EFFECTIVE MATH INTERVENTIONS IN THE ELEMENTARY PSSA GRADES

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Abstract

This mixed-methods study was conducted to determine the math interventions and strategies that are showing a positive increase in student achievement and growth in grades three, four, and five across the Bellefonte Area School District. Effective math teachers were first identified by looking at multiple academic data sets and then questionnaire responses were compared to determine similarities in their instructional practices. The similar interventions and strategies will be shared with teachers through professional learning sessions and ultimately used with students in classrooms. The strategies and interventions that were identified to be showing success were guided/small group math instruction, extra and focused work on open-ended math questions, the use of online math programs like Reflex Math, and data use. The effectiveness of departmentalization was also analyzed. The qualitative data supports departmentalization while the quantitative data does not. This area will require additional analysis in the future. Finally, the professional learning needs of staff were identified and will help guide the district's professional learning plan and its Comprehensive Plan. Some of these areas that will be focal points are guided math, the integration of technology, and data use.

CHAPTER I

Introduction

As the principal of Benner Elementary School in the Bellefonte Area School District, I closely monitor the scores of my school as well as the scores of the other three elementary schools in my district on the Pennsylvania System of School Assessment (PSSA). This high stakes assessment measures progress for grade three through grade five students in elementary schools across the state of Pennsylvania. The assessment measures Math and English Language Arts for students in grades three through five, and also Science for students in grade four.

Math is the content area that I continue to revisit and analyze. My school district has experienced stagnant, or declining, student math scores over the past five or more years at the elementary level. We have also identified a lack of consistency in math curriculum implementation and low scores in our student growth indicators. These struggles can be traced back to possible issues in curriculum gaps, student data use, implementation of the Everyday Math program, and how teachers implement instructional strategies and interventions. We currently have an inconsistent mix of interventions being implemented across the district. We have canned programs like IXL and Reflex Math along with other website-based programs. We also have small group or 1-1 teacher lead intervention lessons and activities like Guided Math. The goal of this study is to determine what interventions are showing a positive increase in student achievement and growth and provide this information to our teachers through professional learning opportunities.

The Bellefonte Area School District has four elementary schools serving students from kindergarten through fifth grade. Each of the buildings has a principal who is responsible for the managerial and instructional leadership of their buildings. Part of the instructional leadership portion of the position is to monitor the academic progress of students and make informed decisions and changes to the academic setting when necessary. Low and stagnant math scores have led me to this research project in hopes of finding out why and to find ways to help my teachers and students make improvements.

This research study will be completed during 2019-2020 school year. Data will be collected and analyzed from the 2016-17, 2017-18, and 2018-19 school years through a mixed methods research process. Quantitative math data will be collected and analyzed from the students in grades three through five. Data that will be collected will include PSSA data, Classroom Diagnostic Testing scores, end of year district benchmark assessment scores, and teacher specific PVAAS data. Qualitative data will be collected from teachers through the use of a survey. Open ended and closed ended questions will be used. The survey will focus on teachers' impressions of the Everyday Math Program. This is the core program being used in our district. The survey will also target the instructional strategies and interventions teachers are using to increase student achievement in math.

The data and findings from this study will allow me to work closely with our district's math coach to develop and implement professional learning for teachers focused on interventions and strategies designed to improve student achievement.

There will be very little upfront expense involved in collecting and analyzing the data for this project. The expense will come from the recommendations generated from

the project. I plan to utilize my district's Math Instructional Coach to help lead the professional learning activities that center around the data analysis review, data protocols, and effective math interventions. These tasks will fit into the coach's daily assigned duties and will not be an additional expense. The biggest expense will come from paying substitutes for the teacher professional learning days. I can also envision the findings from this study could encourage the district to purchase a specific math intervention program for all intermediate math teachers.

An improvement in student math achievement and overall growth is the ultimate objective of this project. This will happen by improving math instruction, selection and intervention use, and data analysis in my district as teachers will be utilizing data to determine effective intervention strategies for students. This study will affect the focus of the professional learning that will be held with staff members during the 2020-21 school year.

The questions that will be answered in this study are ones that educators in my district have thought about for years, but have not been able to definitively answer. Hopefully, this study will provide us with the answers and will positively impact students in the intermediate grades and beyond.

I will focus my research on the following questions:

What instructional strategies are teachers using across the district to increase the growth in student math skills?

How has departmentalization in the elementary schools aided the students in their math growth or hindered their progress?

What professional learning opportunities does the district need to provide teachers to insure more consistent use of data protocols, as well as appropriate intervention strategies?

CHAPTER II

Review of the Literature

Introduction

The growing importance of standardized testing across elementary schools in Pennsylvania has put student test scores at the forefront of many educational conversations. State-wide assessments have led to debates about school effectiveness, teacher effectiveness, and program effectiveness. While many schools continue to show growth and positive academic achievement on the yearly Pennsylvania System of School Assessments, many other schools are not experiencing growth or success. Even more important than growth on standardized tests is the overall growth and achievement of our students in the Bellefonte Area School District. Educators are realizing that their students are not reaching the level of academic growth and achievement for success in applying math skills to real-world math scenarios, nor are they exhibiting the skills to be able to take the advanced math classes that will make them college and career ready once they graduate.

Elementary schools are recognizing math deficiencies and are implementing interventions across all grade levels in hopes of closing the achievement and growth gap. Some interventions have proven to be effective while others have not shown as much promise. The effects of math interventions used by educators are informing classroom practice while also providing professional learning opportunities for classroom teachers that address student challenges. Along with interventions, identifying and implementing effective instructional techniques is crucial to remedying this problem.

This study will analyze the PSSA math trends in the state over the past several years. Factors contributing to little or no growth will be described, as well as best practices found in the Bellefonte Area School District's most successful classrooms in grades three, four, and five. The study will also research various math interventions being used in the school district's elementary schools to determine their effectiveness. The information will help administrators in the district plan professional learning for teachers so that interventions and strategies can be successfully implemented in classrooms across the district.

Various technology-based interventions are becoming popular with schools and students today. The effectiveness of these programs will also be analyzed along with how they make differentiation in math classes more manageable. At the conclusion of this study, the effectiveness of interventions and teaching practices will be identified. Teacher professional learning sessions will be planned and implemented based on these findings in hopes of them directly impacting student achievement and growth.

In order to further understand the setting and results of this study, the demographics of the Bellefonte Area School District must be described. There are four elementary schools servicing grades K-5 in the district. The demographic data is summarized in the table below. Pleasant Gap Elementary and Bellefonte Elementary are both Title I schools. The socioeconomic status is spread throughout the district, but the diversity is minimal with approximately 94% of students being white. Special education student needs in grades three, four, and five are typically serviced within the regular education classroom with push-in services from the learning support teacher or the learning support aide. There are also a growing number of students in each classroom

with math deficiencies who are not receiving special education services but require intensive interventions. In addition to these students, there is an increasing number of students in the testing grade levels who receive counseling or behavioral intervention support to help address social and emotional deficits. These deficits or challenges detract from the potential learning and success of the students.

Table 1

Bellefonte Area School District Demographic Data

(Data was taken from the Pennsylvania Future Ready Index website.)

School	Total Enrollment	Race-White	Economically Disadvantaged	EL Students	Special Education	Gifted
Bellefonte Elementary	371	91.6%	50.9%	0.8%	18.3%	0.8%
Benner Elementary	231	93.9%	22.1%	1.3%	13.9%	2.6%
Marion-Walker Elementary	371	96%	16.4%	1.3%	14.8%	0.5%
Pleasant Gap Elementary	222	93.7%	36.9%	6.8%	18.5%	0.4%

PSSA Statewide Trends

Data from 2015 through 2019, taken from the Pennsylvania Department of Education website, illustrate student achievement scores have fluctuated within the upper 50 percentile range to the lower 40 percentile range. Grade 3 students have performed stronger than grade 4 and 5 students. Grade 5 students have been consistently the lowest of the three grade levels statewide.

Table 2

PSSA Statewide Results

Grade	2019 % Adv/Prof	2018 % Adv/Prof	2017 % Adv/Prof	2016 % Adv/Prof	2015 % Adv/Prof
3	56	54	55	54	49
4	46	44	47	47	44
5	43	45	44	44	43

Table 3

PSSA Bellefonte Area School District Results

Grade	2019 % Adv/Prof	2018 % Adv/Prof	2017 % Adv/Prof	2016 % Adv/Prof	2015 % Adv/Prof
3	67	71	66	63	62
4	62	65	59	77	60

Grade	2019 % Adv/Prof	2018 % Adv/Prof	2017 % Adv/Prof	2016 % Adv/Prof	2015 % Adv/Prof
5	54	56	58	64	56

The scores for Bellefonte Area School District students trend similarly to the statewide scores except that the advanced/proficiency rates are higher. These scores are higher than the average scores across the state, but the scores have remained stagnant, and seem to have plateaued. The bigger concern is the scores of the fifth-grade students as they have not only flatlined but have been consistently much lower than our scores in grades three and four.

The goal of this study is to determine what intervention strategies and math instructional practices teachers within the Bellefonte Area School District are most successful with assisting students in reaching the proficiency threshold on the mathematics PSSA. This literature review will investigate the factors contributing to little or no growth in math for students, math teaching best practices, math interventions, and professional learning for teachers.

Factors Contributing to Low/No Growth

Children enter the schoolhouse doors with varied levels of readiness for learning. About 6% of children have major obstacles in learning math (Chan and Wong, 2019). Many more students suffer from other math difficulties that slow math growth and achievement. Some students have been fortunate enough to have been involved in formalized educational preschool programs. Many come from educationally rich and

vibrant home settings. Of course, some students have not had these early learning benefits. How schools instruct students who begin their formalized schooling behind grade-level expectations can become a problem for the schools and the students. How schools structure their learning settings can also be a problem. It is very easy to place higher-level learners in more challenging classes with supportive teachers and lower-level learners in remedial classes with teachers who may become frustrated and less supportive due to the high needs of the students (Crosnoe et al., 2010). Assigning and instructing students as Crosnoe (2010) describes can become a problem and lead to lower levels of achievement for the neediest students. In typical classrooms, lower achieving students receive lower levels of instruction due to the expectations of the students by the teachers. Basic or low levels of inferential instruction are related to lower test scores for low performing students. Crosnoe (2010) reports that this is the approach that most schools are taking which then causes many students to stay behind their higher peers and make little to no growth.

Friesen and Poscente (2014) discuss the age-old math lesson consisting of remember, recall, and regurgitate facts. Teachers demonstrate a procedure and students practice it repeatedly with similar questions. Friesen and Poscente (2014) refer to this as the North American teaching script, and it has proven to be ineffective. These researchers assert, the inability to change this mindset of teachers continues to stunt the growth of math development of our students.

There are many other factors that can contribute to low math achievement or growth. Chan and Wong (2019) identified several types of math difficulties. They identify number sense deficit, numerosity coding deficit, symbolic deficit, and working

memory deficit. Students who are struggling may show deficits in a number of these areas. Chan and Wong (2019) recommend that students should be assessed comprehensively to determine their weak areas in math so that the correct interventions are put in place. Chan and Wong (2019) also state that these students should be reassessed over time, as their areas of difficulty can change. Early intervention and correctly matched interventions have been found to have positive effects on the acquisition of math concepts later in students' education. The success in matching the intervention to the child points to the reason why a comprehensive assessment to determine the exact gaps that children have in their math learning is important. Research done by Karakonstantaki et al. (2018) finds that a deficit in number sense, the ability to represent and manipulate number quantities on a number line or as an array of objects, is commonly found in students with math impairments. Number sense deficiency leads to a diminished understanding of numbers and their relations with each other. Even more prevalent, according to Karakonstantaki et al. (2018) is poor math achievement caused by the inability to understand the numerical meaning of numbers through symbols.

There is also a correlation between the amount of teacher and student conflict in a classroom and how much a student gains from classroom instruction. The better the relationship with the teacher, the better the student learns and achieves (Crosnoe, 2010). Along with this relationship, is the attitude of the student toward math. Most students begin their schooling with positive attitudes toward math, and based on their experiences in the first few years in school that attitude could remain the same or change. A positive attitude improves a student's desire to learn while a negative one can result in the opposite. Haciomeroglu (2017) states that there is a positive relationship between a

positive attitude and math achievement. This relationship is stronger in the lower grades (1-4) than in the higher elementary grades (4-6). Negative attitudes lead to poor engagement and low performance.

Another contribution to poor math achievement found in the literature is the issue of a student and even a teacher having math anxiety. Math anxiety is defined as an intense fear, nervousness, and dread related to math that leads to the avoidance of math activities and the hindering of mathematical learning (Ruff & Boes, 2014). Math anxiety can begin as early as kindergarten, which can result in students missing out on the building blocks of the skills necessary for later success in math. Anxious math students may even be discouraged from science and math-related career paths later in their lives due to their inabilities to overcome math anxiety.

The causes of math anxiety can vary but fall mostly into three categories: social factors, cognitive factors, and academic factors. Data from research studies indicate that some students are affected by social factors such as race and gender stigmas or the lack of parental support, especially in economically disadvantaged families. Studies have shown that girls are more likely to have higher math anxiety and less math success than boys (Ruff & Boes, 2014). When stereotyped as low-achievers, ethnic minority students can lose interest and motivation in math, which continues to snowball into less success and more anxiety (Ruff & Boes, 2014). Students from economically disadvantaged families typically have parents who were not successful in math as students. They therefore may also have anxiety and are not as encouraging to their children or comfortable enough with math to provide them support at home.

Cognitive factors also can work in tandem with the math anxiety that some students exhibit. These factors include a weak working memory and Dyscalculia. Dyscalculia is defined as a difficulty in making mathematical calculations as a result of a brain disorder. When students are stressed, the emotional feelings of that stress can impede their working memory, which is critical to success in math.

Academic factors contributing to math anxiety include the traditional math curricula used in schools, ineffective teaching styles, and students being taught by anxious teachers. Classroom work that focuses on basic skills, teacher lecture, seatwork, and whole-class instruction is more likely to have students exhibiting math anxiety than classes that focus on real- life problems and application. Explaining the why of math instead of focusing on facts and operations leads to less anxiety in math classrooms.

Math anxiety also affects teachers. Anxious teachers may spend more time avoiding math in class, or when they do teach they may rely on the textbook rather than planning ways to teach math creatively. Ruff and Boes (2014), suggest the areas of teacher math anxiety need to be studied more extensively. They recommend that school counselors be more invested in assisting anxious students and even teachers. Teachers could be taught how to identify students suffering from math anxiety and also be provided with interventions for their classroom lessons that can reduce stress and anxiety for anxious students. School counselors are encouraged to raise an awareness of the psychological aspect of math learning with parents, teachers, and administrators. Systemic school-wide changes were also mentioned by Ruff and Boes, (2014). Ruff and Boes (2014) recommend changing the method of math instruction and teaching styles along with working with teachers to acknowledge and work on the math anxiety they

may possess were areas that could be changed. The idea of providing parent education in ways to help their students and talk to their students about math was also offered as a way to assist highly anxious students (Ruff & Boes, 2014).

The math anxiety cycle is a topic that is also explained in a study by Leung and Cohen (2004). Leung and Cohen (2004) focus their work on teacher anxiety and how that anxiety translates back to the students. The authors explain that the cycle begins when teachers are in elementary school and have negative math experiences and results. The poor experiences result in knowledge gaps in their foundational learning which makes picking up new math concepts difficult. The difficult early math experiences leads to a lack of confidence in math and ultimately an avoidance of math. As the students grow older they avoid higher math classes and math or science career opportunities.

Elementary teachers cannot avoid math. Elementary teachers can avoid higher level math but must still be proficient and comfortable with math to effectively teach their students. Therefore, the cycle continues as students taught by anxious teachers become elementary teachers themselves and transfer the same math anxiety to a new batch of students.

The anxiety problem for math teachers continues or intensifies as new math curriculum or methods of teaching math are implemented by school districts. When teachers are required to move from traditional forms of teaching math to more modern styles of teaching, more anxiety for the teacher can be the result. Students may sense the anxiety and absorb that same uncomfortableness about math. Lueng and Cohen (2004) suggest that this cycle can be broken. Lueng and Cohen (2014) discuss mastery goals. With students, teachers set mastery goals for students to acquire the knowledge and

understanding necessary to demonstrate competency in math performance. Teachers can do this as well by adopting a mastery goal to become a more proficient math teacher. Adopting a mastery goal can happen by recognizing the math experiences they had as young students and to provide more positive experiences for their current students. When searching for mastery they also become more aware of their teaching and its effect on their students.

Another factor contributing to student difficulties in math would be a student's lack of computational fluency (Burns, Nelson, Ysseldyke, and & Kanive, 2014). Computational fluency is the efficient and accurate completion of math calculations. (National Council of Teachers of Mathematics, 2000). Computational fluency is the ability to store basic math facts in your head and pull them from memory easily and quickly. Students with strong computational fluency skills are better able to solve a variety of complex problems and think deeper about mathematical concepts (Burns et, al, 2014). When students have strong computational fluency, time and energy can be devoted to the actual problem and solution rather than on the basic math computations of the problem. Earlier success with basic math skills predicts later success in higher order thinking math skills (Burns et, al, 2014).

The inability and difficulty of solving long, complicated, multi-step word problems continues to be a skill area that is weak with many students and one that educators are struggling to address effectively in their math instruction (Hord and Xin, 2013). Students who exhibit struggles with word problems typically have limited strategies to pull from and the strategies the students have are not typically transferable from one problem to the next problem. Another weakness the students exhibit is the

ability to accurately represent the problem in their minds or on paper. Middle to high achieving students rely on schematic representations of problems while low achieving students rely on pictorial representations like drawing pictures or objects.

Another contributing factor of weak problem-solving skills is a low working memory capacity combined with difficulties processing information. This affects students by making it difficult for them to retain information from the first part of a word problem, process the rest of the problem, and then combine both pieces of information to solve the problem.

Basic reading and comprehension skills are important areas that affect the math abilities of some students. The ability to read accurately, fluently, and being able to comprehend the problem are areas that must be recognized and addressed by teachers so that the focus can be on math thinking and reasoning. The thinking and reasoning required to navigate a problem is an area that is not focused on as much by teachers. Too often, teachers believe that teaching how to solve the problem by looking for keywords is more important than spending time on the thinking and reasoning behind a problem. Time spent on the conceptual understanding behind a problem is a more effective strategy than teaching the steps to problem solving (Hord and Xin, 2013).

High Achieving Schools Best Practices

Specific instructional strategies have been shown to increase student success in math according to (Ysseldyke, Spicuzza, Kosciolek, and Boys 2003). Ysseldyke, Spicuzza, Kosciolek, and Boys (2003), identified matching the level of instruction to the level of the learner along with the appropriate amount and kind of practice. Matching the

levels of the learner with the instruction provided is known as differentiating instruction. Differentiated instruction is a teaching method used to meet the diverse needs of learners. Differentiated instruction targets all learners from high performers to low performers. Just as reading teachers match instruction to student reading levels, math teachers should do the same (Burns et, al, 2014). Differentiated Classrooms have several common structures in place and they include: an ample amount of student responsibility, opportunities for student choice, peer tutoring, flexible grouping, and modified instruction. These classroom structures can allow students to find success and to see themselves as successful math learners. Motivation in math, engagement in the learning process, and a positive attitude can be the result of differentiation when implemented correctly. Both high and lower performing students show an increase in academic achievement and overall attitude towards math when instructed in classrooms where differentiated strategies are in place. Students' desire to work on math, to improve in math, as well as confidence in their abilities increase.

Pre-assessment tools, formal or informal are an effective way to assess a student's understanding of a topic which can then lead to effective differentiation. (Grimes & Stevens, 2009). The use of direct and frequent monitoring of student progress along with the use of corrective, motivational feedback is a common practice found in successful classrooms (Ysseldyke et al., 2003).

These authors also state that time engaged in an appropriately leveled task is a strong predictor of academic achievement. Zank (2015) emphasizes a variety of strategies that appeal to all learning styles creates intrinsic motivation as students experience success. Removing barriers to learning such as frustration or avoidance leads to students

focusing on personal growth. Zank's work follows many of the same differentiation recommendations already mentioned, but also emphasizes the simple importance of identifying students' deficiencies in conceptual understanding, basic computation, fact fluency, problem solving and planning direct instruction in those weak areas.

A strong school-wide intervention framework or RtI is stressed in Zank's research. Zank (2015) states that creating and using an Instructional Strategy Checklist that monitors the frequency and use of instructional strategies is an effective resource for teachers. This checklist should have examples of each strategy and an explanation for implementing the strategies. This resource is helpful in guiding and supporting the teacher through the intervention process with a student or group of students. Another best practice is the use of explicit and systematic instructional strategies targeting problem solving that encourages students to think conceptually. Examples of these types of approaches include memory devices to remember strategies, math talk and think alouds that encourage reasoning and explanations, and problem-solving strategies. Zank's final recommendation is the creation and use of quality assessment tools that track progress as well as common assessments for each grade level.

Ulichnie (2011) emphasizes small group instruction to help students' master learning. What students should be assisted are identified through targeted pre-assessments. Sound assessment practices are another quality of highly effective schools emphasized in Ulichnie's research. Pre-assessments measure whether the students have the prerequisite skills and knowledge for success. The pre-assessment data allows teachers to plan instruction to meet their students' needs. Formative assessments help identify what a child knows, understands, and is able to do (Ulichnie, 2011).

Parent involvement in the home and in the school is an area that can be used as a tool to strengthen a school's environment and academic scores (Park, Stone, & Holloway, 2017). Park et al., (2017) focused on school-based parent involvement like belonging to PTA groups, volunteering in classrooms, and fundraising. The research showed positive indications of school-level student achievement in math and a more stimulating environment in schools where the parents were involved in school activities and had formed school related peer networks with other parents and school staff. Involvement by the parents allowed them to take some of the responsibility of their child's learning from the teachers. Park et al., (2017) also concluded that a child's overall academic achievement is not only affected by the involvement of that student's parents, but even more so by the involvement of the average level of parental involvement in the entire school. In other words, students with little to no parental involvement in the school still benefit from other parents being involved to create a better educational environment. Involved parents lead to schools reporting a higher percentage of students meeting or exceeding the national standard for math and reading skills (Park et al., 2017).

Another promising best practice is described by Crosnoe et al., (2010). In this study, the researchers state that in order to grow low achieving students, the students must be challenged by higher order mathematical concepts and thinking skills. Low achieving students must be in the same higher-level math classes as the other students. Equity must exist in their math instruction and experiences. Equitable experiences in classrooms goes against conventional thinking as educators typically believe that lower students should be segregated from the higher achieving students and taught basic remedial math skills in order to build the foundation for future higher-level math

learning. Simply challenging lower students with an equitable curriculum is not enough unless the lower achieving students also have a supportive teacher guiding the students through the inevitable difficulties and frustrations associated with challenging expectations. Without support, challenging students with lower math abilities in higher level math content and classes could be unsuccessful and counterproductive for the students. Therefore, providing all students a common higher-level curriculum allows lower achieving math students the opportunity to close the achievement gap (Crosnoe et al., 2010). Higher order instruction combined with a positive, supportive teacher promotes more achievement than a rote basic skills approach (Crosnoe et al., 2010).

In the practice guide from the Institute of Education Sciences from 2009 entitled **Assisting Students Struggling with Mathematics: Response to Intervention (RtI) for Elementary and Middle Schools**, eight recommendations are listed for schools as best practices and are summarized briefly below (Gersten, R., Beckmann, S., Clarke, B., Foegen, A., Marsh, L., Star, J.R., & Witzel, B. 2009).

1. Screen all students to identify those at risk and provide interventions to identified at-risk students. The report emphasizes that no one screening measure is perfect and that schools should closely monitor those students who scored slightly above or below the cut-off score for intervention.
2. Instructional materials should focus on whole numbers in kindergarten through grade five and rational numbers in grades four through eight. These materials should be selected by a committee. They also argue that the focus and in-depth coverage provided to proficient students should also be allotted to the students

with mathematical difficulties. Connections should be made between the concepts in the intervention and the current grade level material being taught.

3. Instruction during the intervention should be explicit and systematic. The instruction should provide models for problem solving, verbalizing thought processes, guided practice, corrective feedback, and frequent cumulative reviews of the material.
4. Interventions should provide instruction with solving word problems. An example of this is instruction with problems associated with addition and then with the inverse operation of subtraction.
5. The materials should allow opportunities for students to work with visual representations of mathematical ideas in order to translate symbols and numbers into meaningful understandings.The interventionists should be proficient in the use of visual representations.
6. Interventions at all grade levels should devote about ten minutes in each session on basic fact fluency practice. This can be done with technology or with flashcard type activities.
7. Monitor students receiving interventions and others who are at risk. Use curriculum-based assessments to determine how well the student has learned the day or week's lesson. Also, continue to progress monitor in order to see how the intervention and overall math program is affecting the student.
8. Include motivational strategies within the intervention program. Active engagement and students accomplishments should be encouraged and recognized.

Interventions

According to the National Council of Teachers of Mathematics Principles and Standards for School Mathematics (2000), mathematics should be taught equitably to all children. Students must all have opportunities to be active participants in their learning.

There are two types of math intervention programs, ones that focus on procedural skills with explicit instructions and programs that rely on a conceptual framework of teaching. Procedural skills-based programs such as Connecting Math Concepts, Cover, Copy, and Compare, Flash Math and Reflex Math are systematic approaches that teach math procedures step-by-step in order to perform operations and solve problems. Conceptual based approaches look to improve the understanding of the math principles being used and the "why" behind these principles. Conceptual based approaches focus on building concepts gradually from the concrete to the more abstract. Examples include Mathematics Recovery, The Numeracy Recovery Program, ST Math, and Number Worlds (Karakonstantaki et al., 2018). An issue identified by Karakonstantaki (2018) is that most interventions for elementary math students are designed for students in grades kindergarten through third and that these programs focus on helping students catch up with grade level peers, while not addressing the underlying factors of these students' problems in math. Karakonstantaki (2018) also finds that a focus on conceptual understanding combined with procedural teaching benefitted students the most.

Leali, Byrd, and Tungmala (2012) found that all students need access to important mathematics and that children who need interventions should be provided the support necessary to reach proficiency. Ulichnie (2011) questioned the impact of an intensive math intervention on student math achievement and suggested that students need an equal

amount of support in math compared to what a struggling student would get in reading. Teachers must be aware that often vocabulary and language barriers can create an issue for math learners (Leali, Byrd, and Tungmala, 2012). Leali, Byrd, and Tungmala (2012) found that English Language Learners must be given frequent and direct instruction to move them from simply learning about math vocabulary and symbols to a deeper understanding of math concepts and properties (Leali, et al., 2012). Their research on English Language Learners seems relevant when thinking about all students in need of interventions. As Leali, et al. (2012) explain, math teachers must find different ways of talking about mathematical objects and mathematical situations to bring the concepts into daily conversation and factors other than mathematical skills contribute to success in conversations about solving word problems. Vocabulary understanding and verbal skills are some factors that assist with solving word problems. The setting of the word problem may not be familiar to students and should be discussed. Students may get distracted trying to understand the story rather than focusing their time and energy on pulling the important math information out of the problem. Sufficient background knowledge must be provided to the student and problems can be reworded to fit their prior knowledge if necessary. Graphic organizers and visual representations should be provided to the students along with modeling troublesome vocabulary words or idioms can also be a helpful strategy. Allowing students to verbalize and work on word problems together, with support when needed, can also be a powerful strategy (Leali, et al., 2012).

Mong and Mong (2010) report that both Mastery to Mastery and the Cover, Copy, Compare intervention programs show promise in increasing math fluency in children as measured by digits correct per minute. Computational fluency is a necessary skill for

math success and repeated practice of basic facts is a key component to help develop mastery (Burns et, al, 2014). Extensive practice of basic facts is not found in many math curriculums today, therefore schools should find ways to supplement basic facts instruction in the classroom. Cover, Copy, Compare and Reflex Math are both programs designed to improve the accuracy and fluency of student responses to basic fact problems. Factors that contribute to both program's success include the brief time needed to complete learning trials which allows students to complete many learning trials and keeps motivation high. The other key component is the self-evaluation component which prevents students from practicing incorrect responses.

Math to Mastery relies on the preview of problems, repeated practice, immediate feedback, summative and formative feedback, and self-monitoring of progress. Students working with the Math to Mastery intervention also benefit from the modeling that is part of the program. Modeling shows the correct way to solve the math problems and the appropriate rate at which problems should be solved.

IXL is another technology-based program that differentiates instruction and provides immediate feedback to students. IXL explains incorrect responses when students get a problem wrong. Repeated practice, immediate corrective feedback, goal setting, progress monitoring and self-charting have been shown to increase academic performance.

Both programs, Math to Mastery and IXL, contain many of the same key components. The Math to Mastery program relies on an interventionist to model and provide feedback to the student rather than a worksheet approach as found in the Cover, Copy, Compare program. The social feedback is a valuable component of the Math to

Mastery program. Math to Mastery and Cover, Copy, Compare were both shown to increase student math fact fluency and proficiency, but Math to Mastery showed higher scores with the students which support the need for repeated practice interventions to build fact automaticity in students (Mong & Mong, 2010).

Florez and Wilkins (2016) studied the use of manipulatives by students in math classes. Florez and Wilkins (2016) summarized that student learning is most effective through engaging learning lessons which involve multiple representations of the mathematical content. Math manipulatives are tools used to provide a better understanding of math concepts. Florez and Wilkins (2016) focused on manipulative use over time from grades K-5, and wanted to see if manipulatives affected student learning or growth. Manipulatives are defined as objects that can be touched, moved, rearranged, or stacked. Examples include base-10 blocks, counters, geometric shapes, and pattern blocks. Virtual manipulatives, that students are finding on computer based interactive programs, are being utilized increasingly more in schools. Florez and Wilkins (2016) found a positive relationship between manipulative use and math learning over time, and that the frequency of manipulative use positively affects math learning. The continued use of manipulatives with students in the upper elementary grades is also beneficial to student learning (Florez and Wilkins, 2016). Interestingly enough, their research shows that manipulative use decreases as students progress through the grade levels. The use of manipulatives in the intermediate grades would be an area that would warrant additional professional learning for teachers to become more familiar with manipulatives and how to implement them in their classrooms.

The research regarding manipulative use has been mixed over the years, but more studies point to the benefits than the negatives (Liggett, 2017). Liggett (2017) emphasizes that math instruction should be real for the students and using manipulatives can help make this happen. Liggett (2017) cautions that manipulatives must be used appropriately or they could cause frustration and disrupt student motivation and learning. Liggett (2017) finds that manipulatives will help teachers differentiate their instruction and provide multiple pathways for students learn the new content. Again, manipulatives are not only effective with primary grade students, but also with intermediate students and are especially helpful with students who need remedial help. Liggett (2017) focused on manipulative use for second grade students and the results showed that students who used manipulatives performed better on a post-test than students who did not use manipulatives. Liggett (2017) believes that manipulative use not only increases the overall test score, but also gives students additional methods or strategies for solving problems and being more successful math students. This math understanding and success will transfer later in life to additional success in their schooling and open up varied career opportunities.

Strategies for working with students who struggle with word problems is the focus of the work by Hord and Xin (2013). Metacognition instruction is a skill that can help students organize their thinking and representation of the problem. Teaching students to use schematic representations rather than pictorial representations is another useful strategy to teach students. This decreases the difficulties in storing, organizing, and processing the information needed for the problem. The final point made by Hord and Xin (2013) is to teach the student how to transfer the skills and knowledge from one

problem or situation to similar ones in the future. The lessons and strategies students learn from solving a word problem should be transferable and connected to past and future word problems. Teachers need to help students make these connections.

Technology Based Interventions

Almost every upper level elementary student owns and uses some type of mobile device, iPad, cellphone, etc. Educators are using this technology to improve student engagement, peer interaction, and collaboration. Technology, like mobile devices, can also be used to provide more equitable and personalized instruction, expose students to the technology that are prevalent in the world and workplaces, and improve test scores (Hollands & Pan, 2018). They are also using forms of technology to collect classroom feedback, improve communication, reduce technology costs, and extend the time and place of learning (Karakonstantaki et al.,2010). Elementary teachers are beginning to use technology to improve learning by supplementing teacher led instruction or at times replacing teacher led instruction (Hollands and Pan, 2018).

The most popular mobile learning initiative is the one-to-one laptop, but the inconsistent use and high costs lessen the effectiveness of the initiative at times. Using mobile devices for educational gaming is becoming popular in schools now. Mobile gaming allows students to select their own learning paths based on prior knowledge and learning progress. Students are typically highly engaged in the mobile-based interventions. An interesting find noted by Karakonstantaki et al., (2010) is that the use of computers for math instruction did not significantly enhance student performance, but it did positively affect the performance of those students with math disabilities.

In a study done by Kiger, Herro, and Prunty (2012), second and third grade classrooms utilized the Everyday Math program resources along with mobile learning apps on an iPad to increase skill level on multiplication facts. Students practiced 10 minutes a day. Other students utilized the Everyday Math program along with traditional flashcard methods to practice multiplication facts. Students using mobile learning interventions answered more items correctly on the final assessment. The same students also answered more of the difficult items correctly. This study by Kiger, Herro, and Prunty (2012), suggests combining a traditional curriculum with a mobile device may be an effective way to improve student achievement. Keys to effective mobile learning implementation include: administrative and school commitment, trained teachers, instructional technology integration, classroom management and facilitation with the use of the mobile device. Schools may also need an onsite resource person to support teachers and the technology (Kiger et al., 2012).

Accelerated Math is an example of a technology-based intervention. Its primary focus is to enhance a math curriculum so that teachers can use the program to give students a boost of individualized practice on basic math skills which are necessary for students to have in order to build application and problem-solving skills. Used to complement Everyday Math in a Minnesota school, it has been shown to increase students' academic achievement in math as shown on standardized tests (Kiger et al., 2012). Its use has enabled teachers with the ability to provide more individualized instruction to the students either in the form of individual assignments or one-on-one work with the teacher. Whole group instruction only amounted to 42% of classroom time during math lessons when a supplemental online based math program is used. Utilization

of a core curriculum program alone results in whole group instruction over 81% of the time (Ysseldyke et al., 2003).

In the Ulchnie (2011) study, students utilized IXL for 30 minutes every day as an intervention. IXL is an online program that supports the practice and reinforcement of skills learned in the classroom (Holland & Pan, 2018). The activities in IXL are tied to the Common Core State Standards. At the conclusion of the Ulchnie study all of the students in the focus group made gains in overall math growth. Holland and Pan (2018), referenced other studies that did not show that IXL use with students showed clear, measurable growth. Holland and Pan (2018), also studied the effects of IXL and could not claim causality between IXL and math achievement as measured by the Star Math Assessment. Teachers of the students in this study cited the level of rigor as a concern and stated that the level of rigor in the IXL questions was less than the level of difficulty found on the Star Math Assessment. The same teachers also reported that IXL is useful for practicing and reinforcing skills, but not as helpful in applying concepts to difficult multi-step problems.

Reflex Math is another popular computer-based intervention program being used daily with many students across the country. Reflex Math works on student recall of basic addition, subtraction, multiplication, and division facts with the use of online games for students. The program tracks fluency, measures response speed, and adjusts instruction to meet students at their fact recall development level, while also providing reports for teachers to track performance and usage (Sarrell, 2014). Reflex introduces students to small sets of facts, allows them time to become proficient with the new facts, has a timed component, regulates the difficulty of the facts, and ends each session with

game-based practice (Sarrell, 2014). Sarrell (2014) concluded that at-risk middle school students who participate in the Reflex Math program see higher improvements in math facts than those students using only traditional methods.

Sarrell (2104), further analyzed the data to determine if the program affected males and females differently. Both males and females using the program scored higher on basic fact recall tests than other male and female students not using the program. Females benefitted more than the males from the exposure to Reflex Math.

Spatial Temporal Math or ST Math is another online program. ST Math uses images to help students develop spatial-temporal skills that can improve student understanding of fractions, proportions, and other mathematical skills (Tran et al., 2011). ST Math provides game-based challenges that utilizes visual puzzles. Interactive visuals provide students with immediate feedback on their solutions (Wendt, Rice & Nakamoto, 2019). ST Math has been shown to have positive effects on student achievement after the first year of implementation (Tran et al., 2011). Wendt et al., (2019) also studied the effects of ST Math by comparing grade levels of students receiving ST Math against same grade level students not receiving ST Math. Wendt et al., (2019) compared both groups based on their average scores on state standardized tests and the percentage of students reaching proficiency on these tests. The students in grades three, four, and five who used ST Math had overall higher proficiency percentages on the same state assessment than the same grade levels of students without the exposure to ST Math (Wendt et al., 2019). Students in grades four and five performed better when comparing the average achievement scores of these students. This was not the case with grade three students as the results were not statistically significant (Wendt et al., 2019). Tran (2011)

also reported the additional benefit of positive changes in teacher efficacy and instructional practices after utilizing this program with their students.

Everyday Math

Everyday Math was a federally funded research project out of the University of Chicago. Its philosophy was to build symbolic understanding of math through the use of manipulatives, and student discussions with each other and the teacher. The program focuses on basic fundamental math exercises in grades K-3. In grades 4-6 the focus shifts to problem solving with information from the different curriculum areas as it builds on the math experiences that students have already gained. The program is now in its 4th edition and is the curriculum used in the Bellefonte Area School District.

Bell and Isaacs (2010), describe the program as being organized into nine strands and six themes. The strands include Numeration and Order Relations; Operations and Number Systems; Measures, Numbers in Reference Frames; Algorithms and Procedures; Data and Chance; Geometry and Spatial Sense, Patterns, Rules, and Functions; and Algebra. The themes that the authors feel students need to develop are estimation and number sense, algorithmic and procedural thinking, mental arithmetic skills and reflexes, problem solving and mathematical modeling, multiple representations and methods, and links of mathematics to the everyday world.

According to McGraw-Hill Education, Everyday Math is a comprehensive k-6 math program that provides multiple pathways to learning to help teachers meet the varied needs of the learners in their classrooms. The program contains assessment tools as well as an online evaluation and reporting system. The key feature that Everyday Math

has that most programs do not have is its spiraling feature. This means that lessons and practice of each standard are spread across multiple lessons and units throughout the year. The program offers interactive games for students to practice skills from classroom lessons (mheonline.com/everydaymath4). A drawback of the program is the lack of practice of basic facts (Ysseldyke et al., 2003). This approach to math and this program is quite different than what most teachers are used to utilizing (Bell & Isaacs, 2010). Major changes in how teachers think about math and instruct math needs to be taught to teachers who utilize the Everyday Math curriculum.

Everyday Math has shown to be successful in promoting the growth and achievement of students. In a study completed with a large group of third, fourth, and fifth grade students from Texas, Waite (2000) found those students being instructed with the Everyday Math curriculum had higher scores on the Texas Assessment of Academic Skills and showed greater achievement gains than similar math students using a different curriculum. The students using the Everyday Math curriculum scored 3.9 points higher on the assessment and 81.4 percent of students passed the assessment compared to 72.3 percent. Waite (2000), also looked at all student demographic categories and each category performed better with the exception of Hispanic students. African-American and low-socio-economic students showed greater gains than some of the other groups. The reason suggested for the Hispanic students not showing the same level of achievement was their language barriers that many of them face. Language barriers and math success is a connection that cannot be overlooked.

Departmentalized Math Classes

Elementary teachers over the years have had to be curriculum and content experts in all subject areas in order to meet the needs of their students in the traditional classroom set-up. This structure has been made even more demanding with the pressures on teachers caused by standardized testing (Nelson, 2014). This has made schools rethink their elementary classrooms and some have transitioned to the departmentalized classroom model. Departmentalized classrooms can be defined as a teacher being responsible for the instruction of students in one academic area, or it can be thought of as students moving from one classroom to another classroom for math, science, language arts, and their other classes. Teacher in departmentalized settings can become content experts in their teaching area and can devote their time and energy to plan for only one or two content areas. Instead of having their planning and research for lessons spread out over four or five subject areas, they can focus on one or two subject areas (Nelson, 2014).

A mainstay in elementary education over the years has been the emphasis of relationships with each child and this can be difficult to cultivate in a departmentalized setting. A research study completed by McGrath and Rust (1996) showed that fifth grade self-contained classrooms score significantly higher on group achievement tests when compared to departmentalized peers. In this study, self-contained students gained more than departmentalized students in Total Battery, Language, and Science in fifth and sixth grades, but no differences were found in Reading, Math, or Social Studies. Transition time was more efficient in the self-contained classes. The average transition time was 3.27 minutes for self-contained classes and 4.55 minutes for departmentalized classes. No significant differences were found in actual instruction time. Nelson (2014) wanted to

compare the math performance of fifth grade students in departmentalized settings with those in traditional settings. Nelson (2014) found that students educated in departmentalized classrooms showed a significant statistical difference in achievement compared to students in traditional classrooms. Educating fifth grade students in departmentalized math classes, according to Nelson's research could help students gain a better understanding of mathematical concepts and prepare them for the higher-level learning that awaits them in middle school. Nelson (2014) also believes that the achievement gap is not so much about race or socio-economics, but may be more about the educational setting and level of instruction in these classrooms. She states that departmentalized classrooms provide all students with high levels of instruction and equity in their education.

Professional Learning

Professional learning should be personalized for each teacher just as learning is personalized for students (Hollands & Pan, 2018). The learning for teachers should be job-embedded within their classrooms while learning alongside other teachers under the guidance of math education experts (Friesen & Francis-Poscente, 2014). Friesen & Francis-Poscente (2014) stress the need for teachers to have a combination of lesson study, mentorship, and participation in Math Fair. Friesen & Francis-Poscente (2014) define Math Fair as a collaboration with other math teachers on deep, higher level thinking math problems that opens their eyes to how math can be taught differently.

Teacher learning must be differentiated based on their needs as math teachers. Math teachers must have direct training on planning, implementing, evaluating, and assessing student work. Friesen and Francis-Poscente (2014) stated teachers don't need

additional training on math concepts and procedures for teaching math, but more on identifying the cause of student misconceptions and moving the student's thinking beyond those misconceptions.

Bell and Isaacs (2010), reported that teachers need to think about and teach math differently now than they did in the past. Bell and Isaacs (2010) listed several areas for teacher development in order for them to be successful, and stated that teachers need to understand that mathematics is more than just arithmetic. Effective instruction is also the linking of mathematics to its everyday uses. Strengthening students' use of mathematical vocabulary is another change as well as becoming more comfortable and being able to facilitate partner and group work. The last area of improvement for teacher professional learning is to become familiar with the many strategies that students can use to solve a problem and to encourage students to use multiple strategies and be able to talk about those strategies.

Conclusion

There are many interventions and strategies being implemented in elementary school math classrooms across the United States and throughout the world. There is an abundance of research explaining what works and what is not effective for students exhibiting low math achievement. This study hopes to find out what is successful in my district and what can be added to our math classrooms to fill the gaps. A key learning in the literature review is the concept of high expectations and equity of educational experiences. Lower achieving students must be challenged and provided with the same level of rigor as higher achieving students. The difference is that lower achieving students require more academic and emotional support from the teacher.

Student and teacher anxiety in math is another area that is prevalent in the literature. Math anxiety can halt a student's determination and progress in math class. Math anxiety also has long term effects as students affected with math anxiety typically will avoid higher level math classes and career fields involving math or science.

It is no surprise that differentiation and identifying student strengths and weaknesses through sound assessment practices are effective practices in high achieving schools. Many schools are now taking advantage of students' inclination for technology as they are meeting the needs of students by implementing technology-based programs or applications. There are many programs out there and the research is inconclusive about many of them, but Reflex Math, ST Math, IXL are programs that are of great interest to me since students in my district are exposed to these programs on a daily basis. The research is finding that a combination of direct instruction with a traditional teacher led curriculum and online program can be very effective in elementary math classrooms.

Ultimately, in order to have a positive effect on students and their learning, teachers' skill sets must be enhanced. Teachers should develop the skills to show students how to think deeply about math concepts and to understand the concepts in ways that can be transferred to other problems. Teachers must use strategies that were not prevalent or used with them when they were in math classes as students.

The data that will be collected from this study will inform the research of the strengths and weaknesses found in my district's third, fourth, and fifth grade classrooms. These identified areas will provide educators with strategies that can be enhanced through professional learning opportunities so that what is learned by teachers can be transferred to students to positively affect student growth and development in math.

CHAPTER III

Methodology

Purpose

The purpose of this study is to determine the math interventions and instructional strategies that are proving to be successful in third, fourth, and fifth grade classrooms across the Bellefonte Area School District. Math scores on PSSA standardized assessments vary from classroom to classroom and building to building across the district. Student scores on the PSSA's over the past five years are not seeing much growth. This study will determine the classrooms that are finding success and the commonalities between them. Additionally, this study will identify any trends in classrooms that are not showing success. Instructional strategies and interventions that are increasing growth will be identified. As a result of this research, successful areas of math instruction and promising interventions will be shared with math teachers across the Bellefonte Area School District. This will help improve the overall math achievement of the students. The effect of departmentalization on math scores in the district will be assessed during this study. Finally, the professional learning needs that will benefit math educators and students will be identified.

In quantitative research studies, the collection and analysis of numerical data are used to describe or explain the subject of the study. The quantitative data in this study will focus on student achievement and growth data. This data will help identify the classrooms that are demonstrating the most success as well as the classrooms that are not as successful. By focusing on and analyzing only the numerical data, objectivity in the findings is a strength of the quantitative research portion of this study.

The purpose of qualitative research is to study the quality of a subject. This phase of the research studies the quality of math instructional practices, strategies, and interventions that are being used in classrooms. The qualitative data consists of a teacher questionnaire that identifies the interventions and strategies that are being used in their classrooms. Comparing the strategies used in the classrooms with the classrooms that are showing the most positive results will provide valuable information to all math educators in the Bellefonte Area School District.

Therefore, a mixed-methods approach to research is utilized to answer the research questions. Mixed-methods research is defined as a study that includes both quantitative and qualitative research (Mertler, 2019). Mixed-methods research allows for the mixing of the collection of quantitative data, student archived academic data, with qualitative data, the teacher survey data. Using both types of data prevents the researcher from being limited by only considering one type of data. Mixed-methods research allows for multiple perspectives to be included in the study. Both sets of data are stronger and more informative when combined with each other since neither set of data can answer the research questions alone. A mixed-methods approach to the research will provide depth and breadth to a study (Mertler, 2019).

Setting and Participants

"Inspiring and Preparing Today's Learners to Prepare for Tomorrow's Challenges" is the mission statement of the Bellefonte Area School District. Math achievement is a major curricular area for students to master in order to meet the mission of the school district. Math scores have been a constant area of interest in the district over the years.

The school district is located in the town of Bellefonte, Pennsylvania. Students reside in Bellefonte and in several small neighboring communities. Bellefonte is located approximately 8 miles east of the Pennsylvania State University and approximately 25 miles west of Lock Haven University. The district benefits from being in close proximity to both of these higher institutes of learning. Many quality teachers from the district are graduates from these universities. The district's teachers also benefit from the collaboration and professional learning opportunities that are available through these universities. Many teachers within the district host student teachers from these schools. Being this close to both of the universities produces a community that values education and has high expectations for its students and schools. Parental support is a tremendous resource for the school district.

The school district has a total enrollment of 2,636 students in grades kindergarten through twelfth grade. The district has four elementary schools, one middle school for students in grades six through eight, and a high school for grades nine through twelve. This study is focusing on the students and math teachers across the four elementary buildings in grades three, four, and five for the past three years.

Marion-Walker Elementary and Bellefonte Elementary are both similar in size but opposite in demographics. Both of these schools are the larger elementary schools in the district, but the number of economically disadvantaged students in Bellefonte Elementary are much higher. The two similarly smaller sized schools in the district are Benner Elementary and Pleasant Gap Elementary. Pleasant Gap Elementary has a much higher economically disadvantaged student population than Benner Elementary. Both Pleasant Gap and Bellefonte Elementary Schools are designated Title I Schools. Table 4, on the

next page, shows student population and teacher numbers in grades three, four, and five for the past three years.

Table 4

Number of Students and Math Teachers

School	Year	Third Grade	Fourth Grade	Fifth Grade	Total Students	Number of Math Teachers
Benner	2018-19 2017-18 2016-17	33 42 43	40 47 43	41 42 43	114 131 129	4
Pleasant Gap	2018-19 2017-18 2016-17	26 35 38	34 37 42	41 42 36	101 114 116	4
Marion-Walker	2018-19 2017-18 2016-17	77 55 45	54 43 68	46 64 49	177 162 162	7
Bellefonte	2018-19 2017-18 2016-17	53 59 56	58 51 68	49 63 64	160 173 188	5

In order to more accurately describe each of the elementary schools, the demographics of the schools are shown in percentages on the next page for the 2018-19 School Year.

Table 5

School Demographics A

School	Males/Females	White	Black	Hispanic	Asian	Native American/Alaskan Native	Native Hawaiian/Pacific Islander	2 or More races
Benner	56.4/43.6	96	0.9	0.4	1.3	0	0	1.3

School	Males/Females	White	Black	Hispanic	Asian	Native American/Alaskan Native	Native Hawaiian/Pacific Islander	2 or More races
Pleasant Gap	53.3/46.7	93.3	0.5	1.9	0	1.0	0	3.3
Marion-Walker	48.9/51.1	96.4	0	1.7	0	0.6	0	1.4
Bellefonte	48.5/51.5	88.6	2.4	6.3	0	0	0	2.7

Table 6

School Demographics B

School	Economically Disadvantaged	English Language Learner	Special Education	Gifted Students
Benner	20.7	4	11.5	0.9
Pleasant Gap	38.6	5.2	18.6	0
Marion-Walker	15.6	0.6	14	0.6
Bellefonte	47.9	1.8	21	1.2

The teachers in the study are selected naturally and purposefully. These teachers are currently or recently teaching math in grades three, four, or five over the past three years. The teachers range in years of experience from as little as two years of experience to as much as 25 or more years of experience dating back to the 2016-17 school year. They all have extended their education beyond a Bachelor's Degree and many of them have Master's Degrees. They all have achieved tenure as of the 2019-20 school year.

The elementary schools departmentalize instruction in grades four and five. Students in these grades switch classes for math, science, social studies, and language

arts. One teacher is responsible for math, science, and social studies instruction in each of those grade levels while another teacher is responsible for language arts instruction. The exact structure of the departmentalization in each building may look a little different depending on the number of sections in each grade level.

Previous grade level teachers create classroom rosters. The rosters are finalized by the building principal and many factors are considered when the rosters are created. Equality between the classes across all categories is a priority in the heterogeneously grouped classrooms. The categories considered as class rosters are created include the number of males and females, special education students, English Learner students, behavior concerns, academic abilities of the students, and the overall teacher-student fit. The classroom rosters are created to be as equitable as possible within each school and across the school district.

The district has a Math Intervention Specialist that services Marion-Walker Elementary and Bellefonte Elementary, and a Math Instructional Coach who collaborates and provides professional learning to all elementary teachers. Each of the schools is also led by a building principal whose primary responsibility is managing and overseeing the overall success of their school.

The math classrooms across the Bellefonte Area School District share a common curriculum and have approximately 75 minutes of math instruction per day. Everyday Math is the curriculum that is used in each classroom. Components of the program that are utilized include the student reference book, the math journal, the games and activities, and the online component. Classrooms also supplement with Reflex Math which is an online program that targets basic facts acquisition for students. Reflex Math has been

used in Bellefonte Elementary for the past three years. The 2019-2020 year is the first year that the three outlying buildings are using the program. The classrooms also supplement instruction and provide interventions with various other programs of the teacher's choice.

Typical math lessons include the following components: mental math activity and math message to begin the lesson, direct teaching, independent practice, differentiation, games to reinforce, and a short daily formative assessment. Some teachers differentiate their instruction more effectively by implementing the guided math strategy to their daily instruction. Teachers are transitioning from whole group lessons for the majority of the math class to shorter mini-lessons, math stations that are completed independently by the students, and small group direct instruction based on students' needs.

Technology use is extensive across the district. Every student has been assigned a Chromebook. This 1:1 initiative allows for easy access to the resources and activities that are technology based. All teachers across the district in grades three, four and five utilize some form of technology within their instruction on a daily basis. Promethean Boards are also utilized by each teacher to take advantage of the online resources that are used in the classrooms. Students and staff are adept at utilizing technology resources to support and enhance learning.

Research Plan

This research study follows a Mixed-Methods Research approach. Both quantitative and qualitative research methods and data are utilized. The variables in the study are not manipulated in any way. The variables are measured as they naturally occur within each classroom and with each teacher and student. The variables in question are

the teacher practices used in the math classes and the math data supporting the results of these strategies in how they affect student achievement and growth. The study explores the reasons why some math teachers and classes perform better than other classes and teachers. The researcher is seeking to evaluate causes of any differences within classrooms by looking at archival math data and teacher questionnaire data. In this study, the researcher's goal is to describe and interpret the achievement and growth of the math students in grades three, four, and five along with the teachers' strategies and interventions that are implemented within each classroom and grade level.

An explanatory sequential design method of collecting and analyzing the data is used. In the first phase of the study, quantitative data is collected and analyzed. The teacher's classroom math data is the crux of the research study and is given priority by the researcher. The second phase of the study includes the collection of qualitative data. This data is the teacher questionnaire data. The qualitative data provides more clarity to the quantitative data. The analysis of the quantitative data helps drive the type of qualitative data the researcher needs to answer the research questions. It is the researcher's intent that the thoughts, beliefs, and perceptions of the teachers found in the qualitative data will further enhance and explain the quantitative data.

The level of interaction between the quantitative and qualitative data is interactive. The two strands of data are combined during the data collection and analysis process as opposed to occurring only at the end of the study. Both sets of data receive equal prioritization in addressing the goals of the study. The data is collected sequentially, with the quantitative data collected first and then analyzed to help guide the collection of the of qualitative survey data. The point of interface for the data will be

during the data analysis phase of the study. At this point both sets of the data are combined to analyze and answer the research questions.

The research process involves collecting assessment data for the past three years. The data is then organized and analyzed to allow for the ranking of teachers and their classes. The teachers are ranked from highest to lowest in terms of student achievement. Then survey data from math teachers over the past three years are collected. At this point, the researcher begins to look at the assessment data and compares it to the teacher survey data. Trends in teacher practice in higher performing classes and lower performing classes will be identified. It is important to note that all student and teacher data is confidential and neither teacher nor student is identified in the study. Teachers will be identified by a number through a random selection process to protect their privacy.

The first step in the study is to identify the topic of interest or concern. In this study, math achievement and growth are determined to be a concern and learning why some teachers' classes are more successful over the years than other classes is the purpose of the study.

After identifying the topic and research questions, the next step is to identify the teachers and students who are the natural participants in the study. As discussed earlier, this is done by selecting the math teachers in grades three, and four, and five across the entire district. The identification and selection process each require working with the other building principals and the district's Human Resources Department to determine who the teachers of record were for the math classes during the three-year span that is being studied.

The data is identified and collected after the participants are selected. The researcher determines the quantitative data sets that are consistent and can show the most effective classrooms and teachers in grades three, four, and five. The data selected for the study is PSSA math data, end of year final grade percentage for the students which is based on common curriculum-based measures, and Classroom Diagnostic Tests scores at either the end of the year or the middle of year depending on the final time the tests were completed in each grade level. Classroom Diagnostic Test administration varies by grade level and by year, but were consistent from grade level to grade level and teacher to teacher each year. The final piece of quantitative data to collect is the teacher specific PVAAS score for teachers in grades four and five. This shows the average amount of growth on a three-point scale for teachers in grades four and five over a three-year window.

Pennsylvania System of School Assessment (PSSA) data results are gathered for the 2016-17, 2017-18, and the 2018-19 school years for all students in third, fourth, and fifth grade during those years. The purpose of the assessment is to provide data for teachers and administrators to improve academic performance in reading, math, and science, and for students and parents to understand the student's basic achievement in those academic content areas. The scores are also used as part of the teacher evaluation system and are a major component in each building's School Performance Profile score. For these same students, Classroom Diagnostic Testing (CDT's) data are collected. CDT's are administered in the fall, winter and/or spring. These are assessments that provide diagnostic information to guide instruction and support intervention and enrichment in math, language arts, and science. The other piece of data used is the end of

year final math grades for students. This is the overall percentage earned by the student on the local curriculum-based assessments. Teacher PVAAS data is also collected for those that had it available in grades four and five.

The qualitative data was gathered through the use of Survey Research. The process for creating the survey was to first identify the topic and the purpose for the survey. Next, the target population was identified and since the number of potential participants was limited, it was decided that all teachers would receive the survey. A web-based Google Form was used as the survey tool. This worked well as the researcher and the teachers are familiar with the Google platform since this is the primary online platform utilized in the district. The cover letter and consent forms were developed, followed by the draft of the survey questions. The survey questions were piloted with a teacher and an administrative colleague for feedback. Feedback was received on the amount of time need to take the survey, the clarity of the directions, and questions that needed clarified or reworded. Once the revisions were made, the survey was emailed to the math teachers along with the consent form.

The questionnaire contained both closed and open-ended questions. The purpose of the survey was to gather teacher perceptions, opinions, and experiences on how they feel about the current math program being used in the district. The survey also asked the teachers about the interventions and strategies they use in the classroom and their perceived effectiveness. The survey had 18 questions and a total of 14 teachers participated.

Follow up letters and requests were sent to those teachers who did not complete the survey to increase the participation rate. These responses were automatically tallied in

a Google Spreadsheet for easy manipulation and analysis. This process for collecting survey data was fast, effective, and efficient. Advantages of this type of survey are that it is low cost and the data can be collected quickly. The disadvantage that this researcher found was that it was challenging to encourage the recipients to take the time to complete the survey therefore making the response rate lower than expected.

Once the data is collected it must be organized to allow for analysis of the math classrooms. The researcher averages and summarizes the quantitative data into a table. The teachers are randomly assigned a number name in order to protect their identities and keep the teacher and student data confidential. The point of this study is not to identify weak or strong teachers, but instead to identify the common strategies used by each type of teacher. The high performing and low performing classes and their teachers are identified by the researcher in order to look more closely at questionnaire responses.

Fiscal implications at this stage of the project are nonexistent or minimal at best. The quantitative data occur naturally within the school year and are already accumulated into the grade level's math spreadsheet. The teachers who decide to complete the survey do so voluntarily. In the future, the results of the study may determine the level and type of professional learning provided to the intermediate math teachers. The type of professional learning and amount of time will determine the cost of substitutes for teachers and materials for the learning sessions. The positive aspect of this approach is that there are already days and materials budgeted into the yearly math expense accounts for professional learning days. Additional expenses are dependent upon the results of the study and whether a program or specific intervention is identified as one that the entire district should utilize in the math grades studied.

Data Collection

The qualitative and the quantitative data is collected sequentially during the second semester of the school year. The quantitative data is collected first with the help of the district's math coach. This district-wide archival data is primarily housed and maintained by the math coach. The data is used to help her and other administrators plan professional development and grade level meetings for the teachers throughout the district.

The first step in collecting the data is to identify the teachers who taught math in grades three, four, and five from 2016-2018 school years. These teachers are then assigned a random letter by the researcher to protect their identity. The researcher uses purposeful sampling to identify the participants. Due to the small number of teachers who fit this qualifying category, the selection of participants was intentional. Every teacher who taught or is teaching math in grades three, four, or five during the 2016-2019 school years was selected. The total number of teachers included in the study is twenty. This manageable number of participants allows the researcher the time to devote to each participant in order to more fully understand and describe the results of the data.

The data collected from this sample of teachers may not provide findings that are transferrable to other settings, but it will provide findings that are specific and meaningful to the Bellefonte Area School District. Consistency in staffing was noted at Benner Elementary and Pleasant Gap Elementary as there was less staff turnover, which resulted in fewer teachers to analyze and more consistent results since these teachers were present for all three years of the study. Whereas at Marion-Walker Elementary and Bellefonte Elementary, since they are larger buildings, had more teachers and more teacher turnover.

This led to more teachers to analyze with some not having three years' worth of data to study.

Next, the district-wide math data spreadsheets are shared with the researcher by the math coach. These spreadsheets contain a cohort of students' summative math data from kindergarten through the present grade. In order to analyze three years' worth of teacher data, three separate cohorts of students needed to be analyzed for each teacher. These spreadsheets provided student PSSA scores, Classroom Diagnostic Test scores, and the end of year final percentages on district wide curriculum-based assessments. This data was extrapolated for each teacher in the study and an overall average was calculated for their students PSSA proficiency rate, Classroom Diagnostic Test average score, and the end of year average grade by students on local curriculum-based assessments for each of the three years. An additional piece of data was collected for teachers in grades four and five. Their PVAAS three year rolling averages were collected to determine which teachers had the biggest impact on student growth. All of this information was collected and organized in numerous tables that are included in the next chapter.

As stated earlier, no teachers or students are identified in the data. All teachers are given a random number as an identifier. Great care is given to ensure the confidentiality of the data and other information is not identifiable or included.

Qualitative data is collected in the form of a survey or questionnaire. The purpose of the questionnaire is to get a descriptive picture of what teaching strategies and interventions were occurring in each classroom. The survey is completed using Google Forms and consisted of eighteen questions that are designed to get teacher input about their classroom math practices. The questions are demographic, attitudinal, and

behavioral types. There are closed-ended as well as open -ended questions. The data collected is narrative in nature and does not lend to any type of statistical analysis. The responses are analyzed for patterns in terminology of strategies and interventions. The questionnaires are sent to twenty teachers and fourteen submitted survey results. Questionnaire prompts and responses are found in Appendix A.

Validity

Precautions and checks have been put in place to ensure the validity of the study. The data samples for the quantitative portion of the study are consistent for each teacher and class. Each data point is used to determine the successful math classes. They show a form of overall math achievement for each class. Using three years' worth of data helps minimize outlier classes or unforeseen circumstances that invalidate the data. The qualitative questionnaire data and interviews support each other and are used to clarify and strengthen the quantitative data.

In assessing the validity of qualitative data, the researcher ensures the trustworthiness of the data and findings. In order to accomplish reliability, several methods and sources of data are considered. Triangulation of the data supports the validity of the researcher's findings. Four types of quantitative data are used to determine the achievement or growth of the classrooms and teachers rather than relying on one or two types of data. This helps ensure the validity of the identification of the achievement levels in each of the classrooms.

The researcher's extensive familiarity with the area of study and of the participants also allow for an accurate analysis of the findings which strengthens the validity of the study.

The quantitative and qualitative data are equally relevant in supporting the study and answering the research questions. Both sets of data weigh equally in drawing conclusions at the end of the study. The qualitative data and interview statements support the quantitative results.

The final way to assess the validity of the study is through the use of peer debriefing. Neither of the peers reviewing the study are invested personally in the study. Their review focuses on looking for any inconsistencies or issues with the researcher's interpretation of the data. Interpretations of the data and discussions from the researcher's perspective are vital for this part of this process. The peer de-briefers identify any alternative interpretations and possible bias from the researcher. The de-briefers did not cite any bias or misinterpretations of the data and results.

Closing

This section describes the methodology that is used in the study, including the setting and participants, research plan, data collection, validity, and closing. This study determines the interventions and strategies that math teachers in the Bellefonte Area School District are increasing student achievement and growth with in grades three, four, and five.

CHAPTER IV

Data Analysis and Results

Introduction

In this chapter, the analysis and results of the data collected will be described and summarized in order to answer the research questions. The questions that will be answered are: What instructional strategies or interventions are teachers using in the Bellefonte Area School District to increase growth in student math skills? How has departmentalization in elementary schools aided students in their math growth or hindered their progress? What professional learning opportunities does the district need to provide teachers to ensure more consistent use of intervention strategies as well as data protocols?

Data Analysis

To answer the research question about effective math interventions and strategies being used by teachers in grades three, four, and five in the Bellefonte Area School District, the efficacy of the participating teachers must first be analyzed. In this study, effective teachers are identified by comparing their three-year average scores on three to four sets of data depending on their grade level. Third grade teachers are ranked and analyzed by looking at PSSA scores, end-of-year Math Benchmark average scores, and Spring Classroom Diagnostic scores. The same data is used for fourth and fifth grade teachers along with PVAAS teacher specific data. After collecting and organizing this data, the data set rankings for each teacher were averaged to determine the final overall ranking of each in the study. The questionnaire responses from the top two teachers from

each grade level were then compared and analyzed to determine if any trends existed within their classroom structures or instructional approaches. These trends would be identified as the effective math interventions or strategies used by district teachers.

The process used for answering the research question concerning the effectiveness or lack of effectiveness of departmentalization was to analyze three sets of data. PSSA and PVAAS data prior to and after departmentalization as well as teacher responses from the questionnaire were the data sets used for this question. Fourth and fifth grade PSSA math proficiency rates were compared over a four-year window prior to and after departmentalization. PVAAS three-year Growth Measures were collected to analyze the growth of students prior to and after departmentalization. Teacher perceptions were also considered and compared to the academic data that was collected.

The final question concerning teacher professional learning utilizes the questionnaire responses from the teachers and the findings from the first research question. Commonalities were identified in the questionnaire responses, and the strategies used by the most effective teachers helped in formulating the professional learning needs of the district.

Results

For the first research question, teachers were ranked from highest to lowest on each of the data sets available for the teacher and grade level. Teacher rankings were based strictly on student achievement and growth scores. Their ranking average is shown in the final table. These rankings enabled the researcher to identify the top-tier math

teachers in each grade level so that their habits and pedagogy could be more closely studied to see what makes them more successful than other math teachers.

Looking at only the PSSA proficiency percentages in Table 7, five out of the top seven teachers are third grade teachers. The other two teachers are fourth grade teachers. The remainder of the fourth and fifth grade teachers can be found in the middle and toward the lower end of the scores. Three out of the top five teachers in this data set are from the same school.

Table 7

PSSA 3 Year Average

Ranking	Teacher-Grade	PSSA 16-17	PSSA 17-18	PSSA 18-19	**3-Year Avg.**
1.	5-3	70	90	81	**80**
2.	20-3	78	77	83	**79**
3.	14-4	73	80	65	**73**
3.	19-3	67	82	71	**73**
3.	11-3	N/A	71	74	**73**
4.	7-3	68	67	79	**71**
5.	4-4	67	70	72	**70**
6.	16-3, 5	3-76	60	59	**65**
6.	8-3	68	62	N/A	**65**
7.	17-3	N/A	N/A	63	**63**
7.	12-3	N/A	N/A	63	**63**
7.	1-5	55	75	59	**63**
8.	9-5	61	N/A	N/A	**61**
9.	3-5	76	54	51	**60**
10.	10-4	59	58	61	**59**
11.	6-3	63	63	44	**57**
12.	2-3	50	53	44	**49**
13.	15-3	39	67	38	**48**
14.	13-4	39	53	50	**47**
15.	18-5	40	40	45	**42**

Looking at the end-of-year Benchmark Assessment Data, a similar trend is evident as with the PSSA data. Third grade teachers dominate the top four spots with seven teachers, while a fourth grade and a fifth-grade teacher share the fifth spot.

The Classroom Diagnostic Test scores are interesting, as the scores show an inverse in the rankings compared to the PSSA and the EOY Benchmarks. Fourth and fifth grade teachers have scores much higher than the third-grade teachers. One explanation may be that third grade is the first year that students take the CDT and other online assessments, whereas the older students have had one or two additional years of experience with these types of assessments. The assessment rankings are indicated in Tables 8 and 9.

Table 8

Benchmark Assessment End-of-Year Avg.

Rank	Teacher	EOY Avg. 16-17	EOY Avg. 17-18	EOY Avg. 18-19	3-Year-Avg.
1.	5-3	86	90	87	**88**
1.	20-3	91	87	87	**88**
1.	7-3	88	86	89	**88**
2.	11-3	N/A	84	89	**87**
3.	19-3	82	87	89	**86**
4.	17-3	N/A	N/A	84	**84**
4.	15-3	83	87	81	**84**
5.	14-4	82	81	87	**83**
5.	18-5	77	85	86	**83**
5.	9-5	83.7	N/A	N/A	**83**
6.	1-5	81	84	81	**82**
6.	3-5	83	78	86	**82**
6.	10-4	79	83	83	**82**
6.	16-3, 5	83-3	81-5	83	**82**
6.	12-3	N/A	N/A	82	**82**
7.	4-4	80	79	80	**80**
7.	13-4	79	81	80	**80**
7.	2-3	78	80	83	**80**
8.	6-3	81	78	74	**78**

Rank	Teacher	EOY Avg. 16-17	EOY Avg. 17-18	EOY Avg. 18-19	3-Year-Avg.
9.	8-3	73	72	N/A	**73**

Table 9

Classroom Diagnostic Test 3-Year Avg.

Rank	Teacher	CDT 16-17	CDT 17-18	CDT 18-19	CDT 3-Year Avg.
1.	14-4	1024	1,082	991	**1,032**
2.	9-5	1003	N/A	N/A	**1,003**
2.	4-4	1015	1001	993	**1,003**
3.	1-5	984	1008	979	**990**
4.	3-5	1023	939	960	**974**
5.	18-5	964	952	962	**959**
6.	10-4	945	984	946	**958**
7.	20-3	917	1000	932	**950**
8.	16-3, 5	860-3	997-5	974-5	**944**
9.	13-4	908	951	903	**921**
10.	5-3	880	955	907	**914**
11.	11-3	N/A	885	938	**912**
12.	12-3	N/A	N/A	897	**897**
13.	19-3	845	886	930	**887**
14.	7-3	869	877	897	**881**
15.	6-3	887	855	863	**868**
16.	8-3	871	842	N/A	**857**
17.	17-3	N/A	N/A	829	**829**
18.	15-3	802	857	776	**812**
19.	2-3	804	808	821	**811**

The final set of data to analyze is the PVAAS Teacher Specific Rating. This data is available for only fourth or fifth grade teachers with at least three years of PSSA data prior to the rating being calculated. The scores are represented in Table 10.

Table 10

PVAAS Teacher Specific Rating*

Rank	Teacher	PVAAS 16-17	PVAAS 17-18	PVAAS 18-19	PVAAS 3-Year Avg.
1.	14-4	3.0	3.0	3.0	**3.0**
2.	4-4	3.0	2.3	3.0	**2.8**
3.	18-5	2.0	2.3	2.3	**2.2**
4.	10-4	1.9	2.15	2.3	**2.12**
5.	3-5	1.8	1.65	.47	**1.31**
6.	13-4	.43	.45	3.0	**1.29**
7.	1-5	1.5	1.0	.41	**.97**

*Grade 3 teachers do not receive a PVAAS Teacher Specific Rating. Grade 4 and 5 teachers must have three years worth of data before a PVAAS rating is given.

In order to summarize Tables 7-10 and use all the data to determine the effective teachers for each grade level, teacher rankings in the data categories were averaged to come up with a final ranking. Table 11 shows the most effective math teachers in the Bellefonte School District based on the data collected and analyzed in this study.

Table 11

Average Ranking of Effectiveness

Overall Rank	Average	Teacher/Grade Level	PSSA Rank	Benchmark EOY Rank	CDT Rank	PVAAS Rank
1.	2.5	14-4	3	5	1	1
2.	3.3	20-3	2	1	7	
3.	4.0	5-3	1	1	10	
4.	4.0	4-4	5	7	2	2
5.	5.0	9-5	8	5	2	
6.	5.3	11-3	3	2	11	
7.	5.8	1-5	7	6	3	7
8.	6.0	3-5	9	6	4	5
9.	6.3	19-3	3	3	13	
10.	6.3	7-3	4	1	14	
11.	6.5	10-4	10	6	6	4

Overall Rank	Average	Teacher/Grade Level	PSSA Rank	Benchmark EOY Rank	CDT Rank	PVAAS Rank
12.	6.7	16-3, 5	6	6	8	
13.	7.0	18-5	15	5	5	3
14.	8.3	12-3	7	6	12	
15.	9.0	13-4	14	7	9	6
16.	9.3	17-3	7	4	17	
17.	10.3	8-3	6	9	16	
18.	11.3	6-3	11	8	15	
19.	11.7	15-3	13	4	18	
20.	12.7	2-3	12	7	19	

As can be seen from the Table 11, teacher 14 had the overall highest average ranking from the data analyzed. Unfortunately, this teacher is no longer teaching in the district, and questionnaire data was not able to be collected. The same is true for the teacher ranked in the fifth spot, teacher 9. Therefore, the remainder of the data analysis for this research question will focus on the teachers who are still in the district and have submitted questionnaire responses.

Fourteen out of twenty teachers submitted questionnaire responses. This researcher will focus on the responses from the top two teachers in each grade level in order to identify the strategies and interventions being used in their classrooms that are helping their students be successful. The remaining survey teacher questionnaire results will be found in Appendix B. The teachers and their schools are listed in the Table 12. Responses from the teachers were compared by grade level and then all together with the other grade levels to identify commonalities and differences.

Table 12

Top Ranked Teachers

Grade	Teacher	School
3	**20**	**A**
3	**5**	**D**
4	**4**	**B**
4	**10**	**A**
5	**1**	**D**
5	**3**	**A**

Triangulation was accomplished by comparing three or four sets of academic data to determine the most effective teachers in each grade level. Also, six teacher questionnaire responses were used to identify commonalties and consistencies in the responses.

Table 13

Grade 3 Teacher Responses

Survey Question	Grade 3 Teacher 5	Grade 3 Teacher 20
What data are you utilizing to inform your instruction?	Daily exit tickets (RSAs)	Observation of whiteboard work during the lesson. I check the independent practice page in the students' math journals. After every few lessons I give an

		assessment. Also, the end of unit assessment.
How many times a week do you review data to inform your instruction?	3-4	Each day
How effective do you feel your data analysis process is in informing your instruction.	4	4
How many times a week do you meet in small groups or with individual students during math class?	4-5	4-5
How do you feel about the effectiveness of your differentiated instruction for math?	3	4
What components of the Everyday Math program are you using daily in your instruction?	I used the first two components as a modified whole group lesson, and I used the journal pages as the backbone of the guided practice.	I use the Math Journal pages. Depending on the lesson, I will use the manual to teach it. Other times, I just take the skill and teach it my own way.
What are your impressions on the strengths and weaknesses of EDM?	EDM laid out a scope and sequence that created a good structure for student learning. I also thought the structure of the lessons were okay with modification. I also thought the RSAs, again with modification, created valuable data that could then be used to guide instruction. I thought the homework component was very weak. Students fell into one of two groups; the first could get it done in less than 5 minutes and	A weakness is the spiral. Since third grade did not group their lessons together, students will often forget a skill by the time we come back to another lesson of it. I think there are better ways to incorporate reviews and spirals than the way EDM does. I also think there needs to be more math word problems. If students have a good number sense, EDM does a nice job teaching various strategies, but it also can confuse students who do not have good number sense.

	got it done walking out to the bus on the way home. The second didn't understand it at all, and the homework just caused frustration. Another weakness was the lack of transfer built into the program on how to answer an open-ended question or attack a multiple-choice math question.	
What instructional strategies are you using with ALL students that are outside of the of the Everyday Math program? Please indicate how often you utilize the strategy.	Almost every day IXL – this was very important. It allowed for independent practice assigned to the skill taught in the whole group lesson. I also used Math Fact Pro almost every day to practice math facts. I also brought in practice strategies on a weekly basis that exposed students to the format of the PSSA test and responding to open-ended questions.	Not following the EDM lesson as is and teaching it in small group each day. Fact practice daily using Reflex Math. I also have the students complete study guides to review prior to end of unit assessments. The students also play a mix of EDM games and other games I purchased on Teachers Pay Teachers to review skills (this is one of their math stations).
What math interventions are you using with your students that you have found to be successful in promoting student growth?	Intervention is hard in math because of the way math builds on each component as building blocks of understanding. Once a student misses too many of those building blocks, they fall behind to the point where what the standard is doesn't make sense to them even with interventions.	Daily small group instruction and reteaching lessons as needed. Reflex Math is helping with the fact mastery.
What math basic fact automaticity interventions are you using with your students that you have	Math Fact Pro worked the best. It was a 5-minute session (what the research shows is best) that could be done every day. The	Reflex Math

found to be successful in promoting student growth?	program automatically took away facts students mastered and slowly added new facts for students to learn.	
What are your feelings about the effectiveness of departmentalization for math instruction in grades 4 and 5?	From what I read, the research shows there isn't much of a difference in student achievement. However, teacher satisfaction is better, and teachers are more confident in teaching the subject matter. So, I think it does help with teacher morale and allows the teacher to be a better "expert."	I think it is a great idea, and I wish 3rd grade would departmentalize!!!!!!!!!!!!
What professional learning opportunities do you feel would be beneficial to you and the other staff members of the Bellefonte School District?	All answers were based on my previous experience in third grade math.	More about small group math.
How do you deliver your math lessons?	5-10-minute review using a Collins Writing approach, 10-15 whole group, then guided practice where the amount of help corresponds to student need	math workshop model
Do you assign math homework? If so, how often?	No homework given	Everyday
What technology programs do you find helpful and how often do students use these programs?	IXL!!!, Math Fact Pro, Google Classroom and SeeSaw or Google docs – students would take pictures of their work and explain their thinking.	Reflex Math daily. Early finishes also play Prodigy.

Looking at both of the teachers' responses in Table 7 provides anecdotal data that supports the achievement of their students. Both teachers state that they utilize student data during each lesson to inform their instruction, and both consider their data analysis process effective. Meeting in small groups is a common strategy in each of their classrooms, as this occurs 4-5 times a week. When comparing their responses on the EDM components they utilize, the math journal is used by both, but teacher 20 states that sometimes, "I just take the skill and teach it my own way." When discussing programs or strategies that are utilized outside of the EDM program, teacher 3 listed IXL for independent practice, Math Fact Pro to reinforce basic facts, and teaching strategies that focus on open-ended tasks and the format of the PSSA test. Teacher 20 stated again that not always following the EDM lesson format and focusing more on small group instruction is helpful. Basic fact practice with the Reflex Math program, study guides, and other math games during centers are additional strategies mentioned by teacher 20. When asked to share successful interventions they use with students, teacher 3 did not feel that interventions were effective for students in math because once their skill deficit becomes too severe, it is difficult to provide them with an intervention that makes sense to them. Teacher 20 emphasized daily small group instruction and reteaching lessons along with Reflex Math. Both stated they use an intervention or program to assist with the acquisition of basic facts. Teacher 3 uses Math Fact Pro and teacher 20 uses Reflex Math. Other technology programs used include Google Classroom or SeeSaw for students to practice explaining their thinking. Each teachers' approach to teaching the lessons are not traditional either as teacher 3 utilizes John Collins' writing strategies, whole group lesson, and then guided practice. Teacher 20 uses a math workshop model

where students meet with the teacher in small groups and visit centers when not with the teacher. One interesting main difference in their classrooms is that teacher 3 does not give math homework, while teacher 20 assigns math homework every day.

Table 14

Grade 4 Teacher Responses

Survey Question	Grade 4 Teacher 4	Grade 4 Teacher 10
What data are you utilizing to inform your instruction?	Student performance on homework, ACI checks, performance on assessments, CDT information	MasteryConnect, eSpark, Wowzers, District Common Assessment, daily quizzes, observations
How many times a week do you review data to inform your instruction?	2-3	Each day
How effective do you feel your data analysis process is in informing your instruction.	4	5
How many times a week do you meet in small groups or with individual students during math class?	4-5	4-5
How do you feel about the effectiveness of your differentiated instruction for math?	4	4
What components of the Everyday Math program are you using daily in your instruction?	Homelinks, online Daily lessons	Everyday Math is nearly a resource – not our curriculum. Where it is used as a resource in our curriculum – I use it. I do not utilize the online component, as I use other resources that I

		feel are much more beneficial.
What are your impressions on the strengths and weaknesses of EDM?	EMP, I believe, does a wonderful job of providing the foundations for math exploration. The rationale is always indicated, and the actual algorithms take a back seat to ensuring students grasp the mathematical concepts that provide guidance as they progress through the different math disciplines. EMP provides for the opportunities to have rich discussions about ways in which to solve problems. A consistent knock on EMP is the lack of opportunity for practice with basic facts, and I do supplement, especially with multiplication fact acquisition. However, this idea that we need to revamp our math curriculum is not held by me, especially when we're sliding back into more of a traditional math class.	Spiraling is a strength and how they help students to conceptualize the content using manipulatives and various strategies. Weaknesses include "too many strategies" presented that students never do one really well. Also, they sometimes touch on a concept briefly and then move on. Some students need consecutive days and repetition to grasp a concept. Also, EDM does not fully align to the PA Math Standards.
What instructional strategies are you using with ALL students that are outside of the of the Everyday Math program? Please indicate how often you utilize the strategies.	I do like "Reflex Math" for purposeful fact practice. All kids seemingly have benefitted from the use of the program. Occasionally, I will use aspects of Khan Academy to assist with a strategy or algorithm assistance.	We are utilizing "guided math" with math centers. Students meet with me for a small group lesson of 4-6 students. We cover the main math concept in the curriculum using a EDM or Engage NY lesson... or a lesson that is appropriate to cover the eligible content standard. Students finish the lesson with a Google Forms quiz to check their understanding. When students are not with me, they

		rotate through other centers. One of these is the technology center, where students do Reflex math to work on their math fact fluency. After doing Reflex in this center, they move onto eSpark. eSpark is a program that assesses each student and puts each of them into a learning path appropriate for their math understanding. This program does a great job at differentiating. The other center is student teacher led. Students engage in a Constructed Response Task or a Quick Check on a specific standard. One day students do a constructed response task and then the next quick check... rotating back and forth between the two. The student teacher provides on-demand interventions and instructions if needed. The last center is the game center. Students engage in partner games to practice various math skills, standards, and concepts. Throughout the course of the math class – students can get four or more math skills, concepts, or standards.
What math interventions are you using with your students that you have found to be successful in promoting student growth?	Reflex Math and simply adhering to the tenants of EM. I don't believe I'm knowledgeable enough to deviate from EM, as I do not hold a degree in mathematics instruction. But I believe strongly that students can progress quite well when we maintain the consistency of EMP and	eSpark – it differentiates for each individual student. It provides pre and posttests AND provides students with instruction and practice in a child-friendly format.

	not pick and choose as so many seemingly are doing.	
What math basic fact automaticity interventions are you using with your students that you have found to be successful in promoting student growth?	Reflex Math and practice sheets focusing on fact acquisition in multiplication.	Reflex Math
What are your feelings about the effectiveness of departmentalization for math instruction in grades 4 and 5?	I think it has enabled me to focus on specific courses of study, but I believe it comes at a cost as well. Having taught for many years, I always considered myself a 4th grade teacher, not a math or science teacher. I do not know the strengths and weaknesses of my students like I did when I taught one group of students all day. However, I'm not sure that this is possible with the expectations placed on everyone with all the programs we're expected to know and know well.	I am a better math teacher due to departmentalization. I put more time and effort into my one subject area being taught rather than having to spread myself thin over several subjects. I am also able to delve into data for my one subject and specifically target it. I'm not stealing time from another subject to make time up for one in which a lesson went longer. All my time is strictly devoted to math.
What professional learning opportunities do you feel would be beneficial to you and the other staff members of the Bellefonte School District?	I'd love to see more professional opportunities for all math teachers, especially newer ones learning the philosophy and practices of the EMP. However, I think that ship has sailed, and we'll simply have more fragmentation of the math program as individuals make decisions as to the order of instruction and the elimination of certain lessons and units.	With using MasteryConnect - making common interventions that teachers could implement and pull from would be extremely helpful. Within MasteryConnect you can see easily where your students need additional instruction and interventions and it would be nice to have a PL to address next steps.

How do you deliver your math lessons?	primarily whole group instruction	math workshop model
Do you assign math homework? If so, how often?	3-4 days a week	Everyday
What technology programs do you find helpful and how often do students use these programs?	Reflex Math and students engage in it about 3 times per week in the classroom.	eSpark and Reflex math - we use them daily

Looking at the 4th grade teacher responses from Table 8 show that both teachers utilize data at least 2-3 times a week to inform instruction. Both use assessment information and daily checks to inform instruction. Teacher 10 does this every day. Small group instruction is a key component of both of their classrooms as they stated they meet 4-5 times a week with small groups. They did differ a bit on their use of the EDM resources. Teacher 4 uses EDM online components, whereas teacher 10 uses the online components as they best fit the student needs for that lesson or will supplement with other resources. Guided Math was listed as an additional instructional strategy used by teacher 10. Within the guided math lesson are additional centers or stations that students rotate through each day. One noteworthy center is a constructed response center. Both teachers express that Reflex Math is effective for reviewing and practicing basic math facts. Teacher 4 also stated that Khan Academy can be helpful for some concepts. Teacher 10 utilizes eSpark with the students. Reflex Math and eSpark were also mentioned as interventions being used to promote student growth and these are predominantly the only technology-based programs used by these teachers. They both also differed in their delivery of math lessons as Teacher 4 uses traditional whole group

instruction, but teacher 10 uses a math workshop/Guided Math model. Homework appears to be a key piece of promoting student growth in both classrooms as they assign homework three or more times a week. One interesting statement made by teacher 4 was that this teacher does not believe in deviating from the EDM lesson plans and follows the scope and sequence closely.

Table 15

Grade 5 Teacher Responses

Survey Question	Grade 5 Teacher 1	Grade 5 Teacher 3
What data are you utilizing to inform your instruction?	A combination of student observation, check-ins, journal work, morning work, Mastery Connect CDT's, and PSSA's.	Math assessments; daily observations; review the homework.
How many times a week do you review data to inform your instruction?	2-3	Each day
How effective do you feel your data analysis process is in informing your instruction.	4	4
How many times a week do you meet in small groups or with individual students during math class?	3-4	2-3
How do you feel about the effectiveness of your differentiated instruction for math?	4	4
What components of the Everyday Math program are you using daily in your instruction?	I use parts of the EDM lessons in the manual and the student journals.	Mostly the daily lesson, whole group, small group, independent work.

What are your impressions on the strengths and weaknesses of EDM?	Most of the lessons are standards-based, but I have found myself double-checking because I don't want to waste time teaching non-standards-based concepts. EDM does not "spiral" effectively, so I revisit the more difficult skills during guided math lessons. The open-response tasks are not "rich" enough, so I use outside resources to fill the gap.	Strengths are they give the students multiple strategies and some flexibility in the way they solve the problems. Weaknesses – sometime they put too much into one lesson and it can be overwhelming to some students.
What instructional strategies are you using with ALL students that are outside of the of the Everyday Math program? Please indicate how often you utilize the strategy.	I think any instructional strategy I use is in the EDM program.	
What math interventions are you using with your students that you have found to be successful in promoting student growth?	Small-group instruction, eSpark, Reflex, IXL.	Mostly small group and adapted homework sheets.
What math basic fact automaticity interventions are you using with your students that you have found to be successful in promoting student growth?	Reflex is a great program to promote automaticity.	Online programs and activities such as Math 24.
What are your feelings about the effectiveness of departmentalization for math instruction in grades 4 and 5?	I really like departmentalization because it has allowed me to really focus on two subject areas at a time (math and science or math and social studies depending on the time of year) instead of several. When I am more focused, I deliver better instruction	It is good in a sense that all the students are getting the same instruction from the same teacher. It allows us as the teacher to focus on the specific strategies and we're able to work with the struggling kids. One negative would be the time constraints at times.

	for the students, leading to better understanding and learning. I feel it's very effective and hope it stays!	
What professional learning opportunities do you feel would be beneficial to you and the other staff members of the Bellefonte School District?	It would be great to collaborate with 4th and 5th grade math teachers to see how they use existing resources and learn what other effective resources they use. Also, I would like to see how they use Google Classroom (or other tech-related programs) for math.	Grade level and department meeting.
How do you deliver your math lessons?	A combination of the two approaches.	A combination of the two approaches.
Do you assign math homework? If so, how often?	3-4 days	Everyday
What technology programs do you find helpful and how often do students use these programs?	eSpark (average 3 times a week), Reflex (average 3 times a week), IXL (almost every day when teaching a unit)	In the past I have used Zearn and MathGames.com.

The grade 5 responses from Table 9 show that both teachers utilize daily observation of students to inform instruction along with reviewing student work like homework and journal work. Data is utilized by teacher 1 two or three times a week and teacher 3 uses data each day. They both utilize small group instruction at least two to three days a week. They also stated that they use the EDM resources as the basis of their instruction with little deviation. Teacher 1 stated in the question about strengths and weaknesses of the program that the spiraling component does not provide enough review for the students on certain topics which requires additional review during guided math lessons. The open-response tasks are also not rich enough in this teacher's opinion and

require modifications or additional resources. Both teachers stated that small-group instruction is an intervention that has promoted student growth. Teacher 3 also stated that adapted homework sheets are helpful, while teacher 1 mentioned eSpark, IXL, and Reflex Math. Reflex Math was again mentioned as a basic fact intervention that has been successful with students and teacher 3 stated online programs and Math 24 have been helpful. Both teachers utilize a combination of whole group and a math workshop model to deliver lessons and homework is assigned three or more days a week by both teachers.

After determining the most effective math teachers in each grade level and comparing their responses on the questionnaire, the following can be summarized about effective math interventions and strategies. Small group instruction is present in some form in all six classrooms. Some teachers refer to it as Guided Math, others call it a math workshop approach. Regardless of the terminology a form of differentiated small group instruction is taking place in the classrooms. In conjunction with this is the use of learning centers or stations to reinforce other math skills. These skills could include basic fact practice, open-ended response activities, review of previously taught content, other on-line math programs.

Another commonality found between the successful teachers is the use of technology. Each of teachers mentioned multiple ways that technology is being used in their classrooms to support and enhance student growth. The most popular program being used is Reflex Math. This is a program that was purchased by the district this past year to improve students' basic fact retention. Teachers are finding success with it and students are also liking the program. Teachers also mentioned programs like IXL, eSpark, as well as others that they are finding to be helpful. Google Classroom was also mentioned as a

way for students to explain, show, and share their work on open-ended tasks with their teacher or other students.

The emphasis on mastering basic facts to improve students' computational fluency is also a common strategy seen in the responses. Through the use of on-line programs like Reflex Math, these teachers are providing students the opportunity to improve their basic recall math facts.

Extra practice on constructed response or open-ended tasks is another area that these top tier teachers devote extra time to with their students. One described this as creating additional activities and opportunities for students to practice their skills as opposed to relying on the EDM open ended response activities. This teacher described the tasks in the EDM program as not "rich enough" for the students.

Finally, an emphasis on data is seen in their daily instruction. Each of the teachers uses data to inform their instruction at least 2-3 times a week. They each feel strongly about their data analysis skills as they all rated themselves at a 4 or 5 which equates to effective to very effective. Knowing their students' strengths and weaknesses through the use of data and planning instructional activities is a key to their students' success.

The next research question to be answered is concerning departmentalization and how it has or has not assisted with student growth in math. For this question the researcher looked at three pieces of data to triangulate the findings. The data included teacher's questionnaire responses in Table 10, grade level PSSA math proficiency data and PVAAS Value-Added Reports shown in Tables 11 and 12.

Table 16

Effects of Departmentalization Questionnaire Responses

What are your feelings about the effectiveness of departmentalization for math instruction in grades 4 and 5?
It is good in a sense that all the students are getting the same instruction from the same teacher. It allows us as the teacher to focus on the specific strategies and we're able to work with the struggling kids. One negative would be the time constraints at times.
From what I read the research shows there isn't much of a difference in student achievement. However, teacher satisfaction is better and teachers are more confident in teaching the subject matter. So, I think it does help with teacher morale and allows the teacher to be a better "expert".
I think it has helped me to become a better math teacher because it has allowed me to focus more on math and has given me more time to develop different activities to help engage students.
I love it! I feel I spend more time focusing on the specific needs of my students and it allows me the freedom to plan intensively for just math. I have become a better teacher being able to just focus on math instruction.
I think it is a great idea and I wish 3rd grade would departmentalize!
I really like departmentalization because it has allowed me to really focus on two subject areas at a time (math and science or math and social studies depending on the time of year) instead of several. When I am more focused, I deliver better instruction for the students, leading to better understanding and learning. I feel it's very effective and hope it stays!
I think it has been very effective. I am a more knowledgeable teacher and all of my professional learning opportunities are used to make me a more effective teacher.
I am a better math teacher due to departmentalization. I put more time and effort into my one subject area being taught rather than having to spread myself thin over several subjects. I am also able to delve into data for my one subject and specifically target it. I'm not stealing time from another subject to make time up for one in which a lesson went longer. All my time is strictly devoted to math.
I think it has enabled me to focus on specific courses of study, but I believe it comes at a cost as well. Having taught for many years, I always considered myself a 4th grade teacher, not a math or science teacher. I do not know the strengths and weaknesses of my students like I did when I taught one group of students all day. However, I'm not sure that this is possible with the expectations placed on everyone with all the programs we're expected to know and know well.
I feel it is very effective. This was my first-year teaching in a departmentalized grade and I thought it was beneficial to focus on teaching just math and science.

Teachers are obviously proponents of departmentalization based on the comments from the questionnaire. They reported being more comfortable and confident in teaching the subject matter. They feel they are better prepared and are content experts. They also benefit from their professional learning being more differentiated and pertinent to their daily work with students. But, the academic data shown in the tables below does not support the teacher's views and opinions as far as it making a positive difference in student performance.

Table 17

PSSA Math Proficiency Rates

Year	4th Grade	5th Grade	Overall
2011-12 through 2014-15-Prior to Departmentalization	77%	73%	75%
2015-16 through 2018-19-Departmentalized	66%	58%	62%

PSSA math proficiency rates decreased significantly in both departmentalized grade levels over the four years of core content instruction being departmentalized.

The three-year window prior to departmentalization for the fourth and fifth grade students across the district shows significant evidence of meeting the standard for Pennsylvania Academic Growth. The opposite is true for the 2017-2019 three-window within the departmentalized setting. There is moderate evidence of students not meeting the standard for academic growth.

Table 18

PVAAS Math 3 Year Growth Measure-PVAAS Value Added Reports

Years	4th Grade	5th Grade	Overall
2013-2015	2.3	2.6	2.5
2017-2019	2.2	-3.2	-0.5

Even though the teachers feel that departmentalization benefits students in the Bellefonte Area School District the academic data is not supporting their feeling. Growth and proficiency rates have dropped dramatically. There may be other reasons for this drop, but this data is not supporting departmentalization in math at this time.

The final research question to be answered centers around the professional learning needs of the teachers as they relate to consistent data protocols and effective strategies or interventions to assist students. Table 13 shows teacher responses to the questionnaire regarding this topic. Triangulation of this data was not achieved as the only pieces of data used were the teacher questionnaire responses.

Table 19

Professional Learning Questionnaire Responses

What professional learning opportunities do you feel would be beneficial to you and the other staff members of the Bellefonte School District?
I feel that we have a strong foundation when teaching math to our students. I think professional learning opportunities could be more with how to teach the EDM lessons using a math workshop model and how to use Mastery Connect to differentiate
More on teaching kids through a math workshop approach and using a flipped classroom approach to teaching.
A math workshop approach.

What professional learning opportunities do you feel would be beneficial to you and the other staff members of the Bellefonte School District?
I'd love to see more professional opportunities for all math teachers, especially newer ones learning the philosophy and practices of the EMP. However, I think that ship has sailed, and we'll simply have more fragmentation of the math program as individuals make decisions as to the order of instruction and the elimination of certain lessons and units.
With using MasteryConnect - making common interventions that teachers could implement and pull from would be extremely helpful. Within MasteryConnect you can see easily where your students need additional instruction and interventions and it would be nice to have a PL to address next steps.
It would be great to collaborate with 4th and 5th grade math teachers to see how they use existing resources and learn what other effective resources they use. Also, I would like to see how they use Google Classroom (or other tech-related programs) for math.
More about small group math.
I would love to have some time dedicated to guided math. To discuss and learn strategies that work well and to learn how to implement it better. It is a fantastic structure for math and I would love to see others move in this direction. It is easier for me since math is all I plan for. I imagine as a 3rd grade teacher it would seem overwhelming trying to create lessons in all the different subject areas, but having time in a professional learning session to create the structures and the materials would be helpful.
Integrating technology in a meaningful and useful way into math instruction. Sometimes I do not feel like I get the most out of a 1:1 setting. I think this could be a very powerful differentiation tool that I do not think I use to the fullest potential.
Grade level and department meeting.

Professional learning centering around small group instruction or guided math was mentioned multiple times in the responses. This fits well with what the top tier teachers in the district are currently doing with their students. The district has recently adopted MasteryConnect to help with collecting and analyzing data. Some teachers responded that professional learning in using MasteryConnect is necessary. Other common themes in their responses was collaboration and common planning time with their grade level teachers across the district, integrating technology in meaningful ways, and time to learn or refresh their learning about the philosophy and practices of the EDM program.

Discussion

The focal point of this research project was to determine strategies used in the classroom to increase the success of Bellefonte Area School District math students and teachers. The questions that were answered identified the effective practices and interventions that are found in the most successful classrooms, the effect of departmentalization on math achievement, and determined the professional learning needs of math teachers.

It was very interesting in determining the most successful math teachers in the district. The researcher used the most appropriate data available and found that the teachers who many thinks are strong teachers were confirmed to be strong teachers, but some of the previously thought of weaker teachers were determined to be just as strong or stronger based on the data used in this study.

The findings for the research questions did not surprise the researcher. This study solidified what many educators know in the Bellefonte Area School District is best practice and what needs improved. Differentiated, small group instruction or as some are calling Guided Math was a strategy for many of the successful teachers. More clarification and professional learning on what this look like in the classroom are needed. Reflex Math is an online program that teachers in the district should continue to use to enhance students' basic fact acquisition as it was identified as beneficial to students in the successful classrooms. This was good information as the district purchased this program last year for all students in grades 2-5. Knowing that it is being used and that teachers are seeing it make a positive difference in student growth justifies the expense in the upcoming year. Consistent use of on-line programs or resources may

be another area for the district look into as many teachers are utilizing a variety of programs based on their interests or likes. Using programs that match what students need and that provide accurate progress monitoring would be beneficial. Data is another area that teachers say they are doing and that they feel they are doing effectively, but again the consistency of data collected as well as its use could be improved on. Teachers also emphasized areas that they enhance with other activities or resources like basic facts practice or open -ended response questions. Gaining consistency across the district with the areas that are being enhanced would be helpful to students and teachers.

The data collected about departmentalization confirms some of the research found in the review of literature. Teachers confirm in their questionnaire responses that they feel like they are becoming content area experts. This is documented in previous studies about departmentalization. The inconsistency of student academic gains is also documented. This study shows that the Bellefonte Area School District may want to take another look at departmentalization or at least dive deeper into the struggles teachers and students are having achieving high levels of math success within this structure. Even though departmentalization is not necessarily an intervention, it is a strategy that is used to increase student academic gains. This is not happening in this district's classrooms. Teachers do not feel as overwhelmed and their morale may be improved, but is it at the expense of student growth and possibly even relationships with students. Much more research needs to be completed in this area.

The research mentions that professional learning should be tailored to the needs of math teachers and collaboration with other teachers is beneficial. The Bellefonte Area School District math teachers who participated in this study also listed collaboration as

grade level time to meet, discuss, and plan with their colleagues as important. This is an area that can be implemented during math professional learning days. Also, another important area to focus on is the strategy of guided math. Teachers have been using guided reading techniques in the district for over ten years. This same idea needs to transcend into math classes in order to provide the differentiation that students require to be successful learners.

Summary

This chapter identified the strategies effective math teachers in third, fourth, and fifth grade are using with their students in the Bellefonte Area School District. Guided Math or a math workshop approach, technology use with programs like Reflex Math, practice on open-ended responses along with more writing and explaining, an emphasis on mastering basic facts, and data use were areas highlighted by the teachers in this study. Departmentalization, even though loved by the teachers, is not showing the academic growth in students as was expected. Further research must be completed to determine whether the departmentalization is directly impacting student success or are there other reasons derailing departmentalization. For students and teachers to be smore successful, professional learning for teachers should be centered around collaboration with grade level colleagues, Guided Math, use of technology, and consistent data identification and use.

The final chapter will focus on the findings and how they can be applied to the Bellefonte Area School District. The fiscal implications of applying the findings will be identified and described. Additional research topics or questions will be discussed.

CHAPTER V

Conclusions and Recommendations

Introduction

This study focused on three research questions. The questions sought answers about effective math interventions and strategies used in the district's third, fourth, and fifth grade classrooms, the effects of departmentalization, and the professional learning needs of upper elementary math teachers.

Academic data was analyzed, effective teachers were identified, and questionnaire responses were summarized for patterns found in each teacher's classroom. The questionnaire responses also provided information about departmentalization and the professional learning needs of teachers. These findings will be used to improve the instruction of students and the professional learning of upper-level elementary math teachers.

Conclusions

The results from this study will be helpful as the district moves forward with the goal of improving student math achievement and growth. The interventions and strategies identified by the effective teachers can be targeted in professional learning sessions or at grade-level math meetings. The identified interventions and strategies are guided math, concentrated work on open-ended responses, the use of the Reflex Math program for basic fact mastery as well as other online learning programs, and the use of data to inform instruction. The findings in this area were not as extensive as the researcher hoped to uncover more specific ways that the effective teachers were making their students more

successful. One promising area that was uncovered was the use of and interest in small group math strategies like Guided Math. Also, the extra practice and work being done by some teachers on open-ended/constructed response questions is interesting. Is this work on open-ended/constructed response questions simply making students better test-takers or is the extra practice on problem solving and explaining their reasoning making them stronger math students?

The practice of departmentalization in grades three, four, and five was examined. The questionnaire responses show that teachers are in favor of this organizational structure. The academic data shows that student achievement and growth have both declined sharply since the inception of departmentalization in the district's math classrooms. The data does not clearly support the use of departmentalization, nor does it make a strong enough case to eliminate departmentalization. It is helpful to know what the teachers' feelings are about departmentalization and how it impacts them professionally. Teacher views were very consistent across the district.

The information gleaned about effective strategies and interventions, along with the teacher questionnaire responses will be used to help formulate a professional learning plan for the district's elementary math teachers. Areas included in this plan are guided math training, the effective and consistent use of online math programs, data use and protocols, and grade-level collaboration. Others areas to investigate would be effective strategies to teach and practice problem solving skills through open-ended/constructed response problems.

Concerns

As stated earlier in the chapter, the results of this study were not as groundbreaking as hoped for when the study began. The number of strategies identified was not extensive, but they were conclusive after analyzing the questionnaire responses. A variety of more specific interventions and strategies were expected to be identified by the teachers. One reason for these general findings may be that the district has emphasized complete fidelity in the implementation of the math curriculum and use of the Everyday Math program for many years. This expectation of fidelity does not leave much room to explore or incorporate different ideas and resources. Teacher's feeling the need to stay rigid with the programming is starting to lessen a little, but many of the teachers in the study are still uncomfortable deviating away from what they are accustomed to doing and the prior mandates.

Another concern was the availability and quality of the data used to determine the effective teachers. Consistent sets of data for each of the grade three, four, and five math teachers was difficult to find. This simple data issue points to a bigger problem within the district. Formative as well as summative data sets need to be identified and used consistently throughout the district. Teachers collect an abundance of data, but the consistency and quality of data across the district and even within grade levels can be questioned.

One piece of data the researcher was forced to use was Classroom Diagnostic Testing data. It was used because the assessment was given across the grade levels throughout the district. This data must be looked at closely, as the data does not show achievement or growth; rather, it is more formative for the teacher to plan instruction and

guide students' future learning experiences. This data did allow for comparisons between classes and teachers, but understanding that the data are not providing a summative score is important to keep in mind. The other data sets such as PSSA proficiency rates, PVAAS Teacher Specific data, and the students' end of year averages on the common benchmark assessments were more definitive and informative for the researcher. Through this available data, the most effective teachers were identified, but the question still remains whether different academic data would provide the same results. Regardless, based on the data available and the teachers identified, common interventions or strategies were identified.

The questionnaire responses used to identify perceptions about departmentalization and professional learning needs were adequate, and the results will be helpful as the future of the district is discussed. These findings will be beneficial as the district is beginning work on its Comprehensive Plan. Math is an area of need across the district and in each of the elementary buildings. The findings about interventions and strategies will be helpful to include in the plan and will partner well with some of the other evidence-based strategies that will be included in the plan.

Recommendations

All of the findings from this study will be shared with the district's math coach and math interventionist to be included in the work they do with teachers and students. The math coach schedules grade-level math meetings three to four times a year. All of the interventions and strategies identified will be part of the teachers' discussions. Guided Math is an area that is new to many teachers. Even if teachers feel strongly about their skills in this area, there is a still a need for professional learning. Differentiation is not

new for the teachers of the district, but deliberate, planned differentiation in math may be new to some teachers. Becoming proficient at differentiating math instruction will take some time and professional learning by the teachers to make it an effective strategy. Utilizing some of our teachers who are comfortable with guided math to lead the professional learning sessions will be a key to the success of the initiative.

Additional practice with Reflex Math for students will be recommended to teachers based on the results of this study. As stated earlier, this program has been purchased by the district with the purpose of providing a supplement to EDM for basic facts practice. Students have continued to struggle with the acquisition of basic facts, and teachers have been utilizing various methods and online programs to attack this issue. Having one common approach and program will be an asset to the district.

Other technology programs will continue to be analyzed in hopes of settling on one or two to use with students as an intervention. Currently, teachers are using a variety of programs. Zearn, IXL, and eSpark are just some of the programs. Another recommendation from this study would be to identify one or two programs that would be best to use with students that also have comprehensive data reports that can be analyzed to track student progress. These programs would be purchased and available for teachers to use as interventions with students.

The practice of teachers developing special lessons and providing opportunities for students to work specifically on open-ended math problems requiring an explanation of their thinking was identified as an area to share with teachers. Like the work done with text dependent analysis questions in English Language Arts classes, similar work must be done in math classes. An emphasis on the strategy and thinking behind problem solving

must be practiced along with showing the work and thinking on paper in an organized way. This is another area that must be addressed by the district's math coach through grade-level meetings or professional learning sessions.

The last area common among the district's most effective math teachers that must be addressed involves the use of data. This is a two-fold area of improvement. Data and data protocols should be analyzed and improved at the district and school level. Then data analysis and the use of the data must be improved at the classroom and individual teacher level to make a difference in student growth and achievement. Much of this can be achieved by consistently utilizing the same assessments throughout the district at regularly scheduled intervals. Aimsweb Plus is an assessment that is available to teachers in the district, but in math the program has been used inconsistently in the upper elementary grades. Classroom Diagnostic Tests should be reviewed to decide if these data are meeting the needs of the district, especially in comparison to the time involved to administer the test. Training for teachers should also be included in this plan so that all teachers understand the assessments and data and are using the same terminology. This will be very helpful as the district continues to move toward the MTSS model of support for students.

Departmentalization is another major area that will need to be discussed and further analyzed. The questionnaire responses show that teachers are in favor of this type of organizational structure. The math data show that student achievement and growth have both declined sharply since the inception of departmentalization in the district's math classrooms. Data in English Language Arts and Science will also need to be analyzed to determine if departmentalization has any impact in these areas. Any type of

deviation from departmentalization will not be popular with teachers and will be another huge change for parents. This is the best time and the worst time to make a change as drastic as abandoning departmentalization. With all of the safety concerns about returning to school under COVID 19 conditions, keeping students together in one classroom with one teacher makes sense. Schools must also think about major unnecessary changes to begin a school year that will have an opening day of school like no other opening day in history. So, this may not be the time to make any changes in the way grades four and five are departmentalized, but if scores continue to falter it will be an area to look at in the future.

The Bellefonte Area School District has an amazing professional learning program that benefits all staff members. The professional learning topics gleaned from the questionnaire results as well as from the identified strategies and interventions will be shared with the committee that plans the professional learning days. The math coach, interventionist, and expert teachers will lead sessions in guided math, open-ended response strategies, data analysis, and effective use of online programs such as Reflex Math. This training will be delayed this year as much of our beginning of the year professional learning time will be focused on opening schools safely and preparing for the possibility of virtual learning and teaching. Professional learning in math will become a priority again once the uncertainty of this school year becomes clearer.

The fiscal implications for implementing the results of this study are minimal. Reflex Math is already purchased by the district for each of the teachers in grades two through five. There is a professional learning committee in place that will plan and facilitate sessions throughout the school year. One additional expense may be incurred by

seeking an outside expert to train staff on guided math if the internal expertise is not available in this area. This may also need to occur since the district recently transferred a math coach back to the classroom and will operate with one coach for the entire district. This coach has been the secondary math coach and does not have experience at the elementary level. The necessity to purchase an additional online resource may be another expense as the district continues to look at its data needs as well as its intervention needs. Overall, the majority of the findings from this study are not costly and can be implemented with little to no additional expense.

Future Directions for Research

As stated earlier, the effectiveness of departmentalization in the school district could be researched further to measure its effects on the academic success of students. Research in departmentalized classes across the curriculum would be needed to see if the data in English Language Arts or science is similar to the math data. The math data declined so sharply that a potential change warrants another look. There are positives and negatives for teachers and students within this structure so the academic data as well as student and teacher perceptions should be considered.

While analyzing the academic data to determine the effective teachers in each grade level it was observed that the end of year benchmark exam scores for all of the teachers in the study were similar. The scores ranged from 73% to 88%, but most of the scores were clumped closely together in the middle of that range. It would then be expected that the PSSA scores would also follow a similar pattern, but they did not. One school's teachers had the lowest PSSA scores even though their end of year benchmark scores were similar to the other teachers throughout the district. How are their benchmark

scores similar, but their PSSA scores drastically lower? Is there a problem with the fidelity of implementation of the benchmark assessments? There needs to be accurate data gleaned from the benchmark assessments in order to plan instruction. This may be an area of improvement for the district.

Does the grade level or building that a teacher is assigned to have more of an effect on that students' test scores than the teacher's skills and pedagogy? Are some of the best teachers in the district teaching in the toughest buildings or teaching in grades that are historically low scoring across the district? Could this be affecting their overall ranking in this study? How can the Bellefonte Area School District support these teachers and students in the lower performing buildings is another area that should be investigated?

Another area to further question and research is the effectiveness of the plethora of online math resources that are available to schools. During these COVID19 times even more programs have been developed and marketed for schools. Sifting through the programs to match district needs with the strengths of each programs in order to determine if any programs would be useful could benefit the district. Having consistent intervention programs available to teachers and students is important as the district moves toward an MTSS model of support for students.

Finally, anxiety was a topic that was discussed heavily in the literature review. Math anxiety did not show up in this study, but it is something to consider as student performance and even teacher performance is evaluated. Are some students and teachers suffering from math anxiety? What can be done to alleviate anxiety caused by math class? These findings could potentially be transferred to other content areas.

Summary

In order for this study to impact the education of students in the Bellefonte Area School District, further professional learning for teachers must occur in the areas of guided math, data analysis, open-ended response questions, Reflex Math, and other online programs. These areas are identified as strengths in practice by the successful upper elementary math teachers in the district. Furthermore, if these strategies continue to show promise they must become common practices utilized in each of the third, fourth, and fifth grade math classrooms.

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APPENDICES

Appendix A

IRB Approval

Institutional Review Board

California University of Pennsylvania

Morgan Hall, 310

250 University Avenue

California, PA 15419

instreviewboard@calu.edu

Melissa Sovak, Ph.D.

Dear Kristopher,

Please consider this email as official notification that your proposal titled "Math Intervention Effectiveness in the Elementary PSSA Grades" (Proposal #18-090) has been approved by the California University of Pennsylvania Institutional Review Board as amended.

The effective date of approval is 8/15/19 and the expiration date is 8/14/20. These dates must appear on the consent form.

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

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

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

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

(4) To continue your research beyond the approval expiration date of 8/14/20 you must file additional information to be considered for continuing review. Please contact instreviewboard@calu.edu

Please notify the Board when data collection is complete.

Regards,

Melissa Sovak, PhD.

Chair, Institutional Review Board

Appendix B

Letter of Participation

Benner Elementary School

490 Buffalo Run Road

Bellefonte, PA 16823

Telephone: (814) 355-2812 Fax: (814) 353-5339

Mr. Kristopher M. Vancas,

Principal / Attendance Compliance Officer

Bellefonte Area

School District

March 6, 2020

To the Math Teachers of 3rd, 4th, and 5th Grade Students at BASD,

Over the past several years Bellefonte Area School District has experienced little growth, or even a decline, in student Math scores over time at the elementary level. Elementary PSSA proficiency rates were 66% in 2015-16, 59% in 2016-17, 63% in 2017-18, and 61% in 2018-19. For the past two years I have been completing coursework as a doctoral student with the California University of Pennsylvania. I am working on completing my action research project to answer the following questions:

What instructional strategies are teachers using across the district to increase the growth in student math skills?

How has departmentalization in the elementary schools aided the students in their math growth or hindered their progress?

What professional learning opportunities does the district need to provide teachers to ensure more consistent use of data protocols, as well as appropriate intervention strategies?

As part of the research project I would like to identify instructional practices and intervention strategies and programs that teachers are using across the district. My hope is to be able to identify which instructional practices aided students in achieving significant gains in their math fact automaticity and overall math growth and achievement. Once those instructional strategies are identified, I plan on working with the teachers and math coaches to provide professional learning for all elementary professional staff members.

I am writing to invite you to participate in a survey that will help to identify your use of data and instructional practices in regards to math achievement and growth. Please know that the survey is voluntary and you may withdraw from the survey at any time. All answers to the survey will be kept confidential and only used as part of this research project. I would expect the survey to take approximately fifteen (15) minutes to complete. The research project has been approved by the California University of Pennsylvania Institutional Review Board and the Bellefonte Area School District. This approval is effective 08/14/19 and expires 08/14/20.

Please let me know if you have any questions about my action research project and how I plan to utilize the data that I am asking you to provide. I am hopeful that we will be able to expand on the findings of the research project and offer all teachers of the school district strategies to engage our students and enrich their learning. If you have any questions please contact me at 814-280-5029 or van7236@calu.edu. Thank you in advance for your time and consideration.

Sincerely,

Kristopher M. Vancas
Doctoral Student, California University of PA

Appendix C

Questionnaire

Elementary Math Interventions Survey

This survey is designed to collect your ideas and instructional practices that you are utilizing in the classroom with students. The survey is completely optional and all responses will be kept confidential. I hope to be able to identify the instructional practices and interventions that our math teachers are using to increase student growth and achievement in math across grades 3, 4, and 5 in the district. Your information will help to provide professional learning opportunities for your peers in the future.

Your email address (**kvancas@basd.net**) will be recorded when you submit this form. Not you? Switch account

* Required

Please use provide your current elementary building assignment. *

Choose

Please provide the grade level you currently are teaching. *

Choose

How do you deliver your math lessons?

primarily whole group instruction

math workshop model

a combination of the two approaches

Other:

Do you assign math homework? If so, how often?

1-2 days a week

3-4 days a week

everyday

no homework given

What data are you utilizing to inform your instruction?

Your answer

How many times a week do you review data to inform your instruction?

1 to 2 times

2 to 3 times

3 to 4 times

Each Day

How effective do you feel your data analysis process is in informing your instruction.

Not Very Effective

1

2

3

4

5

Very Effective

How many times a week do you meet in small groups or with individual students during math class?

2 to 3 times a week

3 to 4 times a week

4 to 5 times a week

How do you feel about the effectiveness of your differentiated instruction for math?

Not Very Effective

1

2

3

4

5

Very Effective

What components of the Everyday Math program are you using daily in your instruction?

Your answer

What are your impressions on the strengths and weaknesses of EDM?

Your answer

What instructional strategies are you using with ALL students that are outside of the of the Everyday Math program? Please indicate how often you utilize the strategy.

Your answer

What math interventions are you using with your students that you have found to be successful in promoting student growth?

Your answer

What math basic fact automaticity interventions are you using with your students that you have found to be successful in promoting student growth?

Your answer

What technology programs do you find helpful and how often do students use these programs?

Your answer

What are your feelings about the effectiveness of departmentalization for math instruction in grades 4 and 5?

Your answer

What professional learning opportunities do you feel would be beneficial to you and the other staff members of the Bellefonte School District?

Your answer

Submit

Appendix D

Questionnaire Responses

Survey Question	**Teacher 2**
What data are you utilizing to inform your instruction?	mini quizzes, summative assessments, observation
How many times a week do you review data to inform your instruction?	1 to 2 times
How effective do you feel your data analysis process is in informing your instruction.	3
How many times a week do you meet in small groups or with individual students during math class?	1 to 2 times
How do you feel about the effectiveness of your differentiated instruction for math?	3
What components of the Everyday Math program are you using daily in your instruction?	warm-up, focus, homework
What are your impressions on the strengths and weaknesses of EDM?	I like that it provides many practice problems to enhance student understanding. I also like that the warm-up always leads into the focus of the lesson. I do not find it allows for much differentiation.
What instructional strategies are you using with ALL students that are outside of the of the Everyday Math program? Please indicate how often you utilize the strategy.	
What math interventions are you using with your students that you have found to be successful in promoting student growth?	I do small group reteaching based on quick formative assessments when time allows. This has proven to be most successful for me.
What math basic fact automaticity interventions are you using with your students that you have found to be successful in promoting student growth?	Reflex Math

What are your feelings about the effectiveness of departmentalization for math instruction in grades 4 and 5?	
What professional learning opportunities do you feel would be beneficial to you and the other staff members of the Bellefonte School District?	A math workshop approach
How do you deliver your math lessons?	a combination of the two approaches
Do you assign math homework? If so, how often?	3-4 days a week
What technology programs do you find helpful and how often do students use these programs?	Reflex Math (daily for morning work) and SplashMath (several times a week depending on time)

Survey Question	**Teacher 7**
What data are you utilizing to inform your instruction?	Daily google quizzes, unit quizzes and assessments
How many times a week do you review data to inform your instruction?	3 to 4 times
How effective do you feel your data analysis process is in informing your instruction.	4
How many times a week do you meet in small groups or with individual students during math class?	1 to 2 times
How do you feel about the effectiveness of your differentiated instruction for math?	4
What components of the Everyday Math program are you using daily in your instruction?	Math message, Lesson parts 1&2, games, math boxes, sometimes readiness and enrichment when needed,
What are your impressions on the strengths and weaknesses of EDM?	Strengths- spiraling, incorporating all math concepts in showing how they are connected, using real world problem solving, Weakness- focus on fact automaticity, need more work with fractions and measurement.
What instructional strategies are you using with ALL students that are outside of the of the Everyday Math program? Please indicate how often you utilize the strategy.	Timed fact sheets three times a week so students can master foundational facts and higher by the end of third grade
What math interventions are you using with your students that you have found to be successful in promoting student growth?	fact timed sheet, reflex math, IXL
What math basic fact automaticity interventions are you using with your students that you have found to be successful in promoting student growth?	giving timed fact sheets three times a week that focus on mastery of foundational facts first.
What are your feelings about the effectiveness of departmentalization for math instruction in grades 4 and 5?	I cannot comment since I teach third grade.

What professional learning opportunities do you feel would be beneficial to you and the other staff members of the Bellefonte School District?	More on teaching kids through a math workshop approach and using a flipped classroom approach to teaching.
How do you deliver your math lessons?	a combination of the two approaches
Do you assign math homework? If so, how often?	3-4 days a week
What technology programs do you find helpful and how often do students use these programs?	Reflex and IXL 2-3 times a week.

Survey Question	**Teacher 11**
What data are you utilizing to inform your instruction?	I use a google form to assess each lesson. This allows me to differentiate my instruction every day.
How many times a week do you review data to inform your instruction?	Each Day
How effective do you feel your data analysis process is in informing your instruction.	4
How many times a week do you meet in small groups or with individual students during math class?	1 to 2 times a week
How do you feel about the effectiveness of your differentiated instruction for math?	4
What components of the Everyday Math program are you using daily in your instruction?	Most components
What are your impressions on the strengths and weaknesses of EDM?	It allows students to have a deeper understanding of math, however the spiraling component is unnecessary in my opinion.
What instructional strategies are you using with ALL students that are outside of the of the Everyday Math program? Please indicate how often you utilize the strategy.	Reflex, extra practice on occasion, mini quizzes, modified assessments
What math interventions are you using with your students that you have found to be successful in promoting student growth?	Reflex
What math basic fact automaticity interventions are you using with your students that you have found to be successful in promoting student growth?	Reflex
What are your feelings about the effectiveness of departmentalization for math instruction in grades 4 and 5?	NA
What professional learning opportunities do you feel would be beneficial to you and the other staff members of the Bellefonte School District?	NA

How do you deliver your math lessons?	Primarily whole-group instruction
Do you assign math homework? If so, how often?	3-4 days a week
What technology programs do you find helpful and how often do students use these programs?	Reflex, 3 times per week

Survey Question	**Teacher 13**
What data are you utilizing to inform your instruction?	Small Group Observations, Exit Tickets, Multiple Choice Tests, Open Response Tests
How many times a week do you review data to inform your instruction?	Each Day
How effective do you feel your data analysis process is in informing your instruction.	5
How many times a week do you meet in small groups or with individual students during math class?	1 to 2 times a week
How do you feel about the effectiveness of your differentiated instruction for math?	5
What components of the Everyday Math program are you using daily in your instruction?	Problem Sets, Math Boxes, Journal Pages, Open Tasks
What are your impressions on the strengths and weaknesses of EDM?	Not well aligned to PA Core
What instructional strategies are you using with ALL students that are outside of the of the Everyday Math program? Please indicate how often you utilize the strategy.	
What math interventions are you using with your students that you have found to be successful in promoting student growth?	
What math basic fact automaticity interventions are you using with your students that you have found to be successful in promoting student growth?	Reflex
What are your feelings about the effectiveness of departmentalization for math instruction in grades 4 and 5?	I think it has been very effective. I am a more knowledgeable teacher and all of my professional learning opportunities are used to make me a more effective teacher.
What professional learning opportunities do you feel would be beneficial to you and the other staff members of the Bellefonte School District?	

How do you deliver your math lessons?	Primarily whole-group instruction
Do you assign math homework? If so, how often?	3-4 days a week
What technology programs do you find helpful and how often do students use these programs?	Zearn, E-Spark, Quizziz - 2-3 Times per week during Workshop Time

Survey Question	Teacher 16
What data are you utilizing to inform your instruction?	I use a combination class work, my own created formative assessments/exit tickets, observations, mini-quizzes, and summative assessments at the end of units to drive instruction.
How many times a week do you review data to inform your instruction?	1 to 2 times
How effective do you feel your data analysis process is in informing your instruction.	3
How many times a week do you meet in small groups or with individual students during math class?	1 to 2 times a week
How do you feel about the effectiveness of your differentiated instruction for math?	3
What components of the Everyday Math program are you using daily in your instruction?	I use the manual as a guide, but often make the lesson my own that fits my own style and what my kids need. This looks differently each year, because each group of kids is different.
What are your impressions on the strengths and weaknesses of EDM?	Strengths-teaching concepts in a conceptual manner as opposed to straight procedures. A major weakness in my opinion is that concepts don't spiral as much as they should and can be difficult to revisit content to make sure students are retaining what has been taught.
What instructional strategies are you using with ALL students that are outside of the of the Everyday Math program? Please indicate how often you utilize the strategy.	I use Khan Academy almost daily.
What math interventions are you using with your students that you have found to be successful in promoting student growth?	I use Khan Academy and my own created materials. I also utilize my classroom aide and Learning support teacher when they are pushing in to help my students grow.
What math basic fact automaticity interventions are you using with your students that you have found to be successful in promoting student growth?	Math Reflex
What are your feelings about the effectiveness of departmentalization for math instruction in grades 4 and 5?	I think it has helped me to become a better math teacher because it has allowed me to focus more

	on math and has given me more time to develop different activities to help engage students.
What professional learning opportunities do you feel would be beneficial to you and the other staff members of the Bellefonte School District?	Integrating technology in a meaningful and useful way into math instruction. Sometimes I do not feel like I get the most out of a 1:1 setting. I think this could be a very powerful differentiation tool that I do not think I use to the fullest potential.
How do you deliver your math lessons?	Primarily whole-group instruction
Do you assign math homework? If so, how often?	1-2 days a week
What technology programs do you find helpful and how often do students use these programs?	Math Reflex and Khan Academy-they use these tools almost daily.

Survey Question	**Teacher 17**
What data are you utilizing to inform your instruction?	Unit Assessments, CDTs, daily check-ins
How many times a week do you review data to inform your instruction?	2 to 3 times
How effective do you feel your data analysis process is in informing your instruction.	3
How many times a week do you meet in small groups or with individual students during math class?	2 to 3 times a week
How do you feel about the effectiveness of your differentiated instruction for math?	4
What components of the Everyday Math program are you using daily in your instruction?	All of them
What are your impressions on the strengths and weaknesses of EDM?	Strengths- Presentations with tools Manipulatives Spiraling curriculum Justifying solutions Problem-solving Weaknesses- Certain content topics covered in depth, while others receive weak coverage
What instructional strategies are you using with ALL students that are outside of the of the Everyday Math program? Please indicate how often you utilize the strategy.	Additional organizers and manipulatives, one on one and small group learning, peer teaching, reviewing and reteaching of lessons
What math interventions are you using with your students that you have found to be successful in promoting student growth?	Learning Support teachers and I work together to create assignments and assessments together. We have often used the documents in the Shared Drive-Fourth Grade Math Curriculum and revised them using DocHub. We use graphic organizers, manipulatives, explicit instruction and lots of visual representations.
What math basic fact automaticity interventions are you using with your	Reflex

students that you have found to be successful in promoting student growth?	
What are your feelings about the effectiveness of departmentalization for math instruction in grades 4 and 5?	I feel it is very effective. This was my first-year teaching in a departmentalized grade and I thought it was beneficial to focus on teaching just math and science.
What professional learning opportunities do you feel would be beneficial to you and the other staff members of the Bellefonte School District?	None at this time
How do you deliver your math lessons?	a combination of the two approaches
Do you assign math homework? If so, how often?	3-4 days a week
What technology programs do you find helpful and how often do students use these programs?	Daily- EDM, Khan Academy, Zearn, Reflex, Math Antics videos I have heard great things about eSpark.

Survey Question	Teacher 18
What data are you utilizing to inform your instruction?	Student responses in small group instruction, homework problems, quizzes and informal assessments throughout my lessons
How many times a week do you review data to inform your instruction?	1 to 2 times
How effective do you feel your data analysis process is in informing your instruction.	2
How many times a week do you meet in small groups or with individual students during math class?	3 to 4 times a week
How do you feel about the effectiveness of your differentiated instruction for math?	4
What components of the Everyday Math program are you using daily in your instruction?	I often use the math journal pages to assess how well my students understand the concepts and to give them some practice with the skill. I use the Teachers Manual to guide what concepts need to be taught and then usually determine how I am going to do that in a small group setting when I plan the week before.
What are your impressions on the strengths and weaknesses of EDM?	I feel it gives too many different strategies that the students become confused and blend them together. It also spends time on unnecessary skills instead of spending more time on one skill so that students have time to really digest and understand what they are doing. It doesn't allow for practice.
What instructional strategies are you using with ALL students that are outside of the of the Everyday Math program? Please indicate how often you utilize the strategy.	I teach mostly in a guided math structure where I differentiate the strategies depending on the group. I have found students are getting the individualized instruction needed to help them grow.
What math interventions are you using with your students that you have found to be successful in promoting student growth?	By teaching in a guided math structure, I can spend more time with my struggling students while giving my more advanced students more advanced tasks to complete. I have found that this has motivated my on-level students to push themselves more so that they can try to work on the more challenging tasks, all while I can be giving more guided practice to my struggling learners.

What math basic fact automaticity interventions are you using with your students that you have found to be successful in promoting student growth?	We use Reflex math daily, but unfortunately, I still have students who are struggling and by 5th grade it is imperative for them to know these facts so they will often use multiplication charts and hundreds grids if necessary.
What are your feelings about the effectiveness of departmentalization for math instruction in grades 4 and 5?	I love it! I feel I spend more time focusing on the specific needs of my students and it allows me the freedom to plan intensively for just math. I have become a better teacher being able to just focus on math instruction.
What professional learning opportunities do you feel would be beneficial to you and the other staff members of the Bellefonte School District?	I would love to have some time dedicated to guided math. To discuss and learn strategies that work well and to learn how to implement it better. It is a fantastic structure for math and I would love to see others move in this direction. It is easier for me since math is all I plan for. I imagine as a 3rd grade teacher it would seem overwhelming trying to create lessons in all the different subject areas, but having time in a professional learning session to create the structures and the materials would be helpful.
How do you deliver your math lessons?	a combination of the two approaches
Do you assign math homework? If so, how often?	1-2 days a week
What technology programs do you find helpful and how often do students use these programs?	ESpark has been a wonderful tool that differentiates the practice. I can enrich those who are ready for 6th grade material and it takes them to the grade level that they test in to practice. The program does this automatically which saves me time and it also will send me emails with students' names of kids who may need a small group session on a specific skill that they are struggling with. I will sometimes use Khan Academy to have students practice specific skills as well.

Survey Question	**Teacher 19**
What data are you utilizing to inform your instruction?	Observations, end of unit assessments, mini quizzes
How many times a week do you review data to inform your instruction?	1 to 2 times
How effective do you feel your data analysis process is in informing your instruction.	4
How many times a week do you meet in small groups or with individual students during math class?	2 to 3 times a week
How do you feel about the effectiveness of your differentiated instruction for math?	3
What components of the Everyday Math program are you using daily in your instruction?	All but differentiation options
What are your impressions on the strengths and weaknesses of EDM?	Strengths - lesson format, spiral, hands-on learning, materials provided by EDM, online resources, games Weaknesses - in third grade too much emphasis on multiplication fact strategies, odd unit progression (for example, some units have 2 or 3 lessons on fractions, then move on to multiplication)
What instructional strategies are you using with ALL students that are outside of the of the Everyday Math program? Please indicate how often you utilize the strategy.	Turn and talk, explain your thinking, share solution strategies
What math interventions are you using with your students that you have found to be successful in promoting student growth?	I was lucky to have learning support and a student teacher this year. We were able to divide the class into 3 groups to help differentiate. I also pre-taught some lessons to 1 particular student. I saw a lot of growth with him when I saw this. However, as stated above, I had a student teacher who at that point was teaching most of the day so I had more flexibility with my time.

What math basic fact automaticity interventions are you using with your students that you have found to be successful in promoting student growth?	Reflex Math
What are your feelings about the effectiveness of departmentalization for math instruction in grades 4 and 5?	NA
What professional learning opportunities do you feel would be beneficial to you and the other staff members of the Bellefonte School District?	I feel that we have a strong foundation when teaching math to our students. I think professional learning opportunities could be more with how to teach the EDM lessons using a math workshop model and how to use Mastery Connect to differentiate
How do you deliver your math lessons?	Primarily whole-group instruction
Do you assign math homework? If so, how often?	3-4 days a week
What technology programs do you find helpful and how often do students use these programs?	IXL, Reflex Math