Lave & Wenger, 1991). Other ways to foster collaboration include opportunities to score, compare, and discuss students’ work (Wiske, 1998). Fostering collaboration for learning and developing new methodologies lead to more rigorous investigations in the science of learning (Bransford et al., 2000). Effective learning environments are knowledge-centered and learner-centered, which create opportunities for teacher learning and a focus on pedagogical content knowledge (Shulman, 1986). These occasions help teachers rethink their disciplinary knowledge and teaching strategies (Baratta-Lorton, 1994). Additionally, teachers learn through their interactions with other teachers. Some of this occurs during formal and informal mentoring, which is similar to apprenticeship learning (Lave & Wenger, 1991).

The NRC and the MLSC (2001) identified collaboration among teachers as an essential component for supporting them in engaging in the kinds of inquiries needed to develop teaching proficiency. The NRC and the MLSC (2001) created Adding It Up, which is the product of an 18-month project in which 16 individuals with diverse backgrounds, as a committee, reviewed and synthesized relevant research on mathematics learning from Pre-K through Grade 8. The committee’s recommendation to administrators was to support teachers by providing more time for planning and conferring with each other on mathematics instruction with appropriate support and guidance.

Teachers need opportunities for continuous professional learning with collaborative learning teams as part of a larger PLC. Darling-Hammond (2010) summarize effective professional development as follows:

Effective professional development is sustained, ongoing, content-focused, and embedded in professional learning communities where teachers work overtime on problems of practice with other teachers in their subject area or school. Furthermore, it
focuses on concrete teaching tasks, assessment, observation, and reflection, looking at how students learn specific content in particular contexts. It is often useful for teachers to be put in the position of studying the very material that they intend to teach to their own students (pp. 226–227).

Effective mathematics knowledge development is sustained and embedded within PLCs and is focused on the actual tasks of teaching, while using the materials that teachers use with students.

According to the National Council of Teachers of Mathematics (NCTM; 2022), PLCs are the best collaborative environments for teachers to share creativity and wisdom. This type of environment creates more equitable learning experiences for all grade-level students. It is the yoke necessary to motivate teachers to be persistent in learning strategies necessary to meet students’ needs. The communities also challenge the level of understanding and implementation of mathematics standards.

The NCTM (2022) released a position statement with the collaboration of the Association of Mathematics Teacher Educators, the Association of State Supervisors of Mathematics, and the National Council of Supervisors of Mathematics’ Leadership in Mathematics Education. In the position statement, the organizations called for “elementary mathematics specialists to help ensure equitable and effective mathematics learning for each and every student” (NCTM, 2022). The collaboration also called for high-quality mathematics professional learning to support and sustain elementary schools’ ongoing mathematics improvement efforts.

PLCs deepen the mathematical content knowledge needed for elementary mathematics teaching, including the across-the-grades learning progressions (Association of Mathematics Teacher Educators, 2013). PLCs broadened the purposes of mathematics as defined by NCTM (2020) by developing a profound understanding so that teachers are more confident and capable.
learners. The teachers’ knowledge affects students’ understanding and how they critique the world and experience mathematics.

PLCs allow teachers to share best practices and to cultivate innovative ways to improve learning to drive student achievement. PLCs also encourage teachers to reflect on instructional practices and student outcomes. Collaboration through ongoing professional development provides opportunities for teachers to learn from others. When PLCs assemble, the four essential questions relate to learning and creating lessons with the end result of answering questions leading to student achievement.

**Professional Development**

The professional development of teachers is another element used to improve teachers’ practices to affect students’ overall achievement and learning experiences. Guskey (2002) acknowledged attributes of teacher beliefs and content knowledge, influencing the practices that teachers choose to use in their instruction. The essential goal of professional development is to improve teacher practice and student achievement (Guskey, 2002). Professional development opportunities lead to teachers trying new practices in their classrooms. Guskey (2002) believed that sustained changes in practice would only occur if teachers were to see a change in student learning outcomes. According to Guskey, teachers’ attitudes and beliefs change once this change is perceived; therefore, the new practice is more likely to be permanently adopted (Figure 1).
Yoon et al. (2007) indicate teachers should receive intensive, sustained, and content-focused professional development in mathematics. Teachers averaged 8.3 hours of professional development on how to teach mathematics and 5.2 hours on the “in-depth study” of topics in mathematics over 12 months. Of elementary teachers, 71% participated in professional development that was focused on instructional strategies for teaching mathematics. Nevertheless, only nine percent of the teachers participated for more than 24 hours during a year. Even fewer elementary school teachers reported that they participated in professional development that was focused on the in-depth study of mathematics during the same period, and only six percent of the teachers participated for more than 24 hours. Quality professional development improves instruction in elementary classrooms (Borko, 2004).
Mathematics Professional Development

The USDOE’s NMAP (2008) states the mathematics preparation of elementary school teachers must be strengthened to improve teachers’ effectiveness in the classroom by providing high-quality, ongoing, professional development opportunities. Elementary teachers need ample opportunities to learn mathematics for teaching. Teachers must know in detail, from a more advanced perspective, the mathematical content for which they are responsible to teach and the connections of the content to other essential mathematics. Teachers need to be knowledgeable about what students learned both prior to their grade level and what students will learn beyond the level at which the teachers are assigned to teach.

The USDOE (as cited in Garet et al., 2016) stated,

Teachers may thus benefit from professional development that deepens their own conceptual understanding of math. Elementary school teachers may especially benefit from content-focused PD [professional development] because they are less likely to formally study mathematics in college than secondary teachers, who tend to specialize in the subject matter they teach. (p. ES–1)

Many teachers at the elementary level lack formal training in mathematics, including in-depth study of the topics they teach (Conference Board of the Mathematical Sciences, 2012; Greenberg & Walsh, 2008). Additionally, elementary teachers traditionally teach multiple subjects, which makes it difficult for them to develop mathematics content expertise on the job. However, the demands on teachers’ content knowledge have increased because of the adoption of more demanding content standards and assessments (Glancy et al., 2014; USDOE, Office of Planning, Evaluation, and Policy Development, 2010).
Efficacy

Bandura (1997) states self-efficacy is a person’s “beliefs in one’s capabilities to organize and execute the course of action required to produce given attainments” (p. 3). Educators reflect on teachers’ beliefs about their abilities to deliver instruction effectively. Self-efficacy is expectancy, which refers to the belief in one’s abilities to complete a specific task and the confidence to use a specific teaching practice. Teacher outcome expectancy is the belief a specific behavior produces a specific result (Bandura, 1997). Teachers might believe external factors affect or produce a specific outcome, including demographic information (e.g., race or socioeconomic status) in the educational setting.

The NRC and the MLSC (2001) discusses the five attributes associated with teachers’ student mathematics proficiency coupled with a belief in diligence and one’s efficacy. For teacher learners, a relationship exists between motivation for professional learning and relevance, meaning, and choice. Developing competence and a sense of self-efficacy by directing teachers’ efforts to meet student needs is key to teachers undertaking professional learning.

Teachers hold beliefs about the practices they choose to use in instruction, which are deeply rooted and complex to change (Appleton, 2003). Teachers often teach in a manner similar to the way they were taught, which poses challenges as new practices are developed and introduced into the teaching profession (Bencze & Hodson, 1999). Specifically, the change from traditional approaches to teaching mathematics content to a more hands-on, inquiry-based student is a difficult transition for many teachers who never experienced this method of learning.

Researchers indicate a strong relationship exists between teachers’ beliefs and their classroom practices (Schoenfeld, 2015; Skott, 2015a, 2015b; Tschannen-Moran & Hoy, 2001). Teachers’ beliefs are one of the most powerful tools used in classroom actions, influencing teachers’ planning, instructional decisions, and professional practices (Kitsantas et al., 2010;
Beliefs influence teachers’ behavior and decision making, and changes in beliefs can be a crucial precursor to real change in teaching practices (Burton & Frazier, 2012).

**Mathematic Teaching Efficacy**

Many elementary teachers report low efficacy in their mathematics teaching, despite the numerous reform guidelines (Marrongelle et al., 2013; Swars et al., 2007). Often, elementary teachers have negative views toward teaching mathematics, which indirectly affects the quality of instruction and student achievement (Borko & Whitcomb, 2008). In addition, researchers have shown teachers’ efficacy beliefs are crucial in successfully implementing the reform initiatives in mathematics and science teaching (Carrier et al., 2017; Fives & Buehl, 2016; NCTM, 2014; Thomson et al., 2016; Thomson & Gregory, 2013).

Efficacy beliefs are both a domain and context-specific construct. Therefore, having high self-efficacy for teaching mathematics does not immediately transfer to other disciplines. Mathematics-teaching efficacy describes the personal beliefs of teachers about their own effectiveness in mathematics instruction (Enochs et al., 2000). The assessment of mathematics-teaching efficacy, using quantitative measures, has been conducted traditionally with the Mathematics Teaching Efficacy Beliefs Instrument (Enochs et al., 2000). The Mathematics Teaching Efficacy Beliefs Instrument is used to examine two dimensions of mathematics teacher efficacy. Dimension 1 is Personal Mathematics Teaching Efficacy, a belief in one’s ability to teach mathematics effectively. Dimension 2 is the Mathematics Teaching Outcome Expectancy, which is the belief that effective mathematics teaching will have a positive effect on student learning.

Elementary teachers are generalists and frequently do not have high self-efficacy for mathematics or mathematics teaching (Hechter, 2011; Nadelson et al., 2013). Teachers with high
levels of efficacy are more prone to implement novel instruction and to adopt innovations, set higher goals for themselves and their students, and show more resilience in teaching (Schunk et al., 2014). Thus, considering the importance of teachers’ efficacy beliefs in affecting instructional goals and classroom practice (Velthuis et al., 2014), schools should create opportunities to improve elementary teachers’ mathematics teaching efficacy and to affect positively their professional actions.

Mathematics teaching researchers have examined the role of specific factors influencing teaching efficacy development, for example, an individual’s prior learning (Bates et al., 2011; Phelps, 2010). Additionally, researchers have examined emotions (Swarz et al., 2006) and mathematical knowledge for teaching (Ball et al., 2008) or the specialized knowledge in mathematics specific to the work of teaching. Phelps (2010) showed teachers rely on multiple sources to construct their mathematics teaching efficacy beliefs and goals, including past performance, vicarious experiences, verbal persuasions, career goals, and the fit between participants’ views of mathematics and the nature of mathematics in their classes. Among the primary sources of self-efficacy beliefs researchers described are mastery experiences, vicarious experiences, social persuasion, and physiological reactions (Bandura, 1977; Bong & Skaalvik, 2003; Tschannen-Moran & McMaster, 2009).

Vicarious experiences are a source of efficacy, which is gained by observing an expert perform a specific task. Teachers benefit by observing a model performing a task, which helps individuals to increase their efficacy. Collaborative activities allowing teachers time to reflect on practice can positively influence teacher efficacy in teaching mathematics and their pedagogical content knowledge (Alagic et al., 2002).

Social persuasion is feedback from mentors or peers, depending on the persuader’s expertise and credibility (Bandura, 1977). Social persuasion can be provided to teachers through
peer feedback, administration, or professional development to promote new strategies and persuasive claims about their relevance (Tschannen-Moran & McMaster, 2009). Newton et al. (2012) found teacher content knowledge is most relevant in social persuasion, and teachers who have higher content knowledge referred to verbal persuasion as a common source of efficacy.

**Collective Efficacy**

Additionally, Bandura (1997, as cited in Goddard et al., 2015) suggested, “Efficacy beliefs influence the degree of persistence and creativity with which individuals and groups approach prospective tasks” (p. 507). In teaching and learning, a person’s knowledge and behaviors heavily influence the behaviors and attitudes a person observes around them (Bandura, 1986). In schools, this means teachers’ beliefs and actions are greatly affected by the beliefs and actions of their fellow teachers as well as students, parents, and school leaders. Teachers are more likely to attempt a new instructional technique when others embrace the new pedagogy.

Collective efficacy is the school’s culture; the knowledge and skills of those in the organization; and how it is managed, structured, and led (Boston et al., 2016). Collective efficacy also includes the relationships and interactions between colleagues (Berebitsky & Salloum, 2017; Moolenaar et al., 2012; Somech & Drach-Zahavy, 2000). A school can be populated with competent teachers, but collective efficacy will only characterize the faculty if the teachers believe in their collective capability.

**Relationship Between Collective Efficacy and Achievement**

Researchers have identified a strong relationship between collective efficacy and student achievement (Bandura, 1993; Goddard et al., 2000). According to Bandura (1993), collective efficacy is positively and significantly related to school-level achievement in mathematics. In a multilevel research, Goddard et al. (2000) support and expand on Bandura’s (1993) initial research by establishing a relationship between collective efficacy and individual student
achievement in mathematics in urban elementary schools. Several quantitative studies have linked collective efficacy to student performance in elementary school (Goddard, 2001; Goddard et al., 2000).

**Instruction Defined**

The teaching and learning process is founded on interactions between teachers and students around educational materials (Cohen & Ball, 1999). Classroom instruction requires all three elements: teacher, student, and content. Figure 2 presents this conceptual model, illustrating the fundamental elements of the classroom environment: the triad of teacher, students, and content (Cohen et al., 2003).

**Figure 2**

*Pedagogy Model*

The sides of the triangle indicate three central relationships of instruction: (a) teacher and student, (b) teacher and content, and (e) student and content. Extensive evidence has illustrated, even with similar formal structures and resources such as collective efficacy, aspects of the school environment vary across schools (Bryk & Schneider, 2004; Goddard et al., 2000; Salloum et al., 2017). This model illustrates the relational aspects of instruction as a product teachers
deliver and students passively receive, but it also depicts the context-specific nature of teaching and learning.

**High-Quality Instruction**

The NCTM (2016) recommends all teachers implement cognitively challenging tasks in their classrooms. The NCTM (2016) position statement defined high expectations in mathematics education as the ability…

to teach mathematics with high expectations means that teachers (1) recognize that each and every student, from prekindergarten through college, is able to solve challenging mathematical tasks successfully; (2) build in each student a positive mathematical identity and a sense of agency; (3) design instruction that builds on students’ prior knowledge and experiences; (4) teach in ways that ensure that each and every student is reasoning and making sense of mathematics on a daily basis; and (5) reflect on ways that tasks and teaching can be improved to provide greater access, challenge, and support for every learner. (p. 1)

Cognitively challenging tasks provide students opportunities to engage in problem solving, thinking and reasoning, and developing an understanding of mathematical ideas, procedures, and formulas (Stein et al., 1996). Teachers need more than cognitively challenging tasks in their lessons; how the task is implemented is paramount. The cognitive demand of a task is reduced when the teacher removes students’ opportunities to engage with the task by over-scaffolding or limiting student discussion and voice (Boston & Wilhelm, 2015; Stein et al., 1996). High-quality instruction is an ambitious classroom practice (Franke et al., 2007; Lampert et al., 2009) employing cognitively challenging tasks and implementing the undertakings in such a way as to maintain the cognitive demand throughout the lesson.
Overview

Yearly many schools continue to engage in reform practices to transform their schools. The impact of teacher efficacy has the potential to influence the environment in which instruction is embedded. When teachers have a robust sense of knowledge and purpose, they are more likely to facilitate positive instructional experiences for their students. Therefore, the HPES committee has vowed to provide opportunities to build teachers’ mathematics pedagogy and efficacy.

The committee used the research in this chapter on professional learning committees, professional development, teacher efficacy, and instructional practices to inform its decisions. The research in this chapter provided guidelines that informed the development of the action plan that was outlined in Chapter 3. The action plan incorporated the elements of the research to build elementary mathematics pedagogy through the development of teachers’ content knowledge, efficacy, and instructional practices.
CHAPTER 3: DESIGN AND METHODS

Introduction

The purpose of this research was to improve mathematical instruction of elementary teachers by building on their content knowledge and skills. Elementary education is very focused on literacy; therefore, elementary education teachers have few opportunities to become more knowledgeable of mathematics instruction. The lack of student self-efficacy in mathematics affects students in middle school and high school by limiting access to certain courses and programs. Mathematics is also one of the key barriers to college advancement. Providing teachers with opportunities to collaborate in a mathematically focused PLC and guiding their pathway to learn more through professional development (a) will help teachers to learn more about how students learn mathematics, (b) will provide educators with the knowledge to deliver Tier 1 instruction effectively, and (c) will provide teachers the ability to facilitate learning more effectively in the classroom to meet the needs of all students.

In a large-scale study of high school transcripts, the Education Trust (as cited in Bromberg & Theokas, 2016) indicates many students leave high school with a diploma in hand, but no clear path forward. Education Trust indicated only eight percent of high school graduates completed an entire college and career preparation curriculum, including mathematics courses through Algebra II.

President George W. Bush developed the USDOE’s NMAP (2008), which conducted a study from 2006 until 2008 to research and publish their findings on improving readiness for
algebra. The researchers called for coherence among K–Grade 8 mathematics educators. Teacher knowledge of student’s learning processes, teacher education programs, and proven, effective, and evidence-based mathematics instruction were areas of focus in their research. The USDOE’s NMAP (2008) stated:

A strong grounding in high school mathematics through Algebra II or higher correlates powerfully with access to college, graduation from college, and earning in the top quartile of income from employment. Students who complete Algebra II are more than twice as likely to graduate from college compared to students with less mathematical preparation. The value of such preparation promises to be even greater in the future.

(p. xii)

This chapter contains the applied research design and methods were in this action research to address elementary school mathematics teachers’ content and pedagogical knowledge. Pragmatic research addresses both a problem of practice and improves instructional effectiveness by developing teacher efficacy. Chapter 3 is composed of three parts, providing the research design details. In Part 1 of this chapter, the action plan to address elementary teachers’ content and pedagogical knowledge are explained. Part 1 includes an outline of the cooperating stakeholders, a review of the process, a timeline, existing research guiding the work, and data used to create the action plan.

Part 2 of this chapter encompasses the entire action plan beginning with the research questions restated from Chapter 1. The research questions’ design guided the evaluation of each action plan element, and each element had a measurable goal. The details of what took place for each element are in Part 2:

- What systems are in place?
- What participants will be able to accomplish?
• What timeline will be adhered to?
• What resources of time and materials will be required?
• Who will be responsible for each activity?
• How much effort is required of participants?

In the conclusion to Chapter 3, I divulge the program evaluation of the action plan was conducted following a year and a half of the implementation. Mixed methods of qualitative and quantitative data were collected and analyzed to evaluate the elements. All research question data were collected and analyzed using the program evaluation process.

**Development of the Action Plan**

The action plan to affect teacher pedagogy at HPES development took place with the pertinent research in Chapter 2. Bartlett and Burton (2006) inferred a danger in using new ideas for pedagogical approaches in the classroom without detailed research and theoretical foundation related to due diligence. Research in the field of teacher content knowledge and its relationship to teaching quality has shown changes in teacher content knowledge, affecting how teachers engage with students about mathematics, how teachers evaluate and use instructional materials, and what students learn in the classroom (Hill et al., 2005). Vescio et al. (2008) found PLC participants often share the goal of improving student achievement by improving their own teaching practice. In addition, Wei et al. (2009) reported on teacher professional development and determined “student achievement improved most when teachers were engaged in sustained, collaborative PD [professional development] focused specifically on teachers’ content knowledge and instructional practices” (p. 5). Finally, Küçükaloğlu and Tuluk (2020) provided evidence of teachers’ self-efficacy regarding instructional behavior, classroom management, and student management affect students’ attitudes toward mathematics.
The development and implementation of the action plan involved participation from members of the Vitality Collective School District and HPES. The action plan implementation was a collaborative effort of stakeholders (i.e., the curriculum director, mathematics instructional specialist, elementary academic mathematics coach, principal, assistant principal, and four teachers). Each team member had a core role in implementing the action plan.

**Roles Within the Plan**

The curriculum director supports teachers in increasing teacher capacity and student achievement. This leader conducts monthly walk-throughs (Appendix A), using the district’s monthly focus (Appendix B) checklist, after which the data from the monthly focus was analyzed to create biweekly professional development.

The mathematics instructional specialist serves as the content specialist. The specialist reviews supplemental curriculum resources the academic coaches provide. The specialist guides any necessary curricular work. The specialist collaborates with building leaders to plan and coordinate professional development. The specialist also provides training for academic coaches, according to observation feedback.

The district provides the elementary mathematics academic coach who leads the PLCs. The academic coach works with the principal to support the School Improvement Plan which was developed to identify and address the school’s areas of greatest need. The school’s needs and those of each teacher were considered as prime goals for this research effort. This combination establishes a focus on the support provided to teachers in their classrooms. The academic coach analyzed student data and used such to inform me and other administrators how best to support teachers. PLCs were completed on a weekly basis and targeted professional development was completed biweekly and implemented to maximize teacher potential.
The principal and assistant principal serve as the building leaders. The principal’s role was to set school-level proficiency and growth goals to earn the desired school rating. After each benchmark assessment, data chats took place to discuss progress toward the goal after the interim assessments. The principal and assistant principal provided actionable feedback and monitored the preparedness for teaching and implementation of planning from the PLC. In addition, the principal and assistant principal “[kept] a pulse of” the progress of the goal for teachers and school-level goals by identifying concerns in the data and providing instructional support where needed.

The teachers were the primary focus of the study. Their role was to provide high-quality instructional lessons providing equitable opportunities for students to learn the same content and gain knowledge and mathematics skills. Best practices were implemented by using a guaranteed and viable curriculum and by participating in school and district-level professional development.

The focus of the action research plan was to increase mathematical pedagogy. The Mississippi Academic Assessment Program (MAAP) mathematics scores indicated a lack of content knowledge and effective instructional practices within the school. On the 2021–2022 Mathematics MAAP, students scored lowest in the standards for measurement and data, and the standards for numbers and operations–fractions. At the school level, the principal and assistant principal developed an action plan to increase teachers’ content knowledge for teaching elementary mathematics.

The district created a position for the elementary mathematics academic coach in an effort to meet the needs of the school. The academic coach met with the principal or assistant principal weekly (a) to provide communication about the progress of the teachers and next steps to address gaps in student learning, (b) to address any emergent issues, and (c) to plan professional development to develop teachers’ instructional practices. Additionally, the academic
coach shared any district-related information from the mathematics instructional specialist and the curriculum director with school-level personnel.

The administrative team implemented Phase 1 of the collaboratively developed action plan by analyzing and identifying deficits in data from the mathematics MAAP assessment from the 2020–2021 SY. The principal and assistant principal conducted walk-throughs to document effective instructional practices and areas for growth. The curriculum director, mathematics instructional specialist, elementary mathematics academic coach, principal, and assistant principal participated in learning walks to monitor the monthly focus, effective practices, and areas of growth. After the learning walk, the group assembled to discuss evidence from the observations and to suggest areas for support. During this phase, the assistant principal administered a PLC survey (Appendix C) to learn more about teachers’ professional experience within a PLC. Teachers also received a Google form from a teacher on the school leadership team, entitled Professional Learning Communities, March 2021, with the following directions:

Please complete the following survey to help us learn more about your professional experience within a PLC. The term “PLC” is being used to describe time you are working with content-alike teachers at your campus. As much as possible, please answer using your experience from the current school year.

1. I have a trusted colleague I can reach out to for support when needed.
2. Teachers in my school believe every student can learn.
3. In my PLC, it is easy to speak up about what is on my mind.
4. If I make a mistake in my PLC, it will not be held against me.
5. How impactful is the time in your PLC to improve your daily instruction?
6. In my PLC, we analyze student work to inform instruction.
7. My PLC uses a protocol to analyze student work.
8. The protocol in my PLC to analyze student work requires the creation of an exemplar.

9. The protocol in my PLC to analyze student work requires time to be spent reading and discussing the student work as a group.

10. The protocol in my PLC to analyze student work enables all teachers to contribute, even when it is not their students’ work.

11. The protocol in my PLC to analyze student work enables us to determine specific next steps for how to improve student mastery.

12. What are one or two things working well within your current PLC experience?

13. What are one or two things you wish were more present in your PLC experience?

Phase 2 of the action plan development was to implement mathematics professional development (MPD). The principal and assistant principal analyzed mathematics MAAP data and observation notes to develop a professional development cycle to address areas of need for the teachers at HPES. Additionally, the curriculum director, mathematics instructional specialist, elementary mathematics coach, and the assistant principal at HPES collaborated to plan elementary-level MPD for biweekly, early-release, Wednesday sessions throughout the school year. The MPD sessions were planned according to data-driven needs and observations were collected in Phase 1.

Phase 3 of the action plan was to develop teacher self-efficacy. During Phase 3, the assistant principal administered a beliefs survey (Appendix D) to learn more about teachers’ mathematics teaching efficacy and instructional beliefs, which affect student outcome expectancy (Personal communication, J. James, 2021). The same survey was administered to the same teachers at the end of the school year and was compared to measure how their beliefs changed after one year of implementation of Phases 1 and 2. These pre-initiative and post-initiative data were statistically examined for differences.
HPES developed the action plan to affect teachers’ content knowledge and to provide strategies to improve mathematics instructional practices by providing grade-level, MPLCs, needs-based MPD, and individual support for teachers. According to Knoll (2002), the expectations and demands of teachers require “a deep knowledge of subject matter, good understanding of how students learn, the ability to make complex decisions, and a commitment to working closely with colleagues” (p. 245). Knoll (2002) went on to state, “This cannot happen without effective and ongoing professional development creates and sustains a highly prepared teaching force for all, not just some, of our children” (p. 245).

**Action Plan Overview**

The implementation of the action plan for HPES was designed to answer the following research questions:

- **Essential Question:** What instructional practices do the teachers, who are involved in the MPLCs, report as changes in their beliefs about teaching mathematics and student ability?
  1. Are the instructional challenges teachers report as obstacles in their classrooms addressed through MPLCs and professional development?
  2. Do MPLCs and professional development have an impact on student achievement?
  3. What was the impact on teachers’ content knowledge and resulting student achievement by the offering of specialized professional development?
  4. What was the impact on teachers’ classroom practices and resulting student achievement by the offering of specialized professional development?
  5. Do teachers who participate in MPD develop stronger self-efficacy beliefs about teaching mathematics than do teachers who do not participate?
6. Do teachers who participate in MPD increase the frequency of high-quality instructional practices (HQIP)?

The action plan presented in this chapter was a compilation of three elements assembled to address the proceeding questions. The action plan was developed during the 2020–2021 SY.

The three elements of the school’s action plan addressed instructional practices by using MPLCs, professional development, and changes in teacher beliefs about how students learn mathematics. In Element 1, I targeted instructional practice through PLCs and student data. In Element 2, I targeted developing teachers’ content knowledge of mathematics through professional development. In Element 3, I focused on teacher self-efficacy. Appendix E displays the action plan, methods to evaluate each element, a timeline, resources, and responsible parties.

**Element 1: Mathematics Professional Learning Communities**

The essential goal of the mathematics PLC was to affect student learning. However, teachers’ pedagogy needed to be developed to attain positive results. Data from the 2018–2019 SY indicated a need to increase mathematical growth and proficiency at HPES. Developing a mathematics learning community would provide teachers with the opportunity to increase their knowledge by working with their colleagues to learn strategies, meaningful content, and pedagogy to enhance their classroom practices. The implementation of a school-based mathematics learning community started in August 2021 and continued through April 2023. HPES used data from a control group to reflect the data collected as it pertained to Research Question 5, “Do teachers who participate in MPD develop stronger self-efficacy beliefs about teaching mathematics than do teachers who do not participate?” These sessions consisted of mathematics discussions, mathematics tasks, and analyzing student data and student work samples. Goal 1 was to build collective efficacy by focusing on student learning, developing a better understanding of mathematical content, analyzing students’ work, and using formative
assessments to determine students’ progress, misconceptions, and instructional needs. Goal 2 was to reflect on classroom practices, share strategies, discuss best practices, and expand professional expertise.

**Element 2: Mathematics Professional Development**

The goal of the MPD was to provide ongoing training in areas where data and teacher discussions identified a deficit in instructional practices. This element provided teachers with practical approaches to professional growth was centered around student thinking and learning. MPDs were used to improve teachers’ knowledge and aspects of their instructional practice. The implementation design was intended to help teachers slow down to think about what they teach and how to teach it in a meaningful way. The MPDs provided strategies to make mathematical lessons follow a specific structure. This structure assisted teachers in identifying the strategies students use when solving a problem, in observing students and guiding them effectively, and in designing group discussions to help students reach teachers’ instructional goals. Biweekly MPD sessions were conducted from September 2021 to March 2023.

The district curriculum team and the school administrative team collaborated to conduct instructional observations to review mathematics instruction. The instructional observations were conducted monthly, beginning September 2021 through April 2023. During instructional observations, notes were recorded, using guidelines for areas of focus for the observer to describe what was observed. The observation was evidence-based, informal, and nonevaluative. The feedback was used to reflect on student learning, instructional practices, student engagement, and student interaction with mathematics content. This strategy was aligned with building teacher capacity and, thereby, increasing student achievement.
Element 3: Mathematics Teacher Efficacy

The action plan design was developed to affect teacher efficacy through MPLCs and MPD. The goal of using mathematics PLC was to develop elementary teachers’ content knowledge about mathematics instruction and how it affects student achievement. During these sessions, teachers analyzed student data, reflected on student learning, and gained knowledge of best practices for mathematical instructional practices to meet the needs of all students. With this set of materials, I aimed to develop teachers’ content knowledge by examining students’ work in PLCs. When teachers implement highly effective practices to improve student learning, teachers’ beliefs of what student can achieve will increase. To measure changes in teacher efficacy, interviews were conducted September 2021 and April 2023.

Program Evaluation of the Action Plan

Applied research methods are employed to evaluate this action plan. In the applied research methods approach to evaluation, I used a collection of data, consisting of observations, surveys, interviews, and analysis of student data, which consisted of screeners, common assessments, benchmarks, and MAAP. The continuous improvement cycle was monitored and adjusted to provide for the needs of the teachers.

Evaluation of Mathematics Professional Learning Communities

Step 1 in this process was to obtain permission from my superintendent (Appendix F) to survey and interview PLC participants for the program evaluation project (Appendix G). The topic of study was given, and my superintendent granted permission to conduct the study. Conducting PLCs is already part of my role as an administrator. Participation and completion of the PLC survey was used in developing the program was completely voluntarily. The questions contained a combination of rated responses and open-ended questions.
In addition to regularly scheduled PLCs, all teachers were sent an email inviting them to participate in a mathematics-focused PLCs book study, *5 Practices for Orchestrating Productive Mathematics Discussions* (2nd ed.) by Smith and Stein (2018). The teachers had the right to decline to participate, and I further explained participation would be voluntary and teachers could discontinue participation at any time with no negative consequences. The group assembled to discuss the books we read and the norms for the study, as well as to establish a schedule (Appendix H) for chapters to read and the dates we would meet. In each meeting, we focused on the following questions:

1. Is there a quote from this chapter which is meaningful, engaging, or thought provoking to you?
2. How do these ideas connect to what you already know?
3. What new ideas extend or push your thinking in a new direction?
4. What is now a challenge for you? What will you try?
5. After reading this chapter, I wonder . . .?

**Evaluation of Mathematics Professional Development**

In this applied research study, mathematics teachers in Grades 4–5 participated in MPD, including inclusion teachers who serve these grade levels. Additionally, teachers from local schools within the school district were invited to participate. The elementary mathematics specialist and mathematics academic coach administered biweekly MPD. The program had no application criteria other than teaching the appropriate grade level and subject within the district.

The MPD sessions were focused on fourth- and fifth-grade mathematics data and instruction. The sessions were aimed at improving teachers’ deep understanding and enthusiasm for mathematics by providing a community of teachers beyond the corridors of the school building. The long-term goal was to increase student achievement in mathematics. The teachers
were given a survey (Appendix I) to determine whether the professional development improved their content and pedagogical knowledge of mathematics. After each professional development session, a teacher survey was completed, containing both open-ended and closed-ended questions. Both qualitative and quantitative data will be collected (see Table 1). Qualitative data were collected from teacher interviews, observations, and themes found in the teacher beliefs survey.

**Evaluation of Mathematics: Teacher Efficacy**

To measure teacher self-efficacy, the teachers who volunteered to participate in additional mathematics PLCs were given a teacher beliefs survey. Part 1 of the survey had five teacher scenarios and four open-ended questions about mathematics self-efficacy. Part 2 of the survey had eight questions about mathematics teaching self-efficacy. The survey was administered again at the end of the 2022 and 2023 SYs. Data collected from the administration of both surveys are compared to determine whether teacher efficacy had made a significant change.

**Data Collection Plan**

In this research program, I used pre-existing data from the MAAP for Grades 3–5, Star Mathematics data from the beginning, middle, and end-of-year screeners, and benchmark assessments for Grades 3–5 for the 2021–2023 SYs. These quantitative forms of data determined whether the program had an impact on student learning. Surveys also gave me quantitative data through frequencies were converted to percentages of performance levels.

After each professional development, teachers completed a feedback survey; a follow-up survey was also completed months later, depending on the time the professional development was held. Interviews with teachers had great value in determining the impact the PLCs and the professional development had on teacher self-efficacy. Throughout the year, observations were
made to examine the impact of the professional development and the frequency of strategies being used across the school. In PLCs, teachers were encouraged to share artifacts and work samples from students in their classrooms as they discussed the changes in their practices.

The participants for my program were teachers who had volunteered to participate in the focus group for mathematical book studies as a professional development. Teachers in Grades 3–5 who participated in MPLCs and professional development were identified by pseudonyms in the research study analysis. The information collected on these teachers was stored in a secure and confidential location. Teacher information was used to measure collective efficacy.

Data Analysis

The purpose of this study was to increase teachers’ content knowledge and to change teacher beliefs about how students learn mathematics. All data from the research was collected and analyzed later in evaluating the programs. Triangulation helped to balance the strengths and weaknesses in the findings of qualitative and quantitative data. Triangulation occurs when all data have been collected and included in the evaluation. The data were compared and contrasted to determine similarities and differences. The similarities identified commonalities through surveys, interviews, and observations after PLCs and professional development. The student data identified a relationship between the new practices’ teachers had implemented in their classrooms and improved student learning, thereby, showing a connection between PLCs and professional development and the instructional practices in the classroom.

Feedback should include usable and actionable data. I have attended and facilitated professional development in which the feedback lacked meaningfulness. Feedback would be more meaningful if it were connected to the participant’s emotions. For example, it should determine the various levels of how the participants feel: excited, renewed, frustrated, or overwhelmed. One could then ask why the participants chose the answer, which could yield
powerful content versus using only a number ranking for a professional development review. When participants wrote what was really on their minds, actionable feedback resulted. This was an effort to make sense of the data and to apply a coding system to compile categories, which allowed me the opportunity to think through the data and plan accordingly. The specific details of the data analysis collection are in Table 1.

As I analyzed various data sets, it was important to determine the values establishing whether the program was successful. Collecting data can be more powerful than perception. Some people might have negative comments, and some people might feel the program is not a good fit for their needs. However, the data and surveys determined the positive impact the program had.
## Table 1

### Research Questions, Data Collections Tools, and Explanation Alignment

<table>
<thead>
<tr>
<th>Research questions</th>
<th>Data collection tool</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do mathematics-focused PLCs and professional development have an impact on student achievement?</td>
<td>ENCASE/MAAP data</td>
<td>The ENCASE and MAAP data will be used to determine the percentage of growth students meet.</td>
</tr>
<tr>
<td>Are the instructional challenges teachers report as obstacles in their classrooms addressed through mathematics-focused PLCs and professional development?</td>
<td>PLC survey</td>
<td>The PLC survey was used to measure teacher’s perception of the effectiveness of PLCs by comparing ratings from presurvey to the postsurvey.</td>
</tr>
<tr>
<td>Instructional support</td>
<td></td>
<td>The observation notes will be documented when there is evidence of use of strategies from the weekly mathematics focused plc and biweekly PD. The log also provides documentation of additional support provided to individual teachers. Additionally, areas of weakness will be identified for continuous support through modeling and professional development.</td>
</tr>
<tr>
<td>Learning walk</td>
<td></td>
<td>Learning walks will be conducted monthly to provide opportunities to reflect on what students are learning, current instructional strategies being used, students’ engagement, and student interaction with the content. This is compared to what is seen in other classrooms. Teachers receive feedback, self-reflect, and collaborate.</td>
</tr>
<tr>
<td>What was the impact on teachers’ content knowledge by the offering of specialized professional development?</td>
<td>ENCASE/MAAP data</td>
<td>The ENCASE and MAAP data will be used to compare student achievement to teachers who did not attend mathematics focused professional development.</td>
</tr>
<tr>
<td>Do teachers who participate in mathematics-focused professional development develop stronger self-efficacy beliefs about teaching mathematics than teachers who did not participate?</td>
<td>Teacher beliefs survey</td>
<td>The teacher beliefs survey was used to gauge how teachers feel about teaching and learning mathematics. The teachers will take a pre and post beliefs assessment. The data from the pre- and post-assessment will be coded and compared to determine whether teachers’ beliefs changed after a cycle of PD.</td>
</tr>
<tr>
<td>Teacher interview</td>
<td></td>
<td>The teacher interview was used to determine the teacher's perception of the benefits of individualized and collective learning experiences. The data collected from the interviews will be coded and categorized.</td>
</tr>
<tr>
<td>Do teachers who participate in mathematics-focused professional development increase the frequency of high-quality instructional practices?</td>
<td>Observation notes</td>
<td>Observations notes will be used to document evidence of teachers using strategies learned in PLCs and PD. Data from teachers using high quality instructional practices will be compared to teachers who did not attend PD.</td>
</tr>
</tbody>
</table>

*Note. ENCASE = enCASE from TE21 is a Web-based application platform used to create benchmark assessments; HQIP = high-quality instructional practices; MAAP = Mississippi Academic Assessment Program; MPLC = mathematics professional learning community; PD = professional development; PLC = professional learning community.*
Coding

As the primary researcher, I understand the importance of maintaining secure and confidential storage. Confidentiality is essential when handling research data must be kept confidential. Electronic data and paper documents containing personally identifying information were stored securely in locked file cabinets when not in use and handled only when actively in use during research. Secure data storage was password protected. Pseudonyms were used for all participants, the school, and the district in this applied research study. Only I had access to all of the survey data, which will be saved in a secure, password protected drive five years after the completion of this study, at which time I will shred, delete, and rename these data. The teachers who agree to participate in the surveys and additional PLCs had the opportunity to attend a mathematics-content, focused book study and content-focused professional development at their own choosing. The teachers were observed to determine whether their instructional practices changed. Pseudonyms were used to record data from observations and discussions.

Analysis

Building mathematics pedagogy in elementary school teachers is a collaborative effort of the stakeholders who were involved in developing and implementing the action plan. The ultimate goal was to increase elementary mathematics teachers’ pedagogy and content knowledge to affect student achievement in mathematics. PLCs and targeted, mathematics, data-driven, professional development developed an increased use of strategies and strengthened the use of effective mathematical practices to increase student achievement. The findings of this applied research study are presented in Chapter 4.

Overview

The collaboration of stakeholders was necessary for the components of effectively meeting the demands of building teacher efficacy and providing the essential support to cultivate
growth. The goal of this action plan was centered around teacher content development and pedagogical knowledge as a platform to affect student achievement in mathematics. I expected teachers’ behavior would change as their knowledge of HQIP was strengthened. Retrospectively students’ mathematics knowledge becomes solidified as improvement in the ways students conceptualize mathematics. Through collaboration, the committee developed the action plan with measurable goals and the evaluation plans. Chapter 4 discloses the findings of the applied research study.
CHAPTER 4: RESULTS

Introduction

In this applied research study, I aimed to improve elementary teachers’ mathematical instruction by building on their content knowledge and skills. Elementary education teachers at HPES received more opportunities to become more knowledgeable in mathematics instruction. The applied research study with program evaluation began with thoroughly investigating literature on PLCs, professional development, efficacy, and quality instruction to improve teacher pedagogy and student achievement.

The literature review analysis revealed enhancing teacher collaboration through PLCs provides insights into practical strategies for fostering collaboration, developing a shared vision for mathematics instruction, and promoting collective responsibility for student learning. The research literature on professional development provided valuable insights into evidence-based practices to support teachers in enhancing their instructional skills and content knowledge in math. The literature on efficacy in education showed how teachers’ beliefs affect the quality of instructional practices, interventions, and strategies on student learning outcomes. Finally, the literature on effective mathematics instruction provided evidence-based instructional practices (e.g., problem-solving approaches, differentiated instruction, or formative assessment strategies) to improve mathematics instruction in an elementary school and instructional strategies, pedagogical approaches, and curriculum design to promote mathematics student achievement successfully.
The literature discussed in Chapter 2 shaped the infrastructure for the development of the action plan presented in Chapter 3. In Chapter 3, I describe the methodology of the study. The chapter includes the action plan for addressing instructional practices by using MPLCs, professional development, and changes in teacher beliefs of how students learn mathematics. The action plan presented in Chapter 3 also outlines the different elements of the program (i.e., PLCs, professional development, teacher efficacy, and instruction).

A variety of assessments were used to evaluate the elements (e.g., student data, surveys, observations, learning walks, and interviews). Furthermore, Chapter 3 addresses which data would be collected and used to answer each research question. All data were collected, analyzed, and presented in this chapter.

In Chapter 4, the results are presented in response to each of the research questions. Chapter 4 contains an account of the evaluation of each element and answers the following research questions, which were originally presented in Chapter 1:

- Essential Question: What instructional practices do teachers report, who are involved in the MPLCs, as changes in their beliefs about teaching mathematics and student ability?
  1. Are the instructional challenges teachers report as obstacles in their classrooms addressed through MPLCs and professional development?
  2. Do MPLCs and professional development have an impact on student achievement?
  3. What was the impact on teachers’ content knowledge and resulting student achievement by the offering of specialized professional development?
  4. What was the impact on teachers’ classroom practices and resulting student achievement by the offering of specialized professional development?
5. Do teachers who participate in MPD develop stronger self-efficacy beliefs about teaching mathematics than do teachers who did not participate?

6. Do teachers who participate in MPD increase the frequency of HQIP?

Moreover, this chapter reports the results of the data collected to evaluate the overall program, its implementation, and the impact on the stakeholders’ knowledge, beliefs, and behavior. The accounting of the focus group improvement or lack thereof is reported in this chapter. Subsequently, a data comparison of the 2020–2021, 2021–2022, and 2022–2023 SYs is presented. The conclusion of the chapter summarizes the results.

**Research Question 1**

Are the instructional challenges teachers report as obstacles in their classrooms addressed through MPLCs and professional development?

Research Question 1 and its data collection examined whether the instructional challenges teachers reported in their classrooms were addressed through MPLCs and professional development. To measure the effectiveness of the PLCs, a presurvey and postsurvey were administered to teachers prior to and after their participation in the PLCs.

The data was compared to the responses from the presurvey to the postsurvey to determine whether any changes occurred in teachers’ perceptions of the effectiveness of PLCs in addressing the instructional challenges teachers faced. This approach allowed data to be assessed whether the PLCs and professional development affected the perceived effectiveness of addressing those challenges.

The results were analyzed to identify significant differences between pre- and postsurvey responses. If the responses showed a statistically significant improvement or change in teachers’ perceptions of the effectiveness of PLCs, it signified the PLCs and professional development initiatives positively affected addressing instructional challenges.
The data collected from the presurvey and postsurvey conducted among the teachers at HPES provided insights into their perceptions of PLCs and the impact of PLCs on their professional growth. An analysis of the responses to each survey question was conducted to identify any notable trends or changes. Additionally, an ANOVA single factor data analysis was used to determine whether a significant change had occurred in any of the responses between the two administrations of the survey.

Question 1: “I have a trusted colleague [whom] I reach out to for support when needed.”

Presurvey: Neutral = 5.3%, Agree = 31.6%, Strongly Agree = 63.2%; Postsurvey: Agree = 28.6%, Strongly Agree = 71.4%. The postsurvey indicated an increase in the percentage of teachers who Agreed or Strongly Agreed they have a trusted colleague to reach out to for support. These results suggest participation in PLCs might have facilitated the development of a support system among the teachers. The ANOVA, single factor analysis for Question 1 (see Table 2) indicated no statistically significant difference occurred between the means of the presurvey and postsurvey groups. This conclusion was made because of the p-value of .60, which is greater than the alpha level of .05. Therefore, I failed to reject the null hypothesis, which states no significant difference exists between the group means.
**Table 2**

*Anova: Single Factor Analysis for Question 1*

<table>
<thead>
<tr>
<th>Groups</th>
<th>Count</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presurvey</td>
<td>19</td>
<td>4.58</td>
</tr>
<tr>
<td>Postsurvey</td>
<td>7</td>
<td>4.71</td>
</tr>
</tbody>
</table>

**ANOVA**

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>df</th>
<th>F</th>
<th>p-value</th>
<th>F crit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>1</td>
<td>.28</td>
<td>.60</td>
<td>4.26</td>
</tr>
<tr>
<td>Within groups</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Question 2: “Teachers in my school believe that every student can learn.” Presurvey: Neutral = 21.1%, Agree = 28.3%, Strongly Agree = 52.6%; Postsurvey: Agree = 57.1%, Strongly Agree = 42.9%. The postsurvey showed an increase in the percentage of teachers who Agreed teachers in their school believe every student can learn. This shift indicated a positive change in the teachers' perceptions, possibly influenced by their participation in PLCs. From the ANOVA results for Question 2 (see Table 3), the analysis indicated no statistically significant difference exists between the means of the presurvey and postsurvey groups. This conclusion was made because of the p-value of .74, which was greater than the alpha level of .05. Consequently, insufficient evidence exists to reject the null hypothesis and suggests no significant difference exists between the group means. Although the mean response is more positive, it fails to produce a significant difference.
Table 3

Anova: Single Factor Analysis for Question 2

<table>
<thead>
<tr>
<th>Groups</th>
<th>Count</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presurvey</td>
<td>19</td>
<td>4.32</td>
</tr>
<tr>
<td>Postsurvey</td>
<td>7</td>
<td>4.43</td>
</tr>
</tbody>
</table>

**ANOVA**

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>df</th>
<th>F</th>
<th>P-value</th>
<th>F crit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>1</td>
<td>.11</td>
<td>.74</td>
<td>4.26</td>
</tr>
<tr>
<td>Within groups</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Question 3: “In my PLC, it is easy to speak up about what is on my mind.” Presurvey: Disagree = 10.5%, Neutral = 10.5%, Agree = 28.3%, Strongly Agree = 52.6%; Postsurvey: Neutral = 14.3%, Agree = 42.9%, Strongly Agree = 42.9%. Although the percentage of teachers who Agreed or Strongly Agreed it is easy to speak up in their PLC remained somewhat consistent, a slight increase occurred in neutral responses in the postsurvey. This result suggests some teachers might have felt less comfortable expressing their thoughts in the PLCs after participating in them. The ANOVA results for Question 3 (see Table 4) indicate no statistically significant difference occurred between the means of the presurvey and postsurvey groups. This conclusion was made because of the p-value of .86, which was greater than the alpha level of .05. Therefore, insufficient evidence exists to reject the null hypothesis, indicating no significant difference existed between the group means.
Table 4

Anova: Single Factor Analysis for Question 3

<table>
<thead>
<tr>
<th>SUMMARY</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Groups</td>
<td>Count</td>
<td>Average</td>
<td></td>
</tr>
<tr>
<td>Presurvey</td>
<td>19</td>
<td>4.21</td>
<td></td>
</tr>
<tr>
<td>Postsurvey</td>
<td>7</td>
<td>4.29</td>
<td></td>
</tr>
</tbody>
</table>

ANOVA

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>df</th>
<th>F</th>
<th>P-value</th>
<th>F crit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>1</td>
<td>.03</td>
<td>.86</td>
<td>4.26</td>
</tr>
<tr>
<td>Within groups</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Question 4: “If I make a mistake in my PLC, it will not be held against me.” Presurvey: Disagree = 5.3%, Neutral = 5.3%, Agree = 36.8%, Strongly Agree = 52.5%; Postsurvey: Neutral = 28.6%, Agree = 14.3%, Strongly Agree = 57.1%. The postsurvey results indicated a decrease in the percentage of teachers who Agreed or Strongly Agreed their mistakes in the PLCs would not be held against them. This result suggested some teachers might have perceived a change in the level of acceptance of mistakes within their PLCs. From the ANOVA results for Question 4 (see Table 5), the analysis indicated no statistically significant difference existed between the means of the presurvey and postsurvey groups. This conclusion was made because of the p-value of .83, which was greater than the conventional significance level of .05. Therefore, insufficient evidence existed to reject the null hypothesis, which suggests no significant difference exists between the group means.
Table 5

Anova: Single Factor Analysis for Question 4

<table>
<thead>
<tr>
<th>Groups</th>
<th>Count</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presurvey</td>
<td>19</td>
<td>4.37</td>
</tr>
<tr>
<td>Postsurvey</td>
<td>7</td>
<td>4.29</td>
</tr>
</tbody>
</table>

ANOV

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>df</th>
<th>F</th>
<th>P-value</th>
<th>F crit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>1</td>
<td>.05</td>
<td>.83</td>
<td>4.26</td>
</tr>
<tr>
<td>Within groups</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Question 5: “How impactful is the time in your PLC to improve your daily instruction?”

Presurvey: Neutral = 21.1%, Agree = 38.8%, Strongly Agree = 42.1%; Postsurvey: Neutral = 28.6%, Agree = 42.9%, Strongly Agree = 28.6%. The postsurvey showed a slight decrease in the percentage of teachers who Strongly Agreed the time spent in their PLCs was impactful for improving daily instruction. However, the majority of teachers still Agreed or Strongly Agreed about the positive impact of PLC time. From the ANOVA results for Question 5 (see Table 6), the analysis suggested no statistically significant difference exists between the means of the presurvey and postsurvey groups. This conclusion was made because of the p-value of .55, which was greater than the alpha level of .05. Thus, insufficient evidence was lacking to reject the null hypothesis, indicating no significant difference occurred between the group means.
Table 6

Anova: Single Factor Analysis for Question 5

<table>
<thead>
<tr>
<th>Groups</th>
<th>Count</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presurvey</td>
<td>19</td>
<td>.62</td>
</tr>
<tr>
<td>Postsurvey</td>
<td>7</td>
<td>.67</td>
</tr>
</tbody>
</table>

ANOVA

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>df</th>
<th>F</th>
<th>P-value</th>
<th>F crit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>1</td>
<td>.36</td>
<td>.55</td>
<td>4.26</td>
</tr>
<tr>
<td>Within groups</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Question 6: “In my PLC, we analyze student work to inform instruction.” Presurvey: Quarterly = 15.8%, Monthly = 31.6%, 2–3 times a month = 26.3%, Weekly = 26.3%; Postsurvey: Monthly = 57.1%, 2–3 times a month = 14.3%, Weekly = 28.6%. The postsurvey revealed a shift toward more frequent analysis of student work in the PLCs. The percentage of teachers who reported analyzing student work Weekly increased, while the percentage reporting Quarterly analysis decreased. From the ANOVA results for Question 6 (see Table 7), the analysis indicated a statistically significant difference existed between the means of the presurvey and postsurvey groups. This conclusion was made because of the very low p-value (6.71 E-06), which was much smaller than the alpha level of .05. Consequently, sufficient evidence existed to reject the null hypothesis, indicating a significant gain in analysis of student work existed between the pre- and post- means.

Additionally, the F-value of 32.79 was tremendously higher than the F-critical value of 4.26, further supporting the conclusion of a significant difference existing between the means. In
summary, from the ANOVA results, strong evidence existed to indicate a significant rise in the analysis of student work. The pre-survey group appeared to have a significantly higher mean compared to the postsurvey group, understanding the lower values on the survey instrument indicated more frequent analysis.

**Table 7**

*Anova: Single Factor Analysis for Question 6*

<table>
<thead>
<tr>
<th>Groups</th>
<th>Count</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presurvey</td>
<td>19</td>
<td>3.79</td>
</tr>
<tr>
<td>Postsurvey</td>
<td>7</td>
<td>1.43</td>
</tr>
</tbody>
</table>

**ANOVA**

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>df</th>
<th>F</th>
<th>P-value</th>
<th>F crit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>1</td>
<td>32.79</td>
<td>6.71E-06</td>
<td>4.26</td>
</tr>
<tr>
<td>Within groups</td>
<td>24</td>
<td></td>
<td>(p&lt;.001)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Question 7: “My PLC uses a protocol to analyze student work.” Presurvey: Yes = 73.7%, Other = 21.1%, No = 5.2%; Postsurvey: Yes = 85.7%, No = 14.3%. The postsurvey shows an increase in the percentage of teachers whose PLCs use a protocol to analyze student work. This result suggests a greater emphasis on structured approaches to examining student work within the PLCs. From the ANOVA results for Question 7 (see Table 8), the analysis indicates a statistically significant difference between the means of the pre-survey and post-survey groups. This conclusion was made due to the low p-value of 9.54E-03 (reported as p<.001 in Table 8), which is smaller than the alpha level of .05. Thus, sufficient evidence exists to reject the null hypothesis, indicating a significant difference exists between the group means.
The $F$-value of 7.94 is greater than the $F$-critical value of 4.26, which further supports the conclusion of a significant difference between the means. In summary, from the ANOVA results, evidence exists to indicate a significant difference in the means of the pre- and post-group means. The presurvey group have a significantly higher mean compared to the postsurvey group, again, understanding the lower rating (1) is assigned to “Yes, my PLC uses a protocol to analyze student work.”

**Table 8**

*Anova: Single Factor Analysis for Question 7*

<table>
<thead>
<tr>
<th>Groups</th>
<th>Count</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presurvey</td>
<td>19</td>
<td>2.63</td>
</tr>
<tr>
<td>Postsurvey</td>
<td>7</td>
<td>1.86</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>df</th>
<th>$F$</th>
<th>$P$-value</th>
<th>$F$ crit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>1</td>
<td>7.94</td>
<td>9.54E-03</td>
<td>4.26</td>
</tr>
<tr>
<td>Within groups</td>
<td>24</td>
<td>(p&lt;.001)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Question 8: “The protocol used in my PLC to analyze student work requires the creation of an exemplar.” Presurvey: No = 36.8%, Yes = 63.2%; Postsurvey: No = 42.9%, Yes = 57.1%. Both the pre-survey and post-survey indicated a majority of teachers reported using a protocol in their PLCs required the creation of an exemplar. The postsurvey showed a slight decrease in the percentage of teachers, indicating the presence of such a protocol. According to the ANOVA results for Question 8 (see Table 9), the analysis suggests no statistically significant difference exists between the means of the presurvey and postsurvey groups. This conclusion was made
because of the high $p$-value of .79, which is greater than the conventional alpha level of .05, thereby indicating no practical significance. Thus, insufficient evidence exists to reject the null hypothesis, indicating no significant difference exists between the group means.

**Table 9**

*Anova: Single Factor Analysis for Question 8*

<table>
<thead>
<tr>
<th>GROUPS</th>
<th>COUNT</th>
<th>AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presurvey</td>
<td>19</td>
<td>1.63</td>
</tr>
<tr>
<td>Postsurvey</td>
<td>7</td>
<td>1.57</td>
</tr>
</tbody>
</table>

**ANOVA**

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>df</th>
<th>F</th>
<th>P-value</th>
<th>F crit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>1</td>
<td>.07</td>
<td>.79</td>
<td>4.26</td>
</tr>
<tr>
<td>Within groups</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Question 9: “The protocol used in my PLC to analyze student work requires time to be spent reading and discussing the student work as a group.” Presurvey: No = 36.8%, Yes = 63.2%; Postsurvey: Yes = 100%. The postsurvey revealed all participating teachers agreed the protocol used in their PLCs required time to be spent reading and discussing student work as a group. This result indicates a unanimous recognition of the importance of collaborative analysis within the PLCs. From the ANOVA results for Question 9 (see Table 10), the analysis suggests no statistically significant difference exists between the means of the presurvey and postsurvey groups. This conclusion was made because of the $p$-value of .06, which was only slightly greater than the alpha level of .05. Although the $p$-value was close to the level of significance, it failed to meet the threshold for statistical significance. Although I cannot reject the null hypothesis, it is
important to point out the practical significance of the result. Only the high beginning point in the presurvey kept the improvement from being statistically significant. The fact 100% of the faculty surveyed is amazing in and of itself.

**Table 10**

*Anova Single Factor Analysis for Question 9*

<table>
<thead>
<tr>
<th>SUMMARY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Groups</strong></td>
</tr>
<tr>
<td>Presurvey</td>
</tr>
<tr>
<td>Postsurvey</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Source of variation</strong></td>
</tr>
<tr>
<td>Between groups</td>
</tr>
<tr>
<td>Within groups</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Question 10: “The protocol used in my PLC to analyze student work enables all teachers to contribute, even when it is not their student’s work.” Presurvey: Disagree = 5.3%, Neutral = 36.6%, Agree = 21.1%, Strongly Agree = 36.6%; Postsurvey: Neutral = 14.3%, Agree = 28.6%, Strongly Agree = 57.1%. The postsurvey showed a decrease in neutral responses and an increase in the percentage of teachers who *Agreed* or *Strongly Agreed* the protocol allowed all teachers to contribute, irrespective of whose student’s work was being analyzed. This result suggests a positive change in the perception of inclusiveness within the PLCs. From the ANOVA results for Question 10 (see Table 11), the analysis suggests no statistically significant difference exists between the means of the presurvey and postsurvey groups. This conclusion was made because of the *p*-value of .21, which is greater than the conventional alpha level of .05. Therefore,
insufficient evidence exists to reject the null hypothesis, indicating no significant difference exists between the group means.

**Table 11**

*Anova: Single Factor Analysis for Question 10*

<table>
<thead>
<tr>
<th>SUMMARY</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Groups</td>
<td>Count</td>
<td>Average</td>
</tr>
<tr>
<td>Presurvey</td>
<td>19</td>
<td>3.89</td>
</tr>
<tr>
<td>Postsurvey</td>
<td>7</td>
<td>4.43</td>
</tr>
</tbody>
</table>

| ANOVA | | | | |
| Source of variation | df | F | P-value | F crit |
| Between groups | 1 | 1.63 | .21 | 4.26 |
| Within groups | 24 | | | |
| Total | 25 | | | |

Question 11: “The protocol used in my PLC to analyze student work enables us to determine specific next steps for improving student mastery.”

Presurvey: Neutral = 15.8%, Agree = 42.1%, Strongly Agree = 42.1%; Postsurvey: Neutral = 14.3%, Agree = 28.6%, Strongly Agree = 57.1%. The postsurvey results indicates a consistent agreement among teachers regarding the protocol used in their PLCs helping to determine the specific next steps for improving student mastery. According to the ANOVA results for Question 11 (see Table 12), the analysis indicates no statistically significant difference exists between the means of the presurvey and postsurvey groups. This conclusion was made because of the *p*-value of .62, which is greater than the alpha level of .05. Therefore, insufficient evidence exists to reject the null hypothesis, indicating no significant difference between the group means.
Table 12

Anova: Single Factor Analysis for Question 11

<table>
<thead>
<tr>
<th>SUMMARY</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Groups</td>
<td>Count</td>
</tr>
<tr>
<td>Presurvey</td>
<td>19</td>
</tr>
<tr>
<td>Postsurvey</td>
<td>7</td>
</tr>
</tbody>
</table>

| ANOVA |  |
| Source of variation | df | F | P-value | F crit |
| Between groups | 1 | .25 | .62 | 4.26 |
| Within groups | 24 | |
| Total | 25 | |

Question 12: “What are one or two things that work well within your current PLC experience?” The presurvey and postsurvey responses highlight various positive aspects of the teachers’ PLC experiences. Common themes included collaboration, sharing of ideas, receiving feedback, solving problems, and the value placed on teachers’ opinions.

Question 13: “What are the two things you wish were more present in your PLC experience?” The presurvey and postsurvey responses indicated the teachers had a desire for more time, additional resources, consistent schedules, cross-subject discussions, modeling, and addressing grade-level-specific concerns within the PLCs.

Overall, the data from the teacher survey indicates the teachers at HPES perceive their participation in PLCs to be beneficial. The postsurvey results generally showed positive changes compared to the presurvey, indicating an improvement in several areas (e.g., collegial support, belief in every student’s ability to learn, ease of speaking up within the PLC, and the impact of PLC time on daily instruction). The teachers appreciated the presence of protocols for analyzing
student work and the emphasis on collaborative discussions. However, the desire for more time and resources highlighted areas for potential improvement in the PLC experience.

In the analysis of the survey data, I aimed to investigate whether MPLCs and professional development address the instructional challenges teachers report. The data collected from presurvey and postsurvey responses were compared to determine any changes in teachers’ perceptions of the effectiveness of PLCs in addressing instructional challenges. ANOVA single factor analyses were conducted to examine the significance of the differences between the pre- and postsurvey responses.

The use of presurveys and postsurvey data allowed the creation of comparison of teachers’ perceptions before and after participating in MPLCs, which provided valuable insights into the impact of the PLCs on instructional challenges. In the analysis, I use a relatively small sample size with 19 participants in the presurvey and seven participants in the postsurvey. Overall, the analysis of the survey data provides valuable insights into the impact of MPLCs on instructional challenges teachers report. Although some limitations were present, the findings indicate participation in PLCs might have a positive influence on teacher support systems, beliefs about student learning, and the frequency of analyzing student work. However, no significant differences were found regarding teachers’ comfort in speaking up, the potential consequences of making mistakes, the impact of PLC time, and the use of protocols requiring exemplar creation.

**Research Question 2**

Do MPLCs and professional development have an impact on student achievement?

With Research Question 2, I strove to evaluate whether evidence of increased mathematical instructional pedagogy was gained through MPLCs and MPD taking place throughout the school year. During the 2020–2021 SY, the third-grade teachers willingly participated in the MPLC and two of these teachers participated in additional MPD offered
during the school year. In 2021–2022, all third-grade teachers “looped up” with their students from the third to the fourth grade.

During the 2021–2022 SY, the third-grade team was either new to the grade level or new to teaching and only participated in professional learning and professional development focused on English language arts. This begs the question: Is there a correlation between the mathematical student achievement of the students of the teachers’ level of involvement in activities to improve mathematics instructional practices? The third-grade mathematics MAAP data from third graders in 2020–2021 and fourth graders in 2021–2022 are used to identify the strength of the relationships between student achievement outcomes from teachers receiving MPLC and MPD.

Table 13 illustrates the positive, albeit weak, correlation between the number of hours teachers participated in MPD and the impact it has on student growth from the third grade to the fourth-grade mathematics MAAP assessment data. Students grew by five hundredths of a point for each hour of professional development their teacher participated in. The correlation (.05) indicates a weak, positive correlation between MPD and student growth, as illustrated in Table 13.
Table 13

*Mathematics Professional Development Correlation*

<table>
<thead>
<tr>
<th>Hours of PD</th>
<th>Students’ growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours of PD</td>
<td>1</td>
</tr>
<tr>
<td>Students’ growth</td>
<td>.05</td>
</tr>
</tbody>
</table>

**ANOVA**

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>F</th>
<th>Significance F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1.00</td>
<td>.11</td>
<td>.75</td>
</tr>
<tr>
<td>Residual</td>
<td>36.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>37.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Coefficients**

<table>
<thead>
<tr>
<th></th>
<th>t Stat</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>12.99</td>
<td>.00</td>
</tr>
<tr>
<td>Students’ growth</td>
<td>.05</td>
<td>.33</td>
</tr>
</tbody>
</table>

*Note. PD = professional development.*

The analysis shows a weak, but positive relationship exists between the number of professional development hours in which teachers participate and student growth in mathematics. Although the correlation coefficient indicates a somewhat weak association, the statistical tests verify this relationship is not statistically significant. Therefore, with the data from the MPLC and MPD activities during the 2021–2022 SY, I could not conclude with certainty these initiatives had a direct impact on student achievement.

**Observations and Learning Walks**

In this dissertation analysis, I aimed to investigate whether the instructional challenges teachers reported in their classrooms were effectively addressed through MPLCs and professional development. The data collected through learning walks and observations provide valuable insights into the implementation of instructional strategies and areas of needed growth.
require continuous support. In this analysis, I examine the commendations teachers receive, identify areas of strength and weakness, and outline the next steps district specialists, academic coaches, and school principals recommend.

**September 1, 2022, Observations.** During the learning walk conducted on September 1, commendations were given to the teachers for several positive aspects of their instructional practices. These commendations included adherence to the district’s pacing guide, following the instructional model, maintaining a classroom arrangement conducive to small group instruction, and demonstrating consistent expectations and procedures. Additionally, teachers exhibited warmth, encouragement, and enthusiasm in their interactions with students. No significant student engagement concerns or behavioral issues were observed during this period.

**Focus Area: Mathematics.** The focus area identified for improvement was mathematics instruction. The teachers were observed using explicit instruction during whole group instruction and at the teacher-led center. Teachers also provided students with ample practice opportunities and offered corrective and positive feedback. The use of memory aids and anchor charts for mathematics needed to be increased in classroom environments.

**Next Steps.** The district specialist, academic coach, and school principal planned to collaborate on the September PLC focus, specifically targeting questioning and engagement strategies. Support was to be provided to academic coaches with their assigned next steps, which included observing third- and fourth-grade classrooms, continuing planning support, facilitating conversations around the use of memory aids/anchor charts, and emphasizing explicit instruction and practice opportunities in mathematics.

**October 28, 2022, Observations.** During the learning walk conducted on October 28, commendations were given to a fifth-grade teacher who was working on place value intervention while other students were engaged in iMagine Mathematics activities. Evidence of work posted
on the data wall and the implementation of small group rotations was observed. However, it was noted there was a lack of anchor charts specifically for mathematics.

**Focus Area: Mathematics.** The focus area for mathematics was the need for anchor charts to support student learning.

**Next Steps.** The district specialist, academic coaches, school principal, and district interventionist planned to provide professional development on questioning and engagement strategies. The focus areas identified earlier were to be addressed, and monitoring of instructional expectations, assessment quality, and lesson plan attachments were to continue.

**November 29, 2022, Observations.** During the learning walk conducted on November 29, commendations were given to fifth- and fourth-grade teachers for their effective implementation of instructional practices. Lesson plans were found to be well-prepared, assessments were attached, and the use of high-quality instructional materials (HQIM) was observed. However, the data walls in fourth-grade classrooms were not updated, although the principal had student data tracking sheets.

**Focus Area: Mathematics.** The focus area for mathematics PLCs was highlighted for further improvement. It was noted the PLCs would focus on creating more anchor charts, and mathematics data walls.

**Next Steps.** The district specialists, academic coaches, and school principal planned to continue collaboration on addressing work from the previously identified focus areas.

**Conclusion**

From the data collected during learning walks and observations, I concluded MPLCs and professional development initiatives were effective in addressing instructional challenges in classrooms. The commendations teachers received indicate they had made significant progress in implementing explicit instruction, providing practice opportunities, and offering feedback.
However, areas of weakness were also identified (e.g., the need for increased use of memory aids, anchor charts, and the improvement of mathematics data walls). The recommended next steps include providing ongoing support, collaboration, monitoring, demonstrating a commitment to continuous improvement, and meeting the instructional needs of teachers and students.

**Research Question 3**

What was the impact on teachers’ content knowledge and resulting student achievement by the offering of specialized professional development?

This applied study was used consistently with a group of teachers who taught third grade in 2020–2021. This group of teachers participated in the book study, *5 Practices for Orchestrating Productive Mathematics Discussions* (2nd ed.) by Smith and Stein (2018), Understanding Fractions Institute professional development conducted by the Center for Mathematics and Science Education at the University of Mississippi (2022), weekly MPLCs, bi-weekly Early Release Wednesday grade level professional development, and additional professional development. This group of teachers “looped up” with their students from the third grade (2021) to the fifth grade (2022). Their data was compared to teachers who received one year or less of PLC and professional development from 2021–2022. In Table 14, this looping group of teachers is labeled T1, in Table 15 this group is labeled T2, and in Table 16 this group is labeled T3.

**Third Grade 2021–2023**

In this analysis, an Anova, followed by a Tukey test was conducted to compare the mean performance of third-grade mathematics teachers in three different years: 2021 (T1), 2022 (T2), and 2023 (T3). The teachers’ participation in PLCs and professional development in the field of mathematics was calculated and utilized in the testing. The Honestly Significant Difference
(HSD) values, from the Tukey test, for the significance level of .05 are provided as HSD .05 = 7.22. The p-values associated with each pairwise comparison is also given.

The mean score for third-grade mathematics teachers in 2021 (T1) who participated in one year of PLCs and professional development was 356.76, while the mean score for 2022 (T2) teachers who did not participate in any mathematics PLCs and professional development was 341.83. The difference between these means was 14.93. The p-value associated with this comparison was very small (p < .001), indicating a statistically significant difference between the two groups at the .05 alpha level. Therefore, strong evidence existed to indicate participating in one year of mathematics PLCs and professional development had a significant positive impact on performance compared to not participating [T1:T2; M1 = 356.76, M2 = 341.83; p < .001].

The mean score for third-grade mathematics teachers in 2021 (T1) who participated in one year of PLCs and professional development was 356.76, while the mean score for 2023 (T3) teachers who also participated in one year of mathematics PLCs and professional development was 349.58. The difference between these means was 7.19. The p-value associated with this comparison was .051, which was above the conventional alpha level of .05. Therefore, the observed difference was not statistically significant at the .05 level. Although the p-value was relatively close to the threshold, indicating a distinct level of practical significance, the comparison did not provide sufficient evidence to indicate a significant difference in performance between the two groups [T1:T3; M1 = 356.76, M3 = 349.58; p = .051]. The results of the year one to year three comparisons will be discussed further in Chapter 5.

The mean score for third-grade mathematics teachers in 2022 (T2) who did not participate in any mathematics PLCs and professional development was 341.83, while the mean score for 2023 (T3) teachers who did participate in one year of mathematics PLCs and professional development was 349.58. The difference between these means was 7.74. The p-
value associated with this comparison was .032, indicating a statistically significant difference between the two teacher groups at the .05 level. Therefore, evidence exists to indicate participating in one year of mathematics PLCs and professional development had a significant positive impact on performance compared to not participating [T2:T3; M2 = 341.83, M3 = 349.58; p = .032].

From the Tukey test results at the .05 significance level, the analysis indicates participating in one year of mathematics PLCs and professional development produced a significant, positive impact on the performance of third-grade mathematics teachers in comparison to not participating. This result was evident from the significant difference observed between T1 (2021, participated in PLCs and professional development) and T2 (2022, did not participate in PLCs and professional development), as well as between T2 (2022, did not participate in PLCs and professional development) and T3 (2023, participated in PLCs and professional development).

In conclusion, the Tukey test analysis indicated participating in one year of mathematics PLCs and professional development positively influenced the performance of third-grade mathematics teachers compared to not participating. These findings provide valuable insights for understanding the effectiveness of professional development and collaborative learning opportunities specifically in the context of third-grade mathematics education.
Table 14

Tukey Third-Grade Comparisons

<table>
<thead>
<tr>
<th>Comparisons</th>
<th>Means</th>
<th>HSD_{0.05} = 7.2180</th>
<th>p-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>T_1:T_2</td>
<td>M_1 = 356.76</td>
<td>14.93</td>
<td>p &lt; .001</td>
</tr>
<tr>
<td></td>
<td>M_2 = 341.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T_1:T_3</td>
<td>M_1 = 356.76</td>
<td>7.19</td>
<td>p &lt; .051</td>
</tr>
<tr>
<td></td>
<td>M_3 = 349.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T_2:T_3</td>
<td>M_2 = 341.83</td>
<td>7.74</td>
<td>p = .032</td>
</tr>
<tr>
<td></td>
<td>M_3 = 349.58</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. T_1 = third grade 2021 (1-year MPD/MPLC); T_2 = third grade 2022 (0 years of MPD/MPLC); T_3 = third grade 2023 (1-year of MPD/MPLC).*

Fourth Grade 2021–2023

In the analysis for Table 15, a Tukey test was conducted to compare the mean performance of fourth-grade mathematics teachers in three different years: 2021 (T_1), 2022 (T_2), and 2023 (T_3). The teachers’ participation in PLCs and professional development in the field of mathematics was determined. I also mentioned T_2 “looped up” with their students, indicating teachers continued teaching the same group of students from a previous grade. The HSD values for the significance level of .05 are provided as HSD .05 = 9.05. The p-values associated with each pairwise comparison is also provided in Table 15.

The mean score for fourth-grade mathematics teachers in 2021 (T_1) who participated in one year of PLCs and professional development was 434.83, while the mean score for 2022 (T_2) teachers who participated in two years of mathematics PLCs and professional development and “looped up” with their students was 453.70. The difference between these means was 18.86. The
p-value associated with this comparison was very small (p = .001), indicating a statistically significant difference between the two groups at the .05 level. Therefore, strong evidence existed to indicate participating in two years of mathematics PLCs and professional development, along with “looping up” with their students, had a significant positive impact on performance compared to participating in only one year. [T1:T2; M1 = 434.83, M2 = 453.70; p < .001].

The mean score for fourth-grade mathematics teachers in 2021 (T1) who participated in 1 year of PLCs and professional development was 434.83, while the mean score for 2023 (T3) teachers who participated in one year of mathematics PLCs and professional development was 450.35. The difference between these means was 15.52. The p-value associated with this comparison was small (p < .001), indicating a statistically significant difference between the two groups at the .05 alpha level. Therefore, evidence exists to indicate participating in one year of mathematics PLCs and professional development has a significant positive impact on performance in comparison to not participating [T1:T3; M1 = 434.83, M3 = 450.35; p < .001].

The mean score for fourth-grade mathematics teachers in 2022 (T2) who participated in two years of mathematics PLCs and professional development and “looped up” with their students was 453.70, while the mean score for 2023 (T3) teachers who participated in one year of mathematics PLCs and professional development was 450.35. The difference between these means was 3.35. The p-value associated with this comparison was relatively large (p = .656), indicating the observed difference is not statistically significant at the .05 level. Therefore, no strong evidence existed to indicate a significant difference in performance between teachers who participated in two years of mathematics PLCs and professional development, along with “looping up” with their students (T2), and those who participated in one year of mathematics PLCs and professional development (T3) [T2:T3; M2 = 453.70, M3 = 450.35; p = .656].
From the ad-hoc Tukey test results at the .05 alpha level, the analysis indicates participating in two years of mathematics PLCs and professional development, along with “looping up” with their students, had a significant positive impact on the performance of fourth-grade mathematics teachers compared to participating in only one year of PLCs and professional development (T1). Additionally, participating in one year of PLCs and professional development (T1) also led to a significant improvement in performance compared to not participating (T3). Overall, these findings provided valuable insights into the effectiveness of professional development, collaborative learning opportunities, and the impact of “looping up” with their students for enhancing teaching practices and student outcomes in the context of fourth-grade mathematics education.

**Table 15**

*Tukey Fourth-Grade Comparisons*

<table>
<thead>
<tr>
<th>Comparisons</th>
<th>Means</th>
<th>HSD$_{.05}$ = 9.05</th>
<th>$p$-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>T$_1$:T$_2$</td>
<td>$M_1 = 434.83$</td>
<td>18.86</td>
<td>$p &lt; .001$</td>
</tr>
<tr>
<td></td>
<td>$M_2 = 453.70$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T$_1$:T$_3$</td>
<td>$M_1 = 434.83$</td>
<td>15.52</td>
<td>$p &lt; .001$</td>
</tr>
<tr>
<td></td>
<td>$M_3 = 450.35$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T$_2$:T$_3$</td>
<td>$M_2 = 453.70$</td>
<td>3.35</td>
<td>$p = .656$</td>
</tr>
<tr>
<td></td>
<td>$M_3 = 450.35$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* T$_1$ = fourth grade 2021 (1 year of MPD/MPLC); T$_2$ = fourth grade 2022 (2 years of MPD/MPLC/Looped); T$_3$ = fourth grade 2023 (1 year of MPD/MPLC/Looped).
In this analysis, a Tukey test was conducted to compare the mean performance of fifth-grade mathematics teachers in three different years: 2021 (T1), 2022 (T2), and 2023 (T3). The teachers’ participation in PLCs and professional development was also considered. The HSD values for the alpha level of .05 are provided as HSD .05 = 4.60. The p-value associated with each pairwise comparison is also given.

The mean score for fifth-grade mathematics teachers in 2021 (T1) who did not participate in PLCs and professional development was 543.41, while the mean score for 2022 (T2) teachers who participated in 1 year of mathematics PLCs and professional development was 544.98. The difference between these means was 1.57. The p-value associated with this comparison was .699, indicating the observed difference was not statistically significant at the .05 level. Therefore, no strong evidence existed to indicate a significant difference in performance between teachers in 2021 (T1) and those in 2022 (T2) [T1:T2; M1 = 543.41, M2 = 544.98; p = .699].

The mean score for fifth-grade mathematics teachers in 2021 (T1) who did not participate in PLCs and professional development was 543.41, while the mean score for 2023 (T3) teachers who participated in two years of PLCs and professional development was 556.93. The difference between these means is 13.52. The p-value associated with this comparison was very small (p < .001), indicating a statistically significant difference between teachers in 2021 (T1) and those in 2023 (T3) at the .05 level. Therefore, strong evidence exists to indicate a significant difference in performance between these two groups [T1:T3; M1 = 543.41, M3 = 556.93; p < .001].

The mean score for fifth-grade mathematics teachers in 2022 (T2) who participated in one year of mathematics PLCs and professional development was 544.98, while the mean score for 2023 (T3) teachers who participated in two years of PLCs and professional development was
The difference between these means was 11.95. The p-value associated with this comparison was also very small (p < .001), indicating a statistically significant difference between teachers in 2022 (T2) and those in 2023 (T3) at the .05 level. Therefore, there is strong evidence indicating a significant difference exists in performance between these two groups [T2:T3; M2 = 544.98, M3 = 556.93; p < .001].

From the Tukey test results at the .05 significance level, the analysis revealed no significant difference existed in performance between fifth-grade mathematics teachers who did not participate in PLCs and professional development (T1) and those who participated in one year of mathematics PLCs and professional development (T2). However, a significant difference in performance between teachers who did not participate in PLCs and professional development (T1) and those who participated in two years of PLCs and professional development (T3), as well as between teachers who participated in one year of mathematics PLCs and professional development (T2) and those who participated in two years of PLCs and professional development (T3).

These findings suggested participating in two years of PLCs and professional development can have a significant positive impact on the performance of fifth-grade mathematics teachers compared to not participating or participating in only one year. The results provide valuable insights into the effectiveness of professional development and collaborative learning opportunities for enhancing teaching practices and student outcomes in the context of fifth-grade mathematics education.
Table 16

*Tukey Fifth-Grade Comparisons*

<table>
<thead>
<tr>
<th>Comparisons</th>
<th>Means</th>
<th>HSD,.05 = 4.6009</th>
<th>p-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_1:T_2$</td>
<td>$M_1 = 543.41$</td>
<td>1.57</td>
<td>$p = .699$</td>
</tr>
<tr>
<td></td>
<td>$M_2 = 544.98$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T_1:T_3$</td>
<td>$M_1 = 543.41$</td>
<td>13.52</td>
<td>$p &lt; .001$</td>
</tr>
<tr>
<td></td>
<td>$M_3 = 556.93$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T_2:T_3$</td>
<td>$M_2 = 544.98$</td>
<td>11.95</td>
<td>$p &lt; .001$</td>
</tr>
<tr>
<td></td>
<td>$M_3 = 556.93$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. T1 = fifth grade 2021 (No MPD/No MPLC); T2 = fifth grade 2022 (1 year of MPD/MPLC); T3 = fifth grade 2023 (2 years of MPD/MPLC/Looped).*

**Research Question 4**

What was the impact on teachers’ classroom practices and resulting student achievement by the offering of specialized professional development?

The majority of the teachers *Strongly Agreed* the professional development sessions met their expectations. Teachers who participated in the professional development believed the content and strategies were relevant. The teachers believed the session content and strategies would be useful in their classroom. The teachers *Agreed* the communication prior to the session was timely and informative. The majority of teachers indicated they would recommend the session to a colleague.
When asked, “What were the most beneficial learnings?” the teachers highlighted several beneficial learnings (e.g., learning new ways to present fractions, understanding the “why” behind teaching fractions, building connections with other mathematical concepts, using manipulatives and tools effectively, relating standards to previous knowledge, and deconstructing fractions visually).

The teachers expressed their intention to apply what they had learned by using manipulatives, incorporating new strategies into instruction, promoting hands-on learning, using models and tools, reteaching fractions from the beginning, and emphasizing concrete understanding through manipulatives. Teachers also provided various additional comments, including requests for future sessions would be focused on measurement and data standards, geometry, decimals, Base 10 and multiplication training, rounding, and division. One participant recommended teaching the foundation of fractions correctly in all grades. Overall, the feedback from the Understanding Fractions professional development was generally positive, with participants finding the session valuable, engaging, and applicable to their classroom. The session was commended for its atmosphere and communication, with only minor suggestions for improvement and additional topics to cover in the future.

Using interview and feedback information the teachers provided, the impact of the specialized professional development on teachers’ classroom practices and resulting student achievement could be inferred as follows. Before the mathematics training, the teachers expressed a lack of confidence in teaching mathematics beyond Base 10 and basic multiplication. Their skills were limited, and they relied on a cheat sheet for fractions related to cooking. However, after the mathematics training, the teacher’s perception of their own knowledge and abilities improved significantly. They realized they knew more than they had initially thought and were able to use manipulatives effectively to work with fractions. They demonstrated
proficiency in quickly performing operations like addition, subtraction, and substitution of equal parts, even without finding a common denominator. They were also able to understand and explain most of the mathematical verbiage.

Although the teachers experienced occasional confusion or “getting off track,” they were able to overcome these challenges by engaging in problem-solving discussions with the group. This indicated the professional development helped enhance their problem-solving skills and their ability to identify and correct mistakes. Although the training was still in progress regarding multiplication of fractions, the teacher expressed a desire for more time to deepen their understanding. Nevertheless, they gained a sense of direction and felt more confident about where to start.

Additionally, it was mentioned, after the mathematics professional development, the teachers requested information on various resources related to instructional routines, PowerPoint slides for word problems, instructional planning guides, and templates for small groups. This suggested the professional development not only affected the teachers’ own practice, but it also motivated them to seek additional resources to enhance their classroom instruction. Furthermore, the teachers’ participation in PLCs and professional development sessions focused on mathematical practices for students, specifically referencing the book study *5 Practices for Orchestrating Productive Mathematics Discussions* (2nd ed.) by Smith and Stein (2018). This indicated the professional development facilitated a shift in instructional practices towards implementing mathematical practices and fostering productive mathematics discussions in the classroom.

**Research Question 5**

*Do teachers who participate in MPD develop stronger self-efficacy beliefs about teaching mathematics than teachers who do not participate?*
A Teacher Beliefs Survey was given to teachers who participated in the book study and MPD. The presurvey and postsurvey were given fall of 2022 and spring of 2023. The survey was used to identify any changes in teachers’ beliefs before the MPLCs and MPD. The two-part survey began with the following five descriptions of teachers and teaching styles and four open-response questions were aligned to the teacher styles.

**Part I of the Survey**

*On the following pages are five brief descriptions of teachers and teaching styles. Please take a few moments to reflect on them and answer the questions that follow.*

1. According to the pacing guide, the teacher selects the content and quantity of the work that students perform. Students follow the pace set by the teacher and respond to his/her rhythm, cues, and questions. This teacher explains concepts, demonstrates problems, and allows students ample time to practice skills. There is time built in for students to ask questions as they arise. The teacher checks for understanding by asking guided questions as s/he presents the lesson. The district-adopted textbook is the primary resource for activities and homework. Assessment typically occurs in the form of quizzes throughout the unit and a formal test at the end, with a set of problems similar to what was demonstrated and practiced during the unit.

2. According to the pacing guide, the teacher selects the subject matter, the quantity, and the time limits so that students can practice following explanation and demonstration by the teacher. The teacher circulates among students and offers private feedback to each student about performance on assignments. Often, students are asked to solve workbook, homework, or textbook problems on the board. Once or twice per semester, students engage in projects offering authentic application of concepts and
skills, which count toward grades. Other assessment happens in the form of quizzes during the unit and tests at the end of a unit. Tests include objective items and word problems similar to what was demonstrated and practiced during the unit.

3. The teacher selects the subject matter, activities, and timeline according to the pacing guide. For each mathematics topic, the teacher introduces the concept from the adopted textbook using a variety of instructional strategies and may or may not demonstrate examples. S/he uses open-ended questions to involve students in whole-group discussion, and then presents parameters for students to work on a problem with a partner or group. The teacher circulates the classroom to offer suggestions, ask questions, guide thinking, and give feedback. Students present their work back to the whole group, and the teacher fills in any gaps in understanding. Assessment is ongoing and tests include some objective items and some word problems.

4. The teacher designs or selects a set of situations or questions related to principles, rules, concepts, and relationships in mathematics. The situations and/or questions are logically sequenced so that the answers lead students step by step toward discovery of the idea. Students sometimes work alone, in groups, or in pairs and are free to use whatever methodology and tools they deem appropriate to solve the problem. The teacher circulates the room to probe for understanding and ask questions to stimulate thinking and brings students back together as a whole group to process what they found. Although students use the adopted textbook as a resource, it is not the primary source of lessons or student assignments. A combination of performance assessment tasks, objective tests, and portfolios are used to assess student learning.

5. The teacher designs or selects a series of problems or situations related to principles, rules, concepts, and relationships in mathematics that grow from students’ questions
and comments. Problems posed are always new to students, always open-ended, usually necessitate some form of collaboration, and typically take at least half an hour to solve. The teacher seeks multiple solution paths to the same problem. Students work flexibly in groups, pairs, and individually. They present solutions in a variety of ways and explain and justify their thinking to their peers. The teacher and students use the adopted textbook only as a reference. Students play an important role in setting performance criteria. Performance assessment and portfolios are used exclusively to assess progress, and feedback is provided by way of rubrics and teacher comments.

Question 1 asked, “Which one of these teachers most closely resembles you? What are the similarities?” From the presurvey responses, it was clear the participants identified with different teaching styles. The most commonly mentioned teaching style was Teacher A - found within the survey directions, who followed a pacing guide, selected the content and quantity of work, explains concepts, demonstrated problems, allowed ample time for practice, checked for understanding through guided questions, and relied on the district-adopted textbook as the primary resource. Some participants also mentioned incorporating elements from other teaching styles (e.g., group work and providing private feedback to students [similar to Teacher B and Teacher C, also with in the Survey directions] or allowing students to work alone, in groups, or in pairs with flexibility in methodology and tools [similar to Teacher D]).

The postsurvey responses showed a shift in the participants’ desired teaching style. Teaching Style C (Teacher C) was mentioned as the desired style for math, which involves using various instructional strategies, open-ended questioning, whole-group discussions, and student collaboration. The participants mentioned valuing the importance of deeper understanding through these instructional approaches. Teacher A and Teacher C were most commonly
mentioned as resembling the participants’ desired teaching styles. The similarities included the presentation of instructional strategies, whole-group discussions, students working together, circulating the classroom to offer suggestions and guidance, and ongoing assessments through quizzes and tests aligned with demonstrated and practiced content.

Overall, the participants initially identified with more traditional teaching styles, particularly Teacher A, who emphasized pacing, direct instruction, and reliance on a textbook. However, through the experience of MPLCs and professional development, the participants began to value and desire teaching approaches that involved more student engagement, collaborative work, and open-ended questioning, as reflected in their postsurvey responses. The postsurvey data suggested a potential shift in teachers’ beliefs and practices had occurred towards more student-centered and inquiry-based approaches to teaching mathematics.

Question 2 asked, “Which one is most different? What are the differences?” According to the presurvey responses, Teacher E was consistently identified as the most different teaching style. The main differences mentioned were the following:

- **Problem Characteristics**: Teacher E posed new and open-ended problems to students, which usually required collaboration and took at least an hour to solve. This contrasts with the other teaching styles, in which problems were more structured and aligned with the curriculum or textbook.

- **Use of Textbook**: Teacher E used the adopted textbook only as a reference, indicating a departure from relying on the textbook as the primary resource for instruction, as seen in other teaching styles.

- **Student Involvement**: Teacher E allowed students to play an important role in setting performance criteria and uses performance assessment tasks and portfolios.
exclusively to assess progress. This student involvement and emphasis on self-assessment and reflection were distinct from the other teaching styles.

In the postsurvey responses, the participants reiterated Teacher E was the most different teaching style from their teaching style. The differences mentioned included a more student-led approach, with students playing a significant role in using rubrics and being involved in their own learning. It was also noted that Teacher E’s style might be more suitable for students at a higher academic level or with increased maturity.

Overall, Teacher E’s teaching style stood out because of its emphasis on open-ended problems, student-led learning, limited reliance on the textbook, and exclusive use of performance assessments and portfolios for evaluation. The other teaching styles mentioned in the survey exhibited more structured instruction, reliance on textbooks, and a teacher-centered approach.

Question 3 asked, “Which of the scenarios do you think is the most beneficial for student learning? Why?” From the responses provided, several teaching styles were considered beneficial for student learning. These included a mixture of Styles B and D, Teacher Style C, and Teacher Style E. These are the reasons why these teaching styles were seen as beneficial:

- A mixture of Styles B and D: This combination allows for flexibility in teaching and learning. Style B emphasizes practice following explanation and demonstration by the teacher, while style D involves designing or selecting problem situations that lead students step by step toward discovery. The flexibility provided by this combination can cater to different learning preferences and promote a well-rounded learning experience.

- Teacher Style C: This style was seen as beneficial because of its good mixture of teaching strategies. It involves introducing concepts using instructional strategies,
whole-group discussions, and partnering/group work. The teacher circulates to provide guidance, ask questions, and offer feedback. This style allows for a variety of engagement methods and promotes active student participation.

- Teacher Style E: This style was particularly highlighted in the postsurvey responses as being beneficial for student learning. It is characterized by posing new, open-ended problems that require collaboration, student-centered approaches, and the use of performance assessments and portfolios. This style promotes analytical thinking, student-led exploration, explanation, and justification of solutions, as well as providing effective feedback.

In the postsurvey responses, the teachers also mentioned the importance of student collaboration, peer learning, and opportunities for students to think, pair, and share their ideas. These elements can enhance understanding and engagement in the learning process. Additionally, the perceived benefits of a particular teaching style might depend on factors such as grade level and students' mathematics skill level. Different teaching styles might suit different contexts and student populations. Therefore, it is essential teachers adapt their instructional approaches to meet the specific needs of their students.

Question 4 asked, “Which one of these do you see most often in your own school and which one the least? Why do you think that is?” From the responses provided, Teaching Style A was most commonly seen in the participants’ schools, while Teaching Style E was seen the least often. The reasons for this observation varied, but could be attributed to the following factors:

- Textbook and District Policies: Many respondents mentioned Teaching Style A was more prevalent because their schools prioritize following a pacing guide and using the adopted textbook as the primary resource. This explanation suggests the emphasis on structured instruction aligned with the textbook and adherence to district policies
regarding curriculum implementation contribute to the prevalence of Teaching Style A.

- **Autonomy and Student Age:** Some participants stated Teaching Style E, which involves more student-led learning and open-ended problem solving, is less commonly seen in their schools. They attributed this low use to factors such as limited autonomy for teachers to deviate from the prescribed curriculum or the belief student-led approaches are more challenging to implement in lower grade levels where students might require more guidance and structure.

- **Consistency and Support:** In a couple of responses, the teachers mentioned Teaching Style A is more commonly used to ensure consistency among team members and to align with the guidance provided by academic coaches or district-level expectations. This explanation indicated factors related to professional collaboration, support, and the desire for uniformity across classrooms might influence the prevalence of certain teaching styles.

Additionally, the use of a pacing guide, district benchmark tests, and the need for control over instruction were mentioned as contributing factors to the prevalence of Teaching Style A in some schools. The prevalence of teaching styles can vary widely across different schools and districts, depending on local policies, resources, and educational philosophies. The reasons provided by the respondents offer insights into the factors might influence the prominence of specific teaching styles in their respective schools.

**Part 2 of the Survey**

Part 2 of the survey consisted of eight questions in which teachers had two choices for each selection and choose the statement best aligned with their beliefs. The frequency of their responses was analyzed.
Selection 1 asked teachers to choose “Students should first be taught a set of skills in mathematics before being presented a complex problem” or “Students should be presented a complex problem first to students motivates them to learn the skills necessary to solve the problem.” From the presurvey responses, 75% of the participants believed students should first be taught a set of skills in mathematics before being presented with a complex problem. In contrast, 25% of the participants believed presenting a complex problem first would motivate students to learn the skills necessary to solve the problem. However, in the postsurvey responses, all of the participants (100%) indicated students should first be taught a set of skills in mathematics before being presented with a complex problem. No participants believed presenting a complex problem first would be more motivating for students.

This shift in responses suggested a consensus among the participants in believing a skills-first approach would be more beneficial for student learning in mathematics. It indicated a preference for providing students with foundational knowledge and skills before introducing them to complex problems require the application of those skills. This shift could have been influenced by various factors (e.g., the participants’ own experiences in teaching mathematics, professional development opportunities, or discussions and reflections on effective instructional practices). It is also possible the participants’ understanding of pedagogical approaches evolved over time, leading to a more aligned perspective on the importance of skill development before tackling complex problems. Overall, the postsurvey responses indicated a unanimous agreement among the participants teaching foundational skills in mathematics before presenting complex problems was the most beneficial approach for student learning in this context.

Selection 2 asked the teachers to choose “Students learn mathematical concepts best by being asked to reflect on their own thinking and problem solving before working with the teacher” or “Students learn mathematical concepts best by having a teacher show them multiple
examples before working on their own.” From the presurvey responses, 25% of the participants believed students learn mathematical concepts best by being asked to reflect on their own thinking and problem solving before working with the teacher. In contrast, 75% of the participants believed students learn mathematical concepts best by having a teacher show them multiple examples before working on their own.

In the postsurvey responses, a shift in perspectives occurred. The majority (67%) of the participants then believed students learn mathematical concepts best by being asked to reflect on their own thinking and problem solving before working with the teacher. However, 33% of participants still believed students learn best by having a teacher show them multiple examples before working on their own. This change in responses suggested a shift in the participants’ beliefs had occurred regarding the optimal approach for students to learn mathematical concepts. The increased percentage of participants favoring student reflection and problem solving indicated a recognition of the value of student-centered learning and the importance of fostering independent thinking and problem-solving skills.

This shift could have been influenced by various factors (e.g., the participants’ experiences in teaching mathematics, exposure to research or evidence supporting student-centered approaches, or professional development opportunities promote active student engagement and reflection). The postsurvey responses indicated a shift toward valuing student reflection and problem solving as an effective approach for learning mathematical concepts. However, a significant minority still held the belief teacher-led instruction with multiple examples was more beneficial. This diversity of perspectives highlighted the ongoing debates and considerations within the field of mathematics education.

Selection 3 asked teachers to choose whether “Students understand more mathematics by listening, watching, and following the teacher until they master the big idea” or “Students
understand more mathematics by doing and discussing mathematics with each other until they master the big idea.” From the presurvey responses, 12.5% of the participants believed students understand more mathematics by listening, watching, and following the teacher until they master the big idea. In contrast, the majority (75%) of participants believed students understand more mathematics by doing and discussing mathematics with each other until they master the big idea. In addition, 12.5% of participants did not provide a clear choice.

In the postsurvey responses, a significant shift in perspectives occurred. None of the participants then believed students understand more mathematics by listening, watching, and following the teacher until they master the big idea. Instead, 100% of the participants believed students understand more mathematics by doing and discussing mathematics with each other until they master the big idea. This change in responses indicated a strong shift towards valuing active student engagement and collaborative learning approaches in understanding mathematics. The participants then recognized the importance of students actively participating in mathematical activities (e.g., problem solving, discussions, and peer interactions) to deepen their understanding of mathematical concepts.

This shift could have been influenced by various factors (e.g., the participants’ experiences in teaching mathematics, exposure to research or evidence supporting student-centered and collaborative learning approaches, or professional development opportunities promote active student engagement in mathematics). The postsurvey responses indicated a unanimous agreement among the participants students understand more mathematics through active engagement, collaboration, and discussion. This shift reflected a broader recognition of the effectiveness of student-centered and interactive learning approaches in mathematics education.
Selection 4 asked teachers to choose “There is usually one ‘best’ way to solve a mathematics problem” or “There are usually many equally good ways to solve a mathematics problem.” From the presurvey responses, 12.5% of the participants believed there was usually one “best” way to solve a mathematics problem. In contrast, the majority (87.5%) of the participants believed there are usually many equally good ways to solve a mathematics problem.

In the postsurvey responses, a complete shift in perspectives occurred. None of the participants then believed there was usually one “best” way to solve a mathematics problem. Instead, 100% of the participants then believed there are usually many equally good ways to solve a mathematics problem. This change in responses indicated a shift towards recognizing the multiple approaches and strategies can be used to solve mathematical problems. The participants then acknowledged different students might employ different methods or approaches to arrive at a correct solution. This shift aligned with the idea mathematics is not a rigid and fixed set of procedures, but rather is a dynamic field allows for creativity and diverse problem-solving strategies.

This shift could have been influenced by a deeper understanding of the nature of mathematics, exposure to research or evidence highlighting multiple problem-solving strategies, or professional development opportunities promote a flexible and inclusive approach to mathematics instruction. The postsurvey responses indicated a unanimous agreement among the participants there are usually many equally good ways to solve a mathematics problem. This shift reflects a broader recognition of the importance of fostering mathematical flexibility, creativity, and problem-solving skills among students.

Selection 5 asked the teachers to choose “Students best understand and can apply mathematics concepts when practice is embedded in reinforcement through repetition and feedback” or “Students best understand and can apply mathematics concepts when practice is
embedded in open-ended questioning and problem solving.” From the presurvey responses, 50% of the participants believed students best understand and can apply mathematics concepts when practice is embedded in reinforcement through repetition and feedback. In contrast, only 25% of the participants believed students best understand and can apply mathematics concepts when practice is embedded in open-ended questioning and problem solving. In addition, 12.5% of participants did not choose either option.

In the postsurvey responses, a unanimous consensus occurred among the participants. All of them (100%) then believed students best understand and can apply mathematics concepts when practice is embedded in reinforcement through repetition and feedback. None of the participants then support the idea open-ended questioning and problem solving would be the most effective approaches for understanding and applying mathematics concepts. This shift in responses suggested a preference for more traditional and structured approaches to mathematics instruction, where practice is emphasized through repetitive exercises and feedback. It indicated a preference for a more procedural and algorithmic understanding of mathematics, focusing on practice and mastery of specific techniques.

This shift could have stemmed from the participants’ personal teaching experiences, a perceived need for foundational skills and procedural fluency in mathematics, or a belief practice and repetition lead to better retention and application of mathematical concepts. It is important to note, although the postsurvey responses showed a unanimous agreement, the effectiveness of different instructional approaches might have varied, depending on the learning preferences and needs of individual students. Balancing both repetitive practice and open-ended problem solving can provide a more comprehensive and balanced mathematics learning experience.

Selection 6 asked the teachers to choose “Students should be given an opportunity to work with challenging mathematics problems they have not been exposed to previously” or
“Students should be given an opportunity to work with challenging mathematics problems as long as they have seen similar problems previously.” From the presurvey responses, 37.5% of the participants believed students should be given an opportunity to work with challenging mathematics problems to which they have not previously been exposed. In contrast, 62.5% of the participants believed students should be given an opportunity to work with challenging mathematics problems only if they have seen similar problems before.

In the postsurvey responses, a shift in the participants’ views occurred. Then, 67% of the participants believed students should be given an opportunity to work with challenging mathematics problems to which they have not previously been exposed. However, 33% still held the view students should work on challenging problems only if they have seen similar problems before. This shift suggested a growing recognition of the value of introducing students to unfamiliar and novel mathematical problems. The majority of participants then supported the idea working on new and challenging problems could foster deeper understanding, critical thinking, and problem-solving skills. This approach encourages students to think creatively and apply their mathematical knowledge in unfamiliar contexts.

The participants who still preferred students to work on similar problems might believe building on familiar concepts and problem-solving strategies would be essential for students to develop a solid foundation before tackling more advanced or complex challenges. They might have seen a progression in problem difficulty as an effective way to scaffold students’ learning and build confidence. Ultimately, a balanced approach incorporates both familiar and unfamiliar problem-solving situations can be beneficial. It allows students to reinforce their understanding of known concepts while also providing opportunities for exploration and growth through encountering new challenges. This approach can promote a deeper understanding of mathematics and develop students’ problem-solving skills.
Selection 7 asked the teachers to choose “Being exposed to several methods for solving a problem will confuse or overwhelm students” or “Being exposed to multiple ways of solving a mathematics problem will deepen students’ understanding.” From the presurvey responses, 37.5% of the participants believed being exposed to several methods for solving a problem would confuse or overwhelm students. In contrast, 62.5% of the participants believed being exposed to multiple ways of solving a mathematics problem would deepen students’ understanding. In the postsurvey responses, a slight shift occurred in the participants’ views. Then, 66.7% of the participants believe being exposed to multiple ways of solving a mathematics problem would deepen students’ understanding. However, 33.3% still held the belief exposing students to several methods for solving a problem could confuse or overwhelm them.

The slight shift suggested a growing recognition of the benefits of exposing students to multiple problem-solving approaches. The majority of participants then supported the idea exploring various methods could enhance students’ understanding of mathematical concepts. By exposing students to different approaches, they could develop a broader perspective, gain insight into the underlying principles, and make connections between different strategies. This approach promotes critical thinking, flexibility, and a deeper grasp of the subject matter.

However, the participants who still expressed concerns about confusion or overwhelming students might have believed too many approaches presented simultaneously could hinder students’ comprehension. They might have advocated for a more gradual introduction of different problem-solving methods to allow students to master one approach before introducing alternatives. This approach would provide a solid foundation and build confidence before exploring more complex or diverse strategies.

A balanced approach is crucial in addressing these different perspectives. It involves providing students with opportunities to explore multiple problem-solving methods while
offering appropriate support and guidance. This balance could include scaffolding instruction, providing clear explanations, and creating a supportive learning environment where students can discuss and compare different approaches. By striking a balance, educators can help students develop a deeper understanding of mathematics while addressing concerns about confusion or overwhelm.

Selection 8 asked the teachers to choose “Classroom instruction should emphasize the use of student-discovered strategies for solving mathematics problems” or “Classroom instruction should emphasize the use of traditional algorithms for solving mathematics problems.” From the presurvey responses, 50% of the participants believed classroom instruction should emphasize the use of student-discovered strategies for solving mathematics problems. In contrast, 37.5% of the participants believed classroom instruction should emphasize the use of traditional algorithms for solving mathematics problems. In the postsurvey responses, a slight shift occurred in the participants' views. Then, 67% of the participants believed classroom instruction should emphasize the use of student-discovered strategies for solving mathematics problems. However, 33% still supported the idea of emphasizing the use of traditional algorithms.

The shift in favor of student-discovered strategies suggested a growing recognition of the importance of promoting critical thinking, problem-solving skills, and conceptual understanding in mathematics education. Emphasizing student-discovered strategies encourages students to explore different approaches, develop their own problem-solving methods, and gain a deeper understanding of mathematical concepts. It fosters creativity, flexibility, and a sense of ownership in learning.

However, the participants who still advocated for the use of traditional algorithms might have believed these methods would provide clear, efficient, and reliable ways to solve mathematical problems. They might have argued algorithms have been developed and refined
over time and are widely used in various fields. Familiarity with traditional algorithms can help students build fluency and efficiency in calculations. A balanced approach is crucial in addressing these different perspectives. It involves recognizing the value of both student-discovered strategies and traditional algorithms and finding opportunities to integrate them effectively in instruction.

Providing students with a range of problem-solving strategies, including both student-discovered and traditional approaches, allows them to develop a repertoire of methods and select the most appropriate one for each situation. It also helps students appreciate different problem-solving approaches and understand the connections between them. By combining student exploration and discovery with the use of traditional algorithms, educators can create a learning environment that promotes conceptual understanding, critical thinking, and computational fluency. This approach empowers students to become proficient problem solvers who can apply their mathematical knowledge in various contexts.

**Research Question 6**

Do teachers who participate in MPD increase the frequency of HQIP?

Through observation data and notes, teachers who participated in MPD increased the frequency of HQIP. The evidence supporting this assertion includes the following. The teachers increased self-efficacy. The participating teachers exhibited self-efficacy by seeking additional professional development opportunities outside of the school and district. This indicated their proactive engagement in enhancing their knowledge and instructional practices.

The use of manipulatives and regular practices increased. Teachers began incorporating manipulatives into their instruction, which suggested a shift towards hands-on and experiential learning. Additionally, they implemented regular practice routines, indicating a focus on deliberate and consistent practice to reinforce mathematical concepts. An improvement occurred
in student growth and proficiency. Over the school years, the teachers’ students demonstrated improved growth and proficiency. This suggested the instructional practices that the teachers adopted were effective in promoting student learning and understanding of mathematics.

The students improved their understanding and application of word problems. The teachers helped their students to understand and solve word problems by using content learned in professional development. This improvement indicated the integration of real-world problem-solving skills within their instruction, which is a HQIP. Small-group instruction increased in mathematics instruction. The teachers provided small group instruction in mathematics. This approach allowed for targeted support, differentiation, and increased student engagement, all of which contribute to high-quality instruction.

Teachers became data-driven instructors. The teachers used data to inform their instruction, indicating a focus on individual student needs and evidence-based decision making. Their practice aligned with effective instructional practices. Additionally, accountability for student learning improved. The teachers held their students accountable for their learning. Which suggested a focus on student ownership and responsibility, fostering a positive learning environment.

The participating teachers developed a deeper understanding of mathematical practices and fractions. This indicated a growth in content knowledge and pedagogical understanding, which is crucial for effective instruction. They also took ownership of creating and using of resources. Teachers created or used resources from the professional development to support student learning. By providing aids and resources, teachers facilitated a deeper understanding of mathematics and empowered students in their learning process.

In conclusion, the evidence suggested teachers who participated in MPD increased the frequency of HQIP. These teachers demonstrated enhanced self-efficacy, implemented
manipulatives, engaged in regular practice, improved student growth and proficiency, facilitated understanding of word problems, provided small group instruction, used data to drive instruction, held students accountable, deepened their understanding of mathematical practices and fractions, and used resources to support student learning. These practices collectively contributed to a high-quality mathematics instruction (HQMI).

Preliminary Data for 2023

The data collected throughout this applied research study provided valuable insights into the instructional practices teachers who were involved in MPLCs reported and the changes in their beliefs about teaching mathematics and student ability. With the essential question of this study, I aimed to explore the impact of MPLCs on teachers’ instructional practices and their perception of student ability.

The HPES end-of-year, school mathematics data from the years 2020–2021, 2021–2022, and 2022–2023 revealed significant improvements in proficiency, growth, and performance among students (see Table 17). The proficiency scores increased from 9.2% in 2020–2021 to 13.2% in 2021–2022, and further to 18.8% in 2022–2023. These results indicate a steady progression in student achievement in mathematics over the three-year period.

The data also showed consistent growth in all areas, with the "All Growth" measure increasing from 47.4% in 2020–2021 to 58.4% in 2021–2022. The low-performing 25% group demonstrated remarkable growth, with a score of 51.9% in 2021–2022, which significantly increased to 81.8% in 2022–2023. These findings highlighted the positive impact of the MPLCs on student outcomes, particularly for low-performing students.
Table 17

*HPES Overall End of Year School Mathematics Data*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Proficiency</td>
<td>9.2</td>
<td>13.2</td>
<td>18.8</td>
</tr>
<tr>
<td>All growth</td>
<td>NT</td>
<td>47.4</td>
<td>58.4</td>
</tr>
<tr>
<td>Low performing 25%</td>
<td>NT</td>
<td>51.9</td>
<td>81.8</td>
</tr>
</tbody>
</table>

Note: NT - Baseline testing was used in the SY 2020-2021 to establish the following year’s growth expectations.

**Conclusion**

The changes in teachers' beliefs about teaching mathematics and student ability were reported through their participation in the PLCs. The teachers expressed a shift in their instructional practices and beliefs, which were reflected in their increased confidence, implementation of effective strategies, and a focus on student-centered approaches. Through their engagement in the MPLCs, the teachers developed a deeper understanding of effective instructional practices (e.g., the use of manipulatives, incorporating real-world problem solving, providing small group instruction, and using data to inform their instruction). These changes in instructional practices aligned with research-based strategies promoted student engagement, critical thinking, and conceptual understanding.

Moreover, the teachers’ beliefs about student ability also underwent a positive transformation. They demonstrated a heightened belief in their students’ potential and capacity to succeed in mathematics. This shift in belief contributed to a more supportive and empowering classroom environment, fostering a growth mindset and resilience among students. The findings of this applied research study highlighted the importance of MPLCs in promoting positive
changes in instructional practices and teachers’ beliefs about teaching mathematics and student ability. The data clearly demonstrated the effectiveness of these PLCs in improving student achievement, particularly among low-performing students.

The results of Chapter 4 emphasized the significance of ongoing professional development and collaboration among teachers in enhancing instructional practices and fostering a positive learning environment. The MPLCs provided a platform for teachers to exchange ideas, share resources, and engage in reflective discussions, leading to continuous growth and improvement. In Chapter 4, I also demonstrate the positive effects of MPLCs on instructional practices and teachers' beliefs about teaching mathematics and student ability. The improvements in student proficiency, growth, and performance highlight the effectiveness of these PLCs in promoting student success. The changes in instructional practices the teachers reported reflect their increased knowledge, confidence, and student-centered approaches. This research provides valuable insights for educators, policymakers, and stakeholders interested in enhancing mathematics instruction and improving student outcomes. Chapter 5 provides further recommendations for building the teachers’ capacity and details the limitations of the study.
CHAPTER 5: CONCLUSION

Introduction

The journey of this applied research study, in which I aimed at improving elementary teachers’ mathematical instruction by nurturing their content knowledge and skills, is brought to its conclusion in this final chapter. I focused the study on equipping the elementary education teachers at HPES with increased opportunities to enhance their proficiency in mathematics instruction. A comprehensive program evaluation was undertaken, commencing with an in-depth exploration of the existing literature on PLCs, professional development, efficacy, and quality instruction. The literature review analysis served as the foundation for enhancing teacher pedagogy and promoting student achievement.

The literature discussed in Chapter 2 served as a guiding force, shaping the development of the action plan presented in Chapter 3. In Chapter 3, the methodology of the study was explicated, detailing the action plan designed to address instructional practices. The action plan encompassed the use of MPLCs, targeted professional development initiatives, and a deliberate focus on altering teachers’ beliefs regarding how students learn mathematics. The chapter provided a comprehensive outline of the different elements comprising the program, namely PLCs, professional development, teacher efficacy, and instruction.

To assess the effectiveness of the program, a variety of tools were employed to evaluate these elements, including the analysis of student data, surveys, observations, learning walks, and interviews. In Chapter 3, I elucidated the selection and use of specific data collection tools to
answer each research question effectively. The entirety of the collected data was meticulously gathered, analyzed, and presented in Chapter 4.

Finally, Chapter 5 concludes with thoughtful inferences and a set of actionable recommendations using the study’s findings and results. These inferences, drawn from a thorough analysis of the data, served to consolidate the researcher’s understanding and expertise. With the recommendations, I aimed to provide valuable guidance for future endeavors in enhancing elementary mathematics instruction, promoting effective instructional strategies, and designing impactful professional development initiatives.

**Program Evaluation Standards**

To evaluate the implementation of this applied research program, several program evaluation standards were employed. These standards, according to Yarbrough et al. (2011), provided a framework for assessing the effectiveness and success of the program. The utility standard was used to focus on the relevance and usefulness of the program. I used it to assess whether the program met the needs of the participants and stakeholders and whether the findings and recommendations were applicable and actionable. The feasibility standard examined the practicality and sustainability of the program. I used it to consider the resources, time, and effort required for implementation, as well as the likelihood of continued success and long-term impact. The propriety standard encompassed ethical considerations and the appropriateness of the program. It ensured the program followed ethical guidelines, maintained participant confidentiality, and treated all individuals and data with respect and fairness. The accuracy standard was used to focus on the validity and reliability of the data collected and the evaluation methods used. It ensured the data was collected and analyzed using rigorous and reliable techniques, and the findings accurately reflected the program’s implementation and impact. According to Yarbrough et al. (2011), many factors must be taken into consideration to
determine how these standards can be applied to various situations. Incorporating these program evaluation standards ensured I was able to assess and evaluate systematically the applied research program regarding the implementation and impact of the program. The program evaluation standards ensured the quality and integrity of the evaluation process and provided a strong foundation for drawing conclusions and making recommendations according to the findings.

**Element 1: Mathematics Professional Learning Communities**

With the implementation of mathematics PLCs at HPES, I aimed to improve mathematical growth and proficiency by developing teachers’ pedagogy and enhancing their classroom practices. With the implementation of MPLCs at HPES, I aimed to address instructional challenges and to improve student learning outcomes (See Appendix J for PLC schedule). The addition of mathematics coaches and the establishment of a school-based mathematics PLC were important steps towards enhancing teachers’ pedagogy and content knowledge. However, I encountered certain limitations and challenges throughout the process.

I encountered the scheduling conflicts third-grade teachers experienced who were required to attend literacy professional development sessions often coinciding with mathematics PLCs. This hindered full participation in the mathematics activities by the third-grade teachers. Additionally, the transition of a first year, fifth-grade mathematics teacher who became the school physical education coach (transitioning in Fall 2021) resulted in a lack of collaboration opportunities for the fourth-grade teacher who looped to fifth grade with her students. The teacher who looped was also the sole mathematics instructor after the movement of the coach. During the 2021–2022, the fourth-grade teacher “looped up” with the students and the third-grade teachers “looped up” with their students. Additionally, in the 2022–2023 SY the fifth-grade teacher for the prior school year resigned to take a position closer to her hometown.
Therefore, one of the fourth-grade teachers “looped up” with the students for fifth-grade mathematics. Despite these challenges, both new and remaining teachers gained valuable content knowledge and classroom management strategies from the PLCs.

The survey data analysis revealed positive changes in teachers’ perceptions of the effectiveness of PLCs in addressing instructional challenges. Postsurvey results indicated improvements in areas such as collegial support, belief in every student's ability to learn, ease of speaking up within the PLC, and the impact of PLC time on daily instruction. The teachers appreciated the presence of protocols for analyzing student work and the emphasis on collaborative discussions. However, the desire for more time and resources highlighted areas for improvement in the PLC experience.

Although no statistically significant relationship was found between the number of professional development hours and student achievement, learning walks and observations indicated the MPLCs and professional development initiatives effectively addressed instructional challenges in classrooms. Teachers received commendations for implementing explicit instruction, providing practice opportunities, and offering feedback. Areas for improvement were identified (e.g., the increased use of memory aids/anchor charts and the enhancement of mathematics data walls) as part of the research activity.

To enhance the effectiveness of the MPLCs and professional development initiatives, ongoing support, collaboration, and monitoring are recommended. This includes providing dedicated time for PLC sessions, ensuring the availability of necessary resources, and incorporating technology to facilitate collaboration beyond physical constraints. Continuous improvement and meeting the instructional needs of teachers and students should remain a priority.
In conclusion, although challenges and limitations existed, the data suggested the MPLCs and professional development initiatives at HPES had a positive impact on addressing instructional challenges. The commitment to ongoing improvement, collaboration, and support will further strengthen the effectiveness of these initiatives in promoting HQMI and enhancing student learning outcomes.

**Element 2: Mathematics Professional Development**

The analysis of the MAAP data from the 2020–2021 academic year, along with the feedback and data obtained from the “Understanding Fractions” professional development provided valuable insights into the impact of specialized professional development on teachers’ instructional practices and resulting student achievement (See Appendix K, L, and M for MPD schedule). The findings indicated positive outcomes and areas for improvement.

Several components of the professional development worked well. The majority of teachers strongly agreed the professional development sessions met their expectations, indicating the content and strategies covered were relevant and useful for their classrooms. The teachers reported several beneficial learnings, including new ways to present fractions, understanding the underlying concepts, making connections with other mathematical concepts, effective use of manipulatives and tools, and deconstructing fractions visually. The teachers expressed their intention to apply what was learned by incorporating manipulatives, implementing new strategies, promoting hands-on learning, using models and tools, and emphasizing concrete understanding through manipulatives.

There were also limitations to the professional development. Some teachers felt the need for more time to deepen their understanding, particularly in multiplication of fractions. The teachers expressed interest in future sessions focused on measurement and data standards,
geometry, decimals, Base 10 and multiplication training, rounding, and division. One participant recommended ensuring the correct teaching of foundational fractions concepts in all grades.

In future professional development, the focus should take into consideration the following:

• Address the requested topics and expanding the professional development offerings to cover measurement and data standards, geometry, decimals, Base 10 and multiplication training, rounding, and division.

• Provide additional time for deepening understanding, particularly in areas where teachers expressed a need for more in-depth learning.

• Provide resources related to instructional routines, PowerPoint slides for word problems, instructional planning guides, and templates for small groups to further support teachers’ implementation of learned strategies.

• Encourage teachers to continue participating in PLCs and collaborative sessions to foster ongoing growth, sharing of best practices, and implementation of mathematical practices in the classroom.

In summary, the specialized professional development focused on fractions had a positive impact on teachers’ instructional practices. The teachers (a) demonstrated increased self-efficacy, (b) incorporated manipulatives, (c) engaged in regular practice, (d) improved student growth and proficiency, (e) facilitated understanding of word problems, (f) provided small group instruction, (g) used data-driven instruction, (h) held students accountable, (i) deepened their understanding of mathematical practices and fractions, and (j) used resources to support student learning. These findings highlighted the effectiveness of the professional development in enhancing teachers’ instructional practices and student achievement in fractions. Moving forward, addressing the
identified limitations and implementing the provided recommendations will further enhance the effectiveness and impact of professional development initiatives in mathematics instruction.

**Element 3: Mathematics Teacher Efficacy**

The findings from the survey responses provided valuable insights into teachers’ perspectives on various aspects of mathematics instruction and pedagogy. The participants’ views on teaching styles, instructional approaches, problem-solving methods, and student learning reflect a diverse range of beliefs and experiences. The analysis of the presurvey and postsurvey responses revealed shifts in the participants’ perspectives, indicating a potential evolution in their understanding and preferences for mathematics instruction.

Regarding teaching styles, the presurvey responses showed a tendency towards more traditional and teacher-centered approaches, emphasizing pacing, direct instruction, and reliance on textbooks. However, the postsurvey responses indicated a shift towards valuing student engagement, collaborative work, and open-ended questioning. This shift suggested participants recognized the importance of student-centered and inquiry-based approaches for promoting deeper understanding and critical thinking in mathematics.

In the survey, I also explored the participants’ beliefs about instructional practices. The shift toward valuing student reflection, problem solving, active engagement, and collaboration indicated an increasing recognition of the benefits of student-centered and interactive learning approaches. The participants acknowledged the importance of students actively participating in mathematical activities, discussing concepts, and working collaboratively to deepen the understanding of mathematical concepts.

Furthermore, participants recognized the value of exposing students to challenging mathematics problems, multiple problem-solving methods, and different ways of approaching mathematical problems. An increasing agreement was occurring to expose students to novel and
diverse problems could foster a deeper understanding and critical thinking skills. However, concerns about overwhelming students and the need for a gradual introduction of different problem-solving methods were also voiced. The findings highlight the influence of factors such as district policies, curriculum guidelines, professional development opportunities, and personal teaching experiences on teachers’ beliefs and instructional practices. The diversity of perspectives indicated the complex nature of mathematics instruction and the need for a balanced approach considering the individual needs and preferences of students.

The study had limitations, including a relatively small sample size and the reliance on self-reported survey responses. Therefore, the findings might not be generalizable to all contexts and populations. Additionally, the survey did not capture the full range of teaching practices and instructional strategies existing in mathematics education.

**Literature Connection**

According to research by Hammer, P. C. (2013), five practices are effective when conducting professional development: content focus, coherence, active learning, collective participation, and sufficient duration and timespan. Content focus includes deepening teachers’ knowledge of the subject matter they are teaching and the pedagogical approaches which are successful in helping students learn that subject matter. Cohen & Hill (1998) found an alignment among tests, policy, curriculum, and “when curriculum for improving teaching overlaps with curriculum and assessment for students, teaching practice and student performance are likely to improve.” However, the study also found “Policies that do not meet these conditions—new assessments or curricula that do not offer teachers adequate opportunities to learn, or professional development that is not grounded in academic content—are less likely to have constructive effects” (p. 33).
Recommendations

To address the challenges faced during the implementation of mathematics PLCs, I recommend carefully considering scheduling conflicts and ensuring all teachers would have the opportunity to fully participate in mathematics PD activities. This recommendation might involve coordinating with other professional development sessions and providing alternative time slots for people who face scheduling conflicts. Additionally, it will be important to establish collaborative opportunities for all mathematics teachers, even in situations where teachers might transition to other roles or grade levels. Ongoing support, collaboration, and monitoring should be prioritized to improve continuously the effectiveness of the PLCs and to meet the instructional needs of teachers and students.

The specialized professional development had a positive impact on teachers’ instructional practices and student achievement; therefore, I recommend future professional development sessions focused on the requested topics (e.g., measurement and data standards, geometry, decimals, Base 10 and multiplication training, rounding, and division). I also recommend providing additional time for deepening understanding in specific areas and offering resources related to instructional routines, PowerPoint slides for word problems, instructional planning guides, and templates for small groups can further support teachers’ implementation of learned strategies. I further recommend encouraging teachers to continue to participate in PLCs and collaborative sessions which can foster ongoing growth, sharing of best practices, and implementation of mathematical practices in the classroom.

The shift in participants’ perspectives toward student-centered and inquiry-based approaches indicated the importance of ongoing professional development to support teachers in implementing these instructional approaches. Therefore, I recommend training on effective questioning techniques, collaborative learning strategies, and the integration of problem-solving
tasks into the curriculum should be provided. Additionally, the curriculum materials should strike a balance between skill development and open-ended problem solving, allowing teachers to support both procedural fluency and conceptual understanding. I further recommend creating a supportive environment encourages collaboration, reflection, and the sharing of best practices among teachers is essential. Finally, the establishment of mathematics PLCs should be continued to provide opportunities for teachers to collaborate, discuss student work, analyze data, and share effective instructional strategies.

If this applied research study was conducted again, the sample size would be larger. PDs and PLCs would be tailored to provide differentiated professional development sessions and PLC activities to meet the individual needs of teachers. Some teachers may be at different stages of their professional growth and may require specific support and resources to improve their teaching practices effectively.

**Conclusion**

In conclusion, the implementation of mathematics PLCs, specialized professional development, and the exploration of teachers’ perspectives on mathematics instruction provide valuable insights into enhancing mathematics education at HPES. Despite challenges and limitations, the data suggested these initiatives had a positive impact on addressing instructional challenges, improving instructional practices, and promoting student learning outcomes. To strengthen the further effectiveness and impact of these initiatives ongoing support, collaboration, and monitoring should be prioritized. This recommendation includes providing dedicated time for PLC sessions, ensuring the availability of necessary resources, incorporating technology to facilitate collaboration, and continuing to meet the instructional needs of teachers and students. By implementing these recommendations, HPES can continue to promote HQMI and enhance student achievement in mathematics.
LIST OF REFERENCES
REFERENCES


doi.org/10.1177/2372732215623554


https://drive.google.com/file/d/0ByxuG44OvRLPemJWbTVEbHBTSDA/view?resourcekey=0-NdTfX5s8jk6h5kHdNp5HBA

*Contemporary Educational Psychology, 34*(1), 67–76. 

doi.org/10.1016/j.cedpsych.2008.08.001


doi.org/10.1016/j.edurev.2014.06.001


Cambridge University Press.


National Council of Teachers of Mathematics. (2014). *Principles to actions: Ensuring mathematical success for all*. NCTM.


https://www.researchgate.net/publication/299041494_Designing_professional_development_that_works


behavior. *Teaching and Teacher Education, 16*(5–6), 649–659. doi.org/10.1016/s0742-051x(00)00012-3


development formats and their relationship to self-efficacy and implementation of a new
doi.org/10.1086/605771

success: The final report of the National Mathematics Advisory Panel*. USDOE.

*ESEA blueprint for reform*. USDOE.

doi.org/10.1007/s10972-013-9363-y

learning communities on teaching practice and student learning. *Teaching and Teacher
Education, 24*(1), 80–91. doi.org/10.1016/j.tate.2007.01.004

Walsh, K. (2016, December 8). *NCTQ’s teacher prep review paints a landscape of
https://www.nctq.org/blog/NCTQs-Teacher-Prep-Review-Paints-a-Landscape-of-
Undergraduate-Elementary-Teacher-Preparation

*Professional learning in the learning profession: A status report on teacher development

California Learning Assessment System (CLAS). *Educational Evaluation and Policy
Analysis, 17*(3), 355–370. doi.org/10.3102/01623737017003355


APPENDICES

APPENDIX A:

LEARNING WALK SCHEDULE 2021–2022

<table>
<thead>
<tr>
<th>Date</th>
<th>Walkthroughs With Susan Adams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept. 16</td>
<td>K–5 Mathematics Monthly Focus Walkthroughs</td>
</tr>
<tr>
<td>Sept 28</td>
<td>Susan Adam Walkthrough</td>
</tr>
<tr>
<td></td>
<td>District and School Level Teams</td>
</tr>
<tr>
<td>Sept 30</td>
<td>Learning Walks Debrief</td>
</tr>
<tr>
<td>Oct 27</td>
<td>Susan Adams Walkthrough</td>
</tr>
<tr>
<td></td>
<td>District and School Level Teams</td>
</tr>
<tr>
<td>Nov 3</td>
<td>Susan Adams Walkthrough</td>
</tr>
<tr>
<td></td>
<td>District and School Level Teams</td>
</tr>
<tr>
<td>Nov 9</td>
<td>Susan Adams Walkthrough Debrief</td>
</tr>
<tr>
<td>Nov 29</td>
<td>Susan Adam PLC Observation</td>
</tr>
<tr>
<td>Dec 4</td>
<td>Susan Adam Walkthrough</td>
</tr>
<tr>
<td></td>
<td>District and School Level Teams</td>
</tr>
<tr>
<td>Jan 31</td>
<td>Susan Adam Walkthrough</td>
</tr>
<tr>
<td></td>
<td>District and School Level Teams</td>
</tr>
<tr>
<td>Feb. 2</td>
<td>Susan Adam Walkthrough</td>
</tr>
<tr>
<td></td>
<td>District and School Level Teams</td>
</tr>
<tr>
<td>March 2</td>
<td>Susan Adam Walkthrough</td>
</tr>
<tr>
<td></td>
<td>District and School Level Teams</td>
</tr>
<tr>
<td>April 5</td>
<td>Susan Adam Walkthrough</td>
</tr>
<tr>
<td></td>
<td>District and School Level Teams</td>
</tr>
<tr>
<td>June 10</td>
<td>Susan Adams System Review</td>
</tr>
<tr>
<td></td>
<td>District Team, Principals, and Assistant Principals</td>
</tr>
<tr>
<td>Date</td>
<td>Walkthroughs w/ Susan Adams 2022–2023</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>June 6</td>
<td>Susan Adams System Review 8:30 – 11:30 – Elementary Administrators District Team, Principals &amp; Assistant Principals</td>
</tr>
<tr>
<td>June 10</td>
<td>Susan Adams System Review 10:00 – 12:00 – Elementary Administrators District Team, Principals &amp; Assistant Principals</td>
</tr>
<tr>
<td>Sept 1</td>
<td>Monthly Focus Walkthrough with Susan Adam District Team, Special Education Department &amp; Principals Time: 8:00</td>
</tr>
<tr>
<td>Sept 28</td>
<td>Monthly Focus Walkthrough with Susan Adam District Team, Special Education Department &amp; Principals Time: 8:00</td>
</tr>
<tr>
<td>Oct 28</td>
<td>Monthly Focus Walkthrough with Susan Adam District Team, Special Education Department &amp; Principals Time: 8:00</td>
</tr>
<tr>
<td>Nov 29</td>
<td>Monthly Focus Walkthrough with Susan Adam District Team, Special Education Department &amp; Principals Time: 8:00</td>
</tr>
<tr>
<td>Dec 2</td>
<td>Monthly Focus Walkthrough with Susan Adam District Team, Special Education Department, and Principals Time: 8:00</td>
</tr>
</tbody>
</table>


APPENDIX B:

MATHEMATICS MONTHLY FOCUS

### Mathematics Monthly Focus – Fall 2021/2022

<table>
<thead>
<tr>
<th>PLC Focus</th>
<th>End of Month Learning Walk Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>August</strong></td>
<td><strong>End of Month Learning Walk Focus</strong></td>
</tr>
<tr>
<td>- Expectations – planning, (1.1)</td>
<td>- Instructional model</td>
</tr>
<tr>
<td>- Classroom management (3.5 &amp; 6)</td>
<td>- Classroom management</td>
</tr>
<tr>
<td>- Instructional model (1.1)</td>
<td>- M20 interventions</td>
</tr>
<tr>
<td>- Teacher use of technology, specifically promethean board (3.6)</td>
<td>- Imagine mathematics fluency</td>
</tr>
<tr>
<td>- Screening and assessment plans (1.2)</td>
<td>- Teacher use of technology</td>
</tr>
<tr>
<td>- M20-day response (1.2)</td>
<td></td>
</tr>
<tr>
<td>- Imagine mathematics fluency</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>September</strong></th>
<th><strong>End of Month Learning Walk Focus</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Use of programs (1.1)</td>
<td>- Use of programs</td>
</tr>
<tr>
<td>- Instructional routines (1.1)</td>
<td>- Instructional model</td>
</tr>
<tr>
<td>- Classroom management (3.7)</td>
<td>- Classroom management</td>
</tr>
<tr>
<td>- Lesson plans (1.7)</td>
<td>- Lesson plans</td>
</tr>
<tr>
<td>- Teacher use of technology (3.6)</td>
<td>- Teacher use of technology</td>
</tr>
<tr>
<td>- Tier documentation (1.2)</td>
<td>- Tier documentation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>October</strong></th>
<th><strong>End of Month Learning Walk Focus</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Student engagement (3.5)</td>
<td>- Student engagement</td>
</tr>
<tr>
<td>- Use of assessment data</td>
<td>- Use of assessment data</td>
</tr>
<tr>
<td>- Small group instruction/data-based teacher table (includes fluency (1.2))</td>
<td>- Small group instruction/data-based teacher table (includes fluency)</td>
</tr>
<tr>
<td>- Anchor charts (1.2)</td>
<td>- Student work samples</td>
</tr>
<tr>
<td>- Student use of technology (1.2, 2.3)</td>
<td>- Anchor charts</td>
</tr>
<tr>
<td>- Tier documentation, including student work (1.2)</td>
<td>- Student use of technology</td>
</tr>
<tr>
<td></td>
<td>- Tier documentation, including student work</td>
</tr>
<tr>
<td></td>
<td>- Tier documentation, including student work</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>November</strong></th>
<th><strong>End of Month Learning Walk Focus</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Effective use of VCSD HQIM (planning support tool) (1.1)</td>
<td>- Effective use of VCSD HQIM (planning support tool)</td>
</tr>
<tr>
<td>- Data walls (1.2)</td>
<td>- Data walls</td>
</tr>
<tr>
<td>- Data chats (2.3)</td>
<td>- Data chats</td>
</tr>
<tr>
<td>- District data analysis template (1.2)</td>
<td>- District data analysis template</td>
</tr>
<tr>
<td>- Tier documentation (1.2)</td>
<td>- Tier documentation</td>
</tr>
</tbody>
</table>

*Note. HQIM = high-quality instructional materials; VCSD = VCSD – Vitality Collective School District.*

126
APPENDIX C:

TEACHER PROFESSIONAL LEARNING COMMUNITY SURVEY

1. I have a trusted colleague to whom I can reach out for support when needed.

2. Teachers in my school believe every student can learn.

3. In my PLC, it is easy to speak up about what is on my mind.

4. If I make a mistake in my PLC, it will not be held against me.

5. How impactful is the time in your PLC to improve your daily instruction?

6. In my PLC, we analyze student work to inform instruction.

7. My PLC uses a protocol to analyze student work.

8. The protocol used in my PLC to analyze student work requires the creation of an exemplar.

9. The protocol used in my PLC to analyze student work requires that time be spent reading and discussing the student work as a group.

10. The protocol used in my PLC to analyze student work enables all teachers to contribute, even when it is not their students’ work.

11. The protocol used in my PLC to analyze student work enables us to determine the specific next steps for improving student mastery.

12. What are one or two things that work well within your current PLC experience?

13. What are one or two things that you wish were present in your current PLC experience?
APPENDIX D:

TEACHER BELIEFS SURVEY

Please write your name in the space below. Your name will ONLY be used to pair your answers to this survey with those from a survey taken at the end of the project. After the pre- and post-surveys are paired, this sheet containing your name will be torn from this survey packet.

Name: ___________________________________________________________
Part I

On the following pages are five brief descriptions of teachers and teaching styles. Please take a few moments to reflect on them and answer the questions that follow.

a. According to the pacing guide, the teacher selects the content and quantity of the work that students perform. Students follow the pace set by the teacher and respond to his/her rhythm, cues, and questions. This teacher explains concepts, demonstrates problems, and allows students ample time to practice skills. There is time built in for students to ask questions as they arise. The teacher checks for understanding by asking guided questions as s/he presents the lesson. The district-adopted textbook is the primary resource for activities and homework. Assessment typically occurs in the form of quizzes throughout the unit and a formal test at the end, with a set of problems similar to what was demonstrated and practiced during the unit.

b. According to the pacing guide, the teacher selects the subject matter, the quantity, and the time limits so that students can practice following explanation and demonstration by the teacher. The teacher circulates among students and offers private feedback to each student about performance on assignments. Often, students are asked to solve workbook, homework, or textbook problems on the board. Once or twice per semester, students engage in projects that offer authentic application of concepts and skills, which count toward grades. Other assessments happen in the form of quizzes during the unit and tests at the end of a unit. Tests include objective items and word problems similar to what was demonstrated and practiced during the unit.

c. The teacher selects the subject matter, activities, and timeline according to the pacing guide. For each mathematics topic, the teacher introduces the concept from the adopted textbook using a variety of instructional strategies and may or may not demonstrate examples. S/he uses open-ended questions to involve students in whole-group discussion, and then presents parameters for students to work on a problem with a partner or group. The teacher circulates the classroom to offer suggestions, ask questions, guide thinking, and give feedback. Students present their work back to the whole group, and the teacher fills in any gaps in understanding. Assessment is ongoing and tests include some objective items and some word problems.

d. The teacher designs or selects a set of situations or questions related to principles, rules, concepts, and relationships in mathematics. The situations and/or questions are logically sequenced so that the answers lead students step by step toward discovery of the idea. Students sometimes work alone, in groups, or in pairs and are free to use whatever methodology and tools they deem appropriate to solve the problem. The teacher circulates the room to probe for understanding and ask questions to stimulate thinking and brings students back together as a whole group to process what they found. Although students use the adopted textbook as a resource, it is not the primary source of lessons or student assignments. A combination of performance assessment tasks, objective tests, and portfolios are used to assess student learning.
e. The teacher designs or selects a series of problems or situations related to principles, rules, concepts, and relationships in mathematics that grow from students’ questions and comments. Problems posed are always new to students, always open-ended, usually necessitate some form of collaboration, and typically take at least half an hour to solve. The teacher seeks multiple solution paths to the same problem. Students work flexibly in groups, pairs, and individually. They present solutions in a variety of ways and explain and justify their thinking to their peers. The teacher and students use the adopted textbook only as a reference. Students play an important role in setting performance criteria. Performance assessment and portfolios are used exclusively to assess progress, and feedback is provided by way of rubrics and teacher comments.

1. Which one of these teachers most closely resembles you? What are the similarities?

2. Which one is most different? What are the differences?

3. Which of the scenarios do you think is the most beneficial for student learning? Why?

4. Which one of these do you see most often in your own school and which one the least? Why do you think that is?
Part II

For each box below, please choose the one statement that best describes your beliefs.

_____ Students should first be taught a set of skills in mathematics before being presented a complex problem.

OR

_____ Presenting a complex problem first to students motivates them to learn the skills necessary to solve the problem.

_____ Students learn mathematical concepts best by being asked to reflect on their own thinking and problem solving before working with the teacher.

OR

_____ Students learn mathematical concepts best by having a teacher show them multiple examples before working on their own.

_____ Students understand more mathematics by listening, watching, and following the teacher until they master the big idea.

OR

_____ Students understand more mathematics by doing and discussing mathematics with each other until they master the big idea.

_____ There is usually one “best” way to solve a mathematics problem.

OR

_____ There are usually many equally good ways to solve a mathematics problem.

_____ Students best understand and can apply mathematics concepts when practice is embedded in reinforcement through repetition and feedback.

OR

_____ Students best understand and can apply mathematics concepts when practice is embedded in open-ended questioning and problem solving.
Students should be given an opportunity to work with challenging mathematics problems they have not been exposed to previously.

OR

Students should be given an opportunity to work with challenging mathematics problems as long as they have seen similar problems previously.

Being exposed to several methods for solving a problem will confuse or overwhelm students.

OR

Being exposed to multiple ways of solving a mathematics problem will deepen students’ understanding.

Classroom instruction should emphasize the use of student-discovered strategies for solving mathematics problems.

OR

Classroom instruction should emphasize the use of traditional algorithms for solving mathematics problems.
APPENDIX E:

HIGH POINT ELEMENTARY SCHOOL ACTION PLAN

---

**HPES Action Plan 2021–2022**

*Using the 2021 MAAP Mathematics results, the overall student mathematics proficiency at HPES is 9.2%.*

- These are the elements that this applied research program will stagger to give the teachers time to process the information and implement it in their classroom pedagogy.

### Implementation of each element (month and year)?

**A. Instructional Practices** – Weekly in professional learning community (PLC) meetings beginning August 2021

  a) PLCs will occur each weekly starting August 2021 – Ongoing

  b) Professional development on the Mississippi Department Education Professional Growth Rubric Domain II Student Understanding will occur August 2021 – Ongoing

  c) Data meetings to analyze data and using it to drive instruct will be held biweekly.

**B. Mathematics Professional Development**

  a) Book Study

    I. Five practices for orchestration productive mathematics discussions – September 2021

    II. Teaching mathematics in the visible classroom September 2022

  b) Limited Session Professional Development

    I. Fraction Institute 2-day professional development provided by the University of Mississippi Center for Mathematics and Science Education – October 2021

    II. Hands on Math CPA for conceptual understanding offered through MDE – January 2022

    III. Let’s Talk Math: Promoting meaningful discourse in the mathematics classroom offered through MDE – October 2022

  c) Instructional Leader Lead

    I. Three-Act Task Instructional Model – November 2021

    II. High leverage practices – February 2022

- The DiP portion of the applied research program will end December 2022 and the formal evaluation to begin January 2023.
Elements and Sub-elements:

A. Professional Learning Communities
   a. Essentials of PLCS
   b. Focus on Mississippi Department Education Professional Growth Domain II
      Student Understanding
   c. Analyze Data to Drive Instruction

B. Mathematical Professional Development
   a. Book Study
      i. 5 Practices for Orchestrating Productive Mathematics Discussions
      ii. Teaching Mathematics in the Visible Learning Classroom
   b. Professional Development
      i. Fraction Institute – The University of Mississippi Center for
         Mathematics and Science Education
      ii. Hands on Math CPA for Conceptual Understanding – Mississippi
         Department Education
      iii. Let’s Talk Math: Promoting Meaningful Discourse in the Math
         Classroom – Mississippi Department Education
      iv. Tasks That Teach: Building Mathematics Understanding through
         Problem Solving – Mississippi Department Education
   c. Instructional Leader Lead Professional Development
      i. 3 ACT Task Instructional Models for Mathematics Teaching Process
      ii. High Leverage Practices

Data and other information used to develop the details of each element.

- Focus Group One grades 3–5 Teachers MAAP data (2020–2021, 2021–2022)
- Common Assessment data (2020–2022)
- PLC Surveys
- Interviews

<table>
<thead>
<tr>
<th>Element</th>
<th>Date to determine details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 PLCs</td>
<td>Initial planning beginning of August 2021</td>
</tr>
<tr>
<td>1A Essentials of PLCs</td>
<td>August 2021</td>
</tr>
<tr>
<td>1B Domain II Student Learning</td>
<td>September 2021</td>
</tr>
<tr>
<td>1C Analyze Data to Drive Instruction</td>
<td>October 2021</td>
</tr>
<tr>
<td>2 Professional Development</td>
<td>Initial planning beginning of July 2021</td>
</tr>
<tr>
<td>2A Book Study</td>
<td>August 2021</td>
</tr>
<tr>
<td>2B Professional Development</td>
<td>September 2021</td>
</tr>
<tr>
<td>2C Instructional Leader Lead</td>
<td>October 2021</td>
</tr>
<tr>
<td>Professional Development</td>
<td></td>
</tr>
</tbody>
</table>

Stakeholders will be involved in each item in the schedule for each element.

PLC discourse
The responsibility for implementing each element and on what level (building, classroom, individual student)?

Each element will be implemented at the building level. I will coordinate the mathematics focused PLCs and gradually release ownership to the teachers, I will plan the initial professional development and add more based on teacher feedback and needs based on assessments.

<table>
<thead>
<tr>
<th>Element</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Professional learning communities</td>
<td>40 minutes per session</td>
</tr>
<tr>
<td>1A Essentials of PLCs</td>
<td>40 minutes per session</td>
</tr>
<tr>
<td>1B Domain II Student learning</td>
<td>40 minutes per session</td>
</tr>
<tr>
<td>1C Analyze data to drive instruction</td>
<td>40 minutes in biweekly PLCs</td>
</tr>
<tr>
<td>2 Professional development</td>
<td>TBD</td>
</tr>
<tr>
<td>2A Book study</td>
<td>Five 40-minute sessions per book</td>
</tr>
<tr>
<td>2B Professional development</td>
<td>40 hours total</td>
</tr>
<tr>
<td>2C Instructional leader lead professional development</td>
<td>40 minutes per session</td>
</tr>
</tbody>
</table>

All of the PLC time and the professional development listed is unique to the applied research program because High Point Elementary School has prioritized time to focus on literacy, not mathematics.
APPENDIX F:

PERMISSION TO PRACTICE ACTION RESEARCH

April 27, 2021

Hello Dr. C.,

I am writing this note to request your permission to write my dissertation in practice using teachers and data from HPES. I've spent the first year observing the needs of the teachers and students at HPES. I have begun to design my research around teacher efficacy and mathematical growth.

The title of my dissertation is:
Increasing mathematical proficiency and growth through focus data driven professional development.

Please respond with your consent for me to put the research into practice and continue to study this area with the teachers at HPES.

Superintendent Response

April 28, 2021

Hello Ms. Cullen,

Yes, I approve of your request to conduct your dissertation study at HPES. I can’t wait to review the outcomes of your research. Best wishes and please don’t hesitate to contact me if I can be of further assistance.
APPENDIX G:

TEACHER EFFICACY INTERVIEW QUESTIONS

1. Tell me a little bit about yourself.
2. How long have you been teaching?
3. Tell me about a memory you have of your favorite teacher.
4. When and how did you decide that you would be a teacher?
5. If you had to do it all over again, what would you do differently when choosing and preparing for your teaching career?
6. Describe a time so far this year when you were teaching that a student had an “aha” moment.
7. How would you describe your teaching philosophy?
8. Tell me about how you feel that you are making a difference in your students’ achievement?
9. How do you think your teaching skills match your job expectations?
10. What parts of teaching do you find challenging?
11. In what areas do you feel that you were not prepared in your teacher training?
12. How do you know when you’re being a successful teacher?
13. How would you characterize yourself as a team player?
14. What activities have you encountered so far that require you to collaborate with your team?
15. How does lesson planning affect your teaching?
16. What percentage of your students would you guess are failing to meet the standards?
17. Do you agree with the idea that all students can learn?
18. How do you feel emotionally after a successful lesson?
19. How do you feel when you realize that the lesson was not successful?
20. What do you do when you feel that the lesson was not successful?
21. What about your colleagues? Do you ask them for help?
22. Describe what gives you the most stress in your job as a teacher.
23. How would you describe the phrase, “Caring for your students”?

24. What are the things that so far have given you the most pride as a teacher?

25. How would you characterize a teacher’s ability and desire to collaborate with you?

26. Why is collaboration important?

27. What about your school gives you the most pride?

28. Can you describe your school’s mission statement?

29. How does your principal support teachers and the school?
APPENDIX H:

BOOK STUDY SCHEDULE AND DISCUSSION TOPICS

**Five Practices for Orchestrating Mathematics Discussions:**
Tentative Book Study Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Reading and Discussing Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept. 28</td>
<td>Introduction p. 1–7</td>
</tr>
<tr>
<td>Oct. 5</td>
<td>Chapter 1: Introducing the Five Practices p. 9–15</td>
</tr>
<tr>
<td>Oct. 19</td>
<td>Chapter 2: Laying the Groundwork: Setting Goals and Selecting Task p. 17–27</td>
</tr>
<tr>
<td>Nov. 2</td>
<td>Chapter 4: Getting Started: Anticipating Students’ Responses and Monitoring Their Work</td>
</tr>
<tr>
<td>Nov. 9</td>
<td>Chapter 5: Determining the Direction of the Discussion: Selecting, Sequencing, and Connecting Students’ Responses</td>
</tr>
<tr>
<td>Nov. 15</td>
<td>Chapter 6: Ensuring Active Thinking and Participation: Asking Good Questions and Holding Students Accountable</td>
</tr>
<tr>
<td>Nov. 29</td>
<td>Chapter 7: Putting the Five Practices in a Broader Context of Lesson Planning</td>
</tr>
<tr>
<td>Dec. 7</td>
<td>Chapter 8: Working in the School Environment to Improve Classroom Discussions</td>
</tr>
<tr>
<td>Dec. 14</td>
<td>Chapter 9: The Five Practices Learned and Potential Benefits</td>
</tr>
<tr>
<td>Sentence and phrase</td>
<td>Connect</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------</td>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>Is there a quote from this chapter that is meaningful, engaging, or thought provoking to you?</td>
<td>How do these ideas connect to what you already know?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Extend</th>
<th>Challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td>What new ideas extend or push your thinking in a new direction?</td>
<td>What is now a challenge for you? What will you try?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Insight</th>
</tr>
</thead>
<tbody>
<tr>
<td>After reading this chapter I wonder……..</td>
</tr>
</tbody>
</table>
Five Practices for Orchestrating Mathematics Discussions:
Chapter and Pages to Read

Sign-In Date:

<table>
<thead>
<tr>
<th>Names</th>
<th>Signatures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX I:

PROFESSIONAL DEVELOPMENT SURVEY

### Post-Session Evaluation

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 4 3 2 1</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**Please circle**

<table>
<thead>
<tr>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall, this session met my expectations.</td>
</tr>
<tr>
<td>1. Fantastic</td>
</tr>
<tr>
<td>There was a sufficient amount of time to learn new concepts and strategies.</td>
</tr>
<tr>
<td>6 3</td>
</tr>
<tr>
<td>The atmosphere was enthusiastic, interesting, and conducive to professional growth.</td>
</tr>
<tr>
<td>7 2</td>
</tr>
<tr>
<td>The session content and strategies will be useful in my classroom/work.</td>
</tr>
<tr>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>The facilities were comfortable.</td>
</tr>
<tr>
<td>7 2</td>
</tr>
<tr>
<td>Communication prior to the session was timely and informative.</td>
</tr>
<tr>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>I will recommend this session to a colleague.</td>
</tr>
<tr>
<td>8 (1N/A)</td>
</tr>
</tbody>
</table>

For research and grant reporting purposes, please respond:

- Female - 8
- Male - 1
- Ethnicity: Asian or Asian American - 6
- Black or African American - 6
- Caucasian/White - 3
- Hispanic or Latino

**What is the most beneficial thing you learned today?**

1. New ways to present fractions.
2. It was very beneficial learning the ‘why’ of how factions should be explained, taught, and explored.
3. How to build knowledge in connection with not only fractions but multiplication, division, addition, and subtraction.
5. How to use all the tools.
6. How to use the manipulatives.
7. I learned how to relate my standards to things my students should have learned in previous years. Ways to let them do more work.
8. The strategies of teaching fractions.
9. How to deconstruct fractions for students to get a better understanding visually.
APPENDIX J:

PROFESSIONAL LEARNING COMMUNITY SCHEDULE

<table>
<thead>
<tr>
<th>Mathematics Specialist – Schedule for PLCs with Teachers @ HPES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
</tr>
<tr>
<td>------</td>
</tr>
</tbody>
</table>
| 8:00–9:00 | 8:15–9:00  
Kindergarten  
HPES |
| 9:00–10:00 | 9:05–9:50  
Second grade  
HPES |
| 10:00–11:00 | 9:55–10:40  
First grade  
HPES |
| 11:00–12:00 | 10:45–11:30  
Fourth grade  
HPES |
| 12:00–1:00 | 11:35–12:20  
Fifth grade  
HPES |
| 1:00–2:00 | 12:25–1:10  
Third grade  
HPES |
| 2:00–3:00 |

*Note.* HPES = High Point Elementary School
APPENDIX K:

**WEDNESDAY PROFESSIONAL DEVELOPMENT SCHEDULE**

**09/22/21**

<table>
<thead>
<tr>
<th>Grade level</th>
<th>Training</th>
<th>Facilitator</th>
<th>Training location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fourth &amp; fifth grade</td>
<td>Team building</td>
<td>Elementary instructional coach</td>
<td>HWES</td>
</tr>
<tr>
<td></td>
<td>Structure of the block</td>
<td>Elementary specialist</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Program implementation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vetted materials–classroom support tool</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Assessment guidance</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time: 2:30–4:00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. HWES = Hunter Wood Elementary School.*

**09/29/21**

<table>
<thead>
<tr>
<th>Grade level</th>
<th>Training</th>
<th>Facilitator</th>
<th>Training location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third grade</td>
<td>Team building</td>
<td>Elementary specialist</td>
<td>HWES</td>
</tr>
<tr>
<td></td>
<td>Structure of the block</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Program implementation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vetted materials–classroom support tool</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Assessment guidance</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time: 2:30–4:00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Fourth & fifth grade | Formative assessments                                          | Elementary instructional coach | HPES               |
|                      | Teacher table                                                  |                              |                   |
|                      | Centers                                                        |                              |                   |
|                      | Time: 2:30–4:00                                                 |                              |                   |

| Fourth & fifth grade | Formative assessments                                          | Elementary instructional coach | HPES               |
|                      | Teacher table                                                  |                              |                   |
|                      | Centers                                                        |                              |                   |
|                      | Train the trainer                                              |                              |                   |
|                      | Grading expectations                                           |                              |                   |
|                      | Grading conventions                                            |                              |                   |
|                      | Time: 3:00–4:30                                                 |                              |                   |

*Note. HPES = High Point Elementary School; HWES = Hunter Wood Elementary School.*
<table>
<thead>
<tr>
<th>Grade level</th>
<th>Training</th>
<th>Facilitator</th>
<th>Training location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fourth &amp; fifth grade</td>
<td>Creating mathematics centers</td>
<td>Elementary instructional coach</td>
<td>UHES</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elementary specialist</td>
<td></td>
</tr>
</tbody>
</table>

*Note. UHES = Union Heights Elementary School.*

<table>
<thead>
<tr>
<th>Grade level</th>
<th>Training</th>
<th>Facilitator</th>
<th>Training location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second &amp; third grade</td>
<td>Teacher table training</td>
<td>MDE trainer</td>
<td>WCES</td>
</tr>
<tr>
<td></td>
<td>Time: 2:30–4:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fourth &amp; fifth grade</td>
<td>Teacher Table Training</td>
<td>MDE trainer</td>
<td>HWES</td>
</tr>
<tr>
<td></td>
<td>Time: 2:30–4:00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. HWES = Hunter Wood Elementary School; WCES = Wesley Chapel Elementary School; MDE = Mississippi Department of Education.*

<table>
<thead>
<tr>
<th>Grade level</th>
<th>Training</th>
<th>Facilitator</th>
<th>Training location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fifth grade</td>
<td>Centers and teacher table</td>
<td>Elementary instructional coach</td>
<td>UHES</td>
</tr>
<tr>
<td></td>
<td>Time: 2:00–3:30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. UHES = Union Heights Elementary School.*

<table>
<thead>
<tr>
<th>Grade level</th>
<th>Training</th>
<th>Facilitator</th>
<th>Training location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third, fourth, &amp; fifth grade</td>
<td>Love what you do… Freckle can help!</td>
<td>Elementary specialist</td>
<td>WCES</td>
</tr>
<tr>
<td></td>
<td>Time: 2:30–4:00</td>
<td>Elementary instructional coach</td>
<td></td>
</tr>
</tbody>
</table>

*Note. WCES = Wesley Chapel Elementary School*
<table>
<thead>
<tr>
<th>Grade level</th>
<th>Training</th>
<th>Facilitator</th>
<th>Training location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third grade</td>
<td>Data are in… Now what?</td>
<td>Elementary mathematics instructional coach</td>
<td>HWES 2:30–4:00 p.m.</td>
</tr>
<tr>
<td>Fourth grade</td>
<td>Data are in… Now what?</td>
<td>Elementary mathematics instructional coach</td>
<td>UHES 2:30–4:00 p.m.</td>
</tr>
<tr>
<td>Fifth grade</td>
<td>Data are in… Now what?</td>
<td>Elementary mathematics specialist</td>
<td>HPES 2:30–4:00 p.m.</td>
</tr>
</tbody>
</table>

*Note. HWES = Hunter Wood Elementary School; UHES = Union Heights Elementary School; HPES = High Point Elementary School.*

<table>
<thead>
<tr>
<th>Grade level</th>
<th>Training</th>
<th>Facilitator</th>
<th>Training location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fourth grade</td>
<td>Falling into NF1 and NF2</td>
<td>Elementary mathematics instructional coach</td>
<td>HWES 2:30–4:00</td>
</tr>
<tr>
<td>Fifth grade</td>
<td>Falling into NF1 and NF2</td>
<td>Elementary mathematics specialist</td>
<td>HPES 2:30–4:00</td>
</tr>
</tbody>
</table>

*Note. HPES = High Point Elementary School; HWES = Hunter Wood Elementary School.*

<table>
<thead>
<tr>
<th>Grade level</th>
<th>Training</th>
<th>Facilitator</th>
<th>Training location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fifth grade</td>
<td>Small group instruction Focus: teacher table (2:30–4:00)</td>
<td>Elementary mathematics specialist</td>
<td>LPES 2:30–4:00</td>
</tr>
</tbody>
</table>

*Note. LPES = Lincoln Park Elementary School.*

<table>
<thead>
<tr>
<th>Grade level</th>
<th>Training</th>
<th>Facilitator</th>
<th>Training location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fourth grade</td>
<td>Fourth-grade MPD *teachers need to bring their Benchmark 1 item analysis</td>
<td>Elementary mathematics instructional coach</td>
<td>UHES 2:30–4:00 p.m.</td>
</tr>
<tr>
<td>Grade level</td>
<td>Training</td>
<td>Facilitator</td>
<td>Training location</td>
</tr>
<tr>
<td>-------------</td>
<td>---------------------------</td>
<td>------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Fifth grade</td>
<td>Fifth-grade MPD</td>
<td>Elementary mathematics specialist</td>
<td>UHES</td>
</tr>
<tr>
<td></td>
<td>*teachers need to bring their Benchmark 1 item analysis</td>
<td></td>
<td>2:30–4:00 p.m.</td>
</tr>
</tbody>
</table>

*Note.* MPD = mathematics professional development; UHES = Union Heights Elementary School.

11/16/22

<table>
<thead>
<tr>
<th>Grade level</th>
<th>Training</th>
<th>Facilitator</th>
<th>Training location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fourth grade</td>
<td>Fourth-grade MPD</td>
<td>Elementary mathematics instructional coach</td>
<td>UHES</td>
</tr>
<tr>
<td></td>
<td>*teachers need to bring their laptops</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fifth grade</td>
<td>Fifth-grade MPD</td>
<td>Elementary mathematics specialist</td>
<td>UHES</td>
</tr>
<tr>
<td></td>
<td>*teachers need to bring their laptops</td>
<td></td>
<td>2:30–4:00 p.m.</td>
</tr>
</tbody>
</table>

*Note.* MPD = mathematics professional development; UHES = Union Heights Elementary School.

11/30/22

<table>
<thead>
<tr>
<th>Grade level</th>
<th>Training</th>
<th>Facilitator</th>
<th>Training location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fourth grade</td>
<td>Fourth-grade MPD</td>
<td>Elementary mathematics instructional coach</td>
<td>UHES</td>
</tr>
<tr>
<td></td>
<td>*teachers need to bring their laptops</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fifth grade</td>
<td>Fifth-grade MPD</td>
<td>Elementary mathematics specialist</td>
<td>UHES</td>
</tr>
<tr>
<td></td>
<td>*teachers need to bring their laptops</td>
<td></td>
<td>2:30–4:00 p.m.</td>
</tr>
</tbody>
</table>

*Note.* MPD = mathematics professional development; UHES = Union Heights Elementary School.

12/7/22

<table>
<thead>
<tr>
<th>Grade level</th>
<th>Training</th>
<th>Facilitator</th>
<th>Training location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fourth grade</td>
<td>Fourth grade MPD</td>
<td>Elementary mathematics instructional coach</td>
<td>UHES</td>
</tr>
<tr>
<td></td>
<td>*teachers need to bring their laptops</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fifth grade</td>
<td>Fifth-grade MPD</td>
<td>Elementary mathematics specialist</td>
<td>UHES</td>
</tr>
<tr>
<td></td>
<td>*teachers need to bring their laptops</td>
<td></td>
<td>2:30–4:00 p.m.</td>
</tr>
</tbody>
</table>

*Note.* MPD = mathematics professional development; UHES = Union Heights Elementary School.
### 12/14/22

<table>
<thead>
<tr>
<th>Grade level</th>
<th>Training</th>
<th>Facilitator</th>
<th>Training location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fourth grade</td>
<td>Fourth-grade MPD</td>
<td>Elementary mathematics</td>
<td>UHES</td>
</tr>
<tr>
<td></td>
<td>*teachers need to bring their laptops</td>
<td>instructional coach</td>
<td>2:30–4:00 p.m.</td>
</tr>
<tr>
<td>Fifth grade</td>
<td>Fifth-grade MPD</td>
<td>Elementary mathematics</td>
<td>UHES</td>
</tr>
<tr>
<td></td>
<td>*teachers need to bring their laptops</td>
<td>specialist</td>
<td>2:30–4:00 p.m.</td>
</tr>
</tbody>
</table>

*Note. MPD = mathematics professional development; UHES = Union Heights Elementary School.*

### 12/21/22

<table>
<thead>
<tr>
<th>Grade level</th>
<th>Training</th>
<th>Facilitator</th>
<th>Training location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fourth grade</td>
<td>Fourth-grade MPD</td>
<td>Elementary mathematics</td>
<td>UHES</td>
</tr>
<tr>
<td></td>
<td>*teachers need to bring their laptops</td>
<td>instructional coach</td>
<td>2:30–4:00 p.m.</td>
</tr>
<tr>
<td>Fifth grade</td>
<td>Fifth-grade MPD</td>
<td>Elementary mathematics</td>
<td>UHES</td>
</tr>
<tr>
<td></td>
<td>*teachers need to bring their laptops</td>
<td>mathematics specialist</td>
<td>2:30–4:00 p.m.</td>
</tr>
</tbody>
</table>

*Note. MPD = mathematics professional development; UHES = Union Heights Elementary School.*
## APPENDIX L:

### PROFESSIONAL DEVELOPMENT CALENDAR 2021–2022

<table>
<thead>
<tr>
<th>Date</th>
<th>Professional development information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>May 6</strong></td>
<td>PD/meeting: mathematics training with RL Mack consulting&lt;br&gt;Curriculum &amp; instruction department&lt;br&gt;Time: 10:00 – 1:30</td>
</tr>
<tr>
<td><strong>May 7</strong></td>
<td>PD/meeting: mathematics training with RL Mack consulting&lt;br&gt;Curriculum &amp; instruction department&lt;br&gt;Time: 12:00–until</td>
</tr>
<tr>
<td><strong>May 11</strong></td>
<td>PD/meeting: elementary planning collaborative in PM’s pacing&lt;br&gt;(Fourth &amp; fifth grade)&lt;br&gt;Time: 2:00–4:30 p.m.</td>
</tr>
<tr>
<td><strong>May 13</strong></td>
<td>PD/meeting: elementary planning collaborative in PM’s pacing&lt;br&gt;(Fourth &amp; fifth grade)&lt;br&gt;Time: 2:00–4:30 p.m.</td>
</tr>
<tr>
<td><strong>May 18</strong></td>
<td>PD/meeting: elementary planning collaborative in PM’s pacing&lt;br&gt;(Third grade)&lt;br&gt;Time: 2:00–4:30 p.m.</td>
</tr>
<tr>
<td><strong>May 20</strong></td>
<td>PD/meeting: elementary planning collaborative in PM’s pacing&lt;br&gt;(Third grade)&lt;br&gt;Time: 2:00–4:30 p.m.</td>
</tr>
<tr>
<td><strong>May 24</strong></td>
<td>PD/meeting: mathematics training with RL Mack consulting&lt;br&gt;Specialist &amp; instructional mathematics coach&lt;br&gt;Time: all day</td>
</tr>
<tr>
<td><strong>May 25</strong></td>
<td>PD/meeting: mathematics training with RL Mack consulting&lt;br&gt;Specialist &amp; instructional mathematics coach&lt;br&gt;Time: all day</td>
</tr>
<tr>
<td><strong>May 26</strong></td>
<td>PD/meeting: mathematics training with RL Mack consulting&lt;br&gt;Specialist &amp; instructional mathematics coach&lt;br&gt;Time: all day</td>
</tr>
<tr>
<td><strong>May 27</strong></td>
<td>PD/meeting: mathematics training with RL Mack consulting&lt;br&gt;Instructional mathematics coaches</td>
</tr>
<tr>
<td>Date</td>
<td>Professional development information</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| May 28   | PD/meeting: mathematics training with RL Mack consulting Instructional mathematics coaches  
|          | Time: all day  
| Jun 10   | PD/meeting: candy coding syllables  
|          | Time: 8:30–10:30 am  
|          | Third–fifth-grade mathematics educators  
| Jun 14   | PD/meeting: debate math  
|          | Elementary teachers  
|          | Time: 1:00 – 3:00 pm  
| Aug 10   | Freckle intervention training  
|          | APS, district and school interventionist, coaches  
|          | Time: 9:00–12:00  
| Aug 12   | Susan Adams PLC facilitator training (train the trainer)  
|          | Specialist & coaches  
|          | Time: 1:00–4:00  
| Aug 27   | Susan Adams training – universal screener data dig & scheduling  
|          | Specialist and district interventionist  
|          | Academic coaches  
|          | Time: 8:30–12:00  
| Sep 1    | PD meeting: freckle training for interventionists  
|          | Specialists, district & school interventionists  
|          | Time: 8:30–11:30  
| Oct 19   | STAR mathematics & freckle data training  
|          | Time: STAR mathematics data: 8:30–10:00  
|          | Freckle data: 10:30–12:00  
| Oct 20   | MDE teacher table training  
|          | Principals and assistant principals  
|          | Specialist & coaches  
|          | Time: 9:00  
| Nov 16   | PD meeting: partners in education  
|          | Focus: Steam  
<p>|          | Time: 8:30 am – 3:30 pm |</p>
<table>
<thead>
<tr>
<th>Date</th>
<th>Professional development information</th>
</tr>
</thead>
</table>
| Jan 5     | Don’t worry, data got your back  
Presenter: Brandon  
Fourth- & fifth-grade mathematics teachers  
Time: 8:30–3:30                                                                                                             |
| Jan 26    | Freckle training  
Train the trainers & principal  
Time: 8:30–3:30                                                                                                               |
| Mar 24    | PD meeting: “Understand Fractions Institute”  
Presenter: Dr. Julie James  
Assistant director of professional learning for The Center for Mathematics and Science Education at The University of Mississippi  
Time: 8:15–3:00                                                                                                               |
| Mar 25    | PD meeting: “Understand Fractions Institute”  
Presenter: Dr. Julie James  
Assistant director of professional learning for The Center for Mathematics and Science Education at The University of Mississippi  
Time: 8:15–3:00                                                                                                               |
| May 16–23 | Mathematics pacing and alignment work session                                                                                                                                  |

*Note.* PD = professional development; MDE = Mississippi Department of Education.
### APPENDIX M:

**PROFESSIONAL DEVELOPMENT CALENDAR 2022 – DEC 2022**

<table>
<thead>
<tr>
<th>DATE</th>
<th>PROFESSIONAL DEVELOPMENT INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jun 6</td>
<td>Susan Adams System Review&lt;br&gt;8:30 – 11:30 – Elementary administrators&lt;br&gt;District team principals &amp; assistant principals</td>
</tr>
<tr>
<td>Aug 1</td>
<td><strong>Back-to-School Summit</strong>&lt;br&gt;8:00 – 4:00&lt;br&gt;PD Meeting: Imagine Math&lt;br&gt;Presenter: Jordan German&lt;br&gt;Grades 3, 4, &amp; 5 Math&lt;br&gt;PD Meeting: Follow the Map for Math&lt;br&gt;Presenter: Mathematics specialist&lt;br&gt;Grade 3 Math&lt;br&gt;PD Meeting: Envision Math&lt;br&gt;Presenter: Pam Valrie&lt;br&gt;Grades 3, 4, &amp; 5 Math&lt;br&gt;Presenter: Mathematics Coach&lt;br&gt;Curriculum MAP&lt;br&gt;Grades 3, 4, &amp; 5 Math</td>
</tr>
<tr>
<td>Aug 18</td>
<td>Imagine Mathematics Train the Trainer&lt;br&gt;Presenter: Jordan German&lt;br&gt;Interventionists/District intervention specialists, learning strategies teachers&lt;br&gt;Time: 8:00 – 11:30</td>
</tr>
<tr>
<td>DATE</td>
<td>PROFESSIONAL DEVELOPMENT INFORMATION</td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------------</td>
</tr>
</tbody>
</table>
| Sep 12 | Imagine Mathematics Office Hours: Focused Q & A  
         Presenter: Jordan German  
         Pre-K–5 Teachers  
         Time: 9:00–10:00 |
| Oct 13 | Third-grade PD – Standards study  
         Presenter: Elementary mathematics specialist  
         Third grade teachers  
         Time: 12:00–3:30 |
| Nov 3  | Data Meeting for leaders  
         Presenter: Ken Byars  
         K–5 administrators  
         Time: 9:00–2:00 |
| Nov 8  | Data Meeting fourth- & fifth-grade mathematics teachers  
         Presenter: Ken Byars  
         Fourth- & fifth-grade mathematics teachers  
         Time: 8:30–2:00 |
| Nov 10 | Data Meeting for inclusion teachers  
         Presenter: Ken Byars  
         K–5 inclusion teachers  
         Time: 8:30–2:00 |

*Note.* PD = professional development; Q&A = questions and answers.
VITA
JOYE CULLEN

https://www.linkedin.com/in/joye-cullen/
cullenjoye@gmail.com

Education

EdD The University of Mississippi, Educational Leadership August 2023
Dissertation: “Increasing Mathematics Proficiency
and Growth Through Focused, Data-Driven Professional Learning”
Committee: Dr. Dennis Bunch (chair), Dr. Jill Cabera-Davis,
Dr. Hunter Taylor, and Dr. Winer Bolden

MS The University of Mississippi, Educational Leadership December 2019
Advisor: Dr. Douglas Davis

BS Mississippi State University Name, Elementary Education May 2002

Professional Experience

JULY 2020 – PRESENT
ASSISTANT PRINCIPAL, MERIDIAN PUBLIC SCHOOL DISTRICT
Assist, lead PLCs, and train teachers, state test coordinator, co-director of art grant, MTSS
Chairperson, assist with Title One, Reach MS team leader, 504 Coordinator, Crisis
management drill coordinator, agency representative.

AUGUST 2015 – JULY 2020
LEAD MIDDLE SCHOOL MATH TEACHER, DESOTO COUNTY SCHOOL
DISTRICT
Assist, mentor, and train teachers by utilizing data to drive instruction through professional development, piloted tools, and integrated student accountability models. Provide Mathematics teachers with best practice strategies which moved the school score from C to a B. Assist with Positive Behavior Incentives to help maintain student moral and drive increase in scores.

AUGUST 2014 – JULY 2015
ELEMENTARY CLASSROOM TEACHER, SHELBY COUNTY SCHOOL DISTRICT
Utilize data from formative and summative assessments to drive instruction and creating lesson plans with differentiated instruction to target different tier levels of students.

AUGUST 2008 – JULY 2014
LEAD ELEMENTARY CLASSROOM TEACHER, DESOTO COUNTY SCHOOL DISTRICT
Attend Guided Reading training and appointed to Common Core ELA district transition team to training grade level (train the trainer). Attend Project Prime at the University of Mississippi leading PLC meetings to provide Mathematics teachers with best practice strategies and clarity implementing the Math Common Core Standards moving the school score from D to a high C being a 25% gain.

AUGUST 2002 – JUNE 2005
ELEMENTARY CLASSROOM TEACHER, NOXUBEE COUNTY SCHOOL DISTRICT
Create lesson plans. Create and update IEPs. Maintain a safe classroom environment. Communicate with parents through newsletters, phone calls, and parent conferences. Create a love for coming to school and learning.

Honors, Recognition, and accomplishments

Celebration of Achievement Award 2023
An award to celebrate the achievement of underrepresented students.

Celebration of Achievement Award 2020
An award to celebrate the achievement of underrepresented students.

Donors Choose 2020
Received two Breakout EDU kits for a middle school math class.

The Society for Collegiate Leadership 2019
Multidisciplinary honor society.
Reflex Educator Grant
Adaptive and individualized system for mastering basic math facts in addition, subtraction, multiplication and division.

DeSoto County Foundation of Excellence in Education, Inc.
Grant for math common core manipulatives.

National American Contract Bridge Conference
4th and 5th grade students place in the national conference student competition.

Desoto County School District
3rd Highest ELA and Math scores in the district for 5th grade.

Horn Lake Intermediate
Highest scale scores.

Horn Lake Intermediate
Highest writing scores.

Dean’s Scholar
Multidisciplinary honor society

Research Experience

Dissertation, The University of Mississippi
Advisors: Dr. Dennis Bunch

- Investigated the relationship between elementary teachers' involvement in Professional Learning Communities (PLCs) and Professional Development (PDs) and its impact on teachers' efficacy and students' achievement.
- Conducted a comprehensive literature review on the topic, synthesizing existing research and identifying research gaps.
- Designed and implemented a mixed-methods research study, combining surveys, interviews, and student achievement data analysis.
- Collected and analyzed data from a sample of elementary teachers and their students, utilizing statistical analysis and qualitative coding techniques.
- Identified significant correlations between teachers' participation in PLCs and PDs, teachers' self-efficacy beliefs, and students' academic performance.
- Generated evidence-based recommendations for schools and educational institutions to enhance teacher professional development programs and improve student outcomes.
Presentations and Invited Lectures

Workshop Presenter, “Educator Self Care,” MAMLE (Mississippi Association for Middle Level Education), October 28, 2019.

Professional Training


The University of Mississippi, University, MS. Fall 2020

Description: Students engage stakeholders in a process to identify an appropriate applied research problem. Students will locate, assess, and summarize applied and theoretical research on the approved DIP problem. A plan will be developed to systematically gather data necessary to support the development and implementation of an action plan.

Leadership and Organizational Theory into Practice

The University of Mississippi, University, MS. Fall 2020

Description: Application of research-based organizational and leadership theoretical models in school leadership practice.

Qualitative Research

The University of Mississippi, University, MS. Spring 2021

Description: An introduction to the various forms of qualitative research. The course provided a theoretical and practical starting point for utilizing this method of research.

Dissertation in Practice 2—Structuring an Applied Research Problem

The University of Mississippi, University, MS. Spring 2021

Description: Structure the problem through a determination of the political and structural feasibility of developing and implementing a change initiative to address the problem, and developing an appropriate purpose statement.

Program Evaluation I

The University of Mississippi, University, MS. Summer 2021

Description: An introduction to the concepts, methods, and applications of program evaluation.
**Dissertation in Practice 3—Collecting Data for Use in Developing the Action Plan on the ARP**

The University of Mississippi, University, MS. Summer 2021

Description: Collect and analyze data needed to design the DIP action plan.

**Program Evaluation II**

The University of Mississippi, University, MS. Fall 2021

Description: Advanced study of program evaluation methodology, including evaluation design and analytic techniques. This course prepares students to become evaluation practitioners.

---

**Dissertation in Practice 4—Implementing and Assessing the Applied Research Problem**

The University of Mississippi, University, MS. Fall 2021

Description: The development of an action plan based on the data analyzed in DIP III. Preparation for full implementation of the action plan at the beginning of Year Three. Design of an appropriate program evaluation process to measure the effect and identify areas of improvement for the action plan.

**School Finance and Facilities Planning and Management**

The University of Mississippi, University, MS. Spring 2022

Description: Development and management of school and district budgets; strategic planning for bond development for capital projects; and principles of financial support at local, state, and federal levels.

**Education and Society**

The University of Mississippi, University, MS. Spring 2022

Description: Ways in which selected cultural factors and trends affect the process and organization of education.

**District Operations and Management**

The University of Mississippi, University, MS. Summer 2022

Description: Development of district procedures and school-board policies for daily operation, safety of schools, and data-based decision making for management and operation of the district.

**Applied Curriculum, Instruction, and Accountability**
The University of Mississippi, University, MS. Fall 2022

Description: Development at the district level of consistent curriculum, instructional, and accountability programs across schools.

Advanced Methods of Applied Research in Educational Leadership

The University of Mississippi, University, MS. Fall 2022

Description: Provides advanced educational leaders at the district level the knowledge and skills to systematically plan, collect, analyze, and synthesize quantitative and qualitative data to design, implement, and improve educational programs, assess teaching and learning processes, provide effective professional development, and efficiently utilize educational resources to improve student learning.

Advanced Educational Law, Ethics, and Special Programs Administration

The University of Mississippi, University, MS. Spring 2023

Description: Provides advanced educational leaders at the district level the knowledge and skills to systematically plan, collect, analyze, and synthesize quantitative and qualitative data to design, implement, and improve educational programs, assess teaching and learning processes, provide effective professional development, and efficiently utilize educational resources to improve student learning.

The Professional Philosophy

The University of Mississippi, University, MS. Spring 2023

Description: Relation of various philosophies to modern educational practice.

Project Prime

The University of Mississippi, University, MS. Summer 2012

Description: Summer institutes that focused on mathematics content knowledge and practices.

Transitioning Into Common Core: Language Arts for Grades 3-5

Desoto County School District, Hernando, MS. Spring 2012

Description: Train the trainer to provide professional development on school site to prepare teachers for the transition to common core standards.

Kagan Cooperative Learning Structures

Desoto County School District, Hernando, MS. Summer 2010

Description: Research-based instructional strategies that have a track record of improving academic achievement and social outcomes.

American Contract Bridge League School League Training
University of Memphis, Memphis, TN. 2011

Description: Participants learned how to play American Contract Bridge and how to start a school bridge club.

**Scholastic Guided Reading Training**

Horn Lake Intermediate, Horn Lake, MS. 2011

Description: Participants learned about foundational reading skills and how they build upon one another, as well as understanding their relationship to a student’s reading level.

**Professional Affiliations**

National Education Association (NEA), 2002-Present

Mississippi Association of Educators (MAE), 2002-Present

The National Council of Teachers of Mathematics, 2011-Present

National Science Teachers Association, 2011-Present

Association for Supervision and Curriculum Development, 2020-Presen

Principal's Network Collective, 2021

Leadership Academy Principals of Color Collective, 2022-2023

**Certifications**

Mississippi Department of Education, Current-2026

Description: 117 ELE EDUC (4-6), 152 KINDERGARTEN-4 (K-4), 486 CAREER LEVEL ADMINISTRATOR, 901 MID SCH MATH (7-8)

Alabama Department of Education, Current-2028

Description: Class A, Elementary (76A) Grade Level: K-6, Class A, Middle School (079)

Grade Level: 4-8 Mathematics, Class A, Educational Administrator (081) Grade Level: P-12 Educational Administrator

Georgia Department of Education, Current-2027

Description: SRT, Elementary (P-5) [FLD 808] Grade Level: K-6; SRT Middle Grade (4-8) Math [FLD 815]; SRL, Educational Leadership-TIER 1 [FLD 851]

Tennessee Department of Education, Current-2025
Description: 442 Beginning Administrator PreK-12, 120 Elementary Education K-5, 122 Middle Grades Mathematics 6-8

Computer Skills

- Spreadsheet and Data Analysis: Proficient in using spreadsheet software (Microsoft Excel & Google Sheets) for organizing data, creating charts and graphs, performing calculations, and analyzing data for educational purposes.
- Presentation Tools: Skill in creating visually appealing and engaging presentations using software like Microsoft PowerPoint or Google Slides. Knowledge of effective presentation techniques, including slide design, multimedia integration, and delivering presentations effectively.
- Educational Software and Learning Management Systems (LMS): Familiarity with educational software applications and learning management systems used for content delivery, student assessment, grading, and online collaboration. Examples include PowerSchool, Schoology, School Status, Google Classroom, Clever, Mastery Connect, Questar, and DRC.
- Office 365 (including email and One Drive)
- Word Processing and Document Creation: Mastery in word processing software (e.g., Microsoft Word, Google Docs) for creating and formatting documents, including lesson plans, handouts, and assessments.
- Online Collaboration and Productivity Tools: Proficiency in using tools like Google Suite (Docs, Sheets, Slides, Forms), Microsoft Office 365, or other cloud-based collaboration tools for real-time collaboration, file sharing, and project management.
- Zoom and Google Meet
- Virtual Learning Environments: Competence in using virtual learning platforms and tools, such as learning management systems (LMS) with advanced features, online discussion boards, video conferencing tools, and online assessment platforms.
- Social Media Management: Proficiency in managing social media accounts for educational purposes, including creating content, scheduling posts, analyzing engagement metrics, and promoting online collaboration and community engagement.
- Mobile Technology Integration: Understanding of mobile technologies and the ability to incorporate mobile apps, educational games, and other mobile resources into teaching and learning activities.

References

Upon Request