Implementing Response to Intervention in Mathematics in a Fifth Grade Mathematics Classroom

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Abstract

The purpose of this study was to determine if integrating technology within interventions would increase the level of understanding of student's mathematical knowledge. The researcher intends to discover if low and high technology strategies would impact student's engagement, participation, and effort towards their mathematical learning. It was hypothesized that students would positively benefit from the use of low and high technology interventions. The researcher suggested that the use of these interventions would improve the students' ability to understand and better retain mathematical concepts. The two research questions that guided this study: Does implementing high and low technology interventions improve the understanding of mathematical concepts for struggling fifth grade math students? And what are specific strategies that best facilitate students' learning when a deficit is identified in a current mathematical learning concept? Two classes consisted of a total of twenty-six fifth grade students, ages 10-11, participated in this six week study. Class I, eleven students, endured math interventions with the use of technology resources. Class II, fifteen students, consisted of students receiving interventions using only basic math supplemental worksheets. All participants improved their scores, however Class I increased their post-test scores by 12% more. Class I's mean post-test score was 97% and Class II's mean post-test score was 85%. Consistently on all subgroups, Class I had more gains and higher scores than Class II. Class I's increased score was 52% and Class II's was 48%. This concludes Class I making more improvements than Class II.

Keywords: interventions, integration, supplemental

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Every year teachers get new students and new academic goals for their classroom. Repeatedly, teachers meet and discuss to review their lessons to improve their instruction for the district, grade levels, and their individual classrooms, in order to increase academic math scores. In an attempt to increase academic scores, most often teachers study assessment subgroups and instill supplemental activities to support weak areas. Also, teachers may decide to devote more instructional time to more difficult concepts. However, perhaps teachers need to look deeper into the delivery of their instruction and the materials used for instruction. Research suggests that educators should teach using a systematic method of instruction, while implementing technology regularly, in order to implement the highest quality of math lessons. The systematic approach to teaching includes the use of evidence-based resources for teaching students with a range of different learning needs (Ascherman, 2017). Furthermore, the integration of the systematic teaching approach with technology is proven to be most effective when instructing students, and improving student's academic success within math instruction.

The use of technology to support lesson instruction within the classroom provides students with reinforcement while learning. It is important that educators understand the importance of implementing technology and how technology benefits students learning. To start, technology consists of both low-tech and high-tech instructional resources (Allsopp, Mchatton, & Farmer, 2010). Low-tech teaching resources consist of manipulatives and concrete examples to support students' understanding when learning new concepts. The use of examples and tools when teaching mathematics is vital to student success. Today's learners experience video games, monitors, and high paced daily interactions throughout their daily home lives. The use of

low-tech resources allows students to visualize learning, physically experience learning, and make real-life connections. Low-tech resources provide dynamics within learning math, which allows students to be more actively engaged and responsible to actively participate during the lesson. Personal interaction while learning creates a more in-depth understanding of new concepts and gives students an opportunity to explore. Active participation in learning through the use of low-tech resources reinforces learning concepts, assists students with multiple learning needs, and provides an additional opportunity for students to understand difficult math concepts within a general education setting.

High-tech use of technology often overwhelms teachers with obstacles of purchasing, learning, and implementing new, "fancy" resources. However, the use of high-tech resources does not need to be complicated. Several technology resources including online programs are extremely user-friendly and simple to implement. Research supports that high-tech resources assist student's understanding of new math concepts by making math come to life! High-tech resources allow students to engage and interact with math concepts by digitally producing learning material aligned with the curriculum. High tech resources have a range of possibilities such as animations, videos, gaming, fact practice, 3-dimensional media, and more (Scharaldi, 2018). Similar to low- tech resources, these resources assist students in learning and reinforce learning concepts by presenting mathematical concepts in different ways. Regularly teachers are faced with challenging decisions planning lessons that engage a range of students' needs, while learning difficult or boring concepts. Implementing technology assists educators by increasing student engagement and addressing multiple learning styles within each lesson.

Furthermore, the use of these high-tech technological resources has increased teacher's assessment opportunities and have allowed teachers to have more accurate detailed information

regarding student's individual levels of understanding. Using technology to administer assessments provides a range of benefits both for educators and students. Technology assessments provide teachers with the opportunity to tailor assessments based on the needs of the students (differentiate), students are provided with immediate feedback to reflect on their assessments, and assessments often can be graded for teachers to allow more time to discuss assessment feedback with students.

In addition, research supports that assessments given through technology are preferred by students and these assessments reflect higher levels of student engagement (Mata, 2016). On the other hand, low-tech resources are also beneficial assessment resources. Low-tech resources can be used as effective assessment tools when used with students needing RtI tiered instruction, to support students with special needs students, to assess IEP learning goals, or used to reteach abstract concepts that were not obtained during regular classroom instruction and assessments. These low-tech resources allow students to have an avenue to learn or show their understanding by showing educators their understanding in a less traditional manner. Allowing students to use manipulatives, models, or other low-tech resources allows teachers to have a more accurate assessment of the understanding levels of each student based on the math standard being taught ("Research on the Benefits of Manipulatives," 2019). In correlation, both forms of technology assessments activate a visual and kinesthetic approach to teaching, learning, and assessing.

Another beneficial way to integrate technology within the classroom is through differentiation. Today's classrooms are filled with a range of different learning styles, abilities, diagnosis, and/or academic readiness (Newton, 2014). The range of needs for each student requires teachers to differentiate their instruction strategies. Differentiated mathematics instruction is an everyday necessity within general education classrooms in order to increase

student learning, and support student's needs (Newton, 2014). Due to several structured state programs such as The Individuals with Disabilities Education Improvement Act (IDEIA), No Child Left Behind (NCLB), and Response to Intervention (RtI), teachers have numerous learning needs and interventions to integrate within general education classrooms (Alahmari, 2019).

The use of technology assists teachers in differentiating instruction in a discreet manner that is not offensive or obvious to all students in the classroom. Technology, both low and high-tech, provides a range of supportive resources for teachers that allows them to support students learning based on the students' level of understanding and the topic being learned. Teachers need to determine the appropriate technology, low or high tech, in order to most effectively meet the instructional needs of students. Technology integration is beneficial to educators because of the easy accessibility, numerous options for evaluation, opportunities to provide ongoing assessments of student progress, and for teaching and learning practices (Allsopp, Mchatton, & Farmer, 2010). Continually throughout education the benefits of the use of technology within math classrooms is endless.

Many math educators teach math in a very uniform, traditional style of teaching assuming students can learn using basic instructional strategies. Despite the increased trend towards the implementation of technology in schools, technology still is not used regularly within math classrooms and teachers still avoid these resources (Mata, 2015). However, research focuses on the ways that technology can enhance current teaching practices within the classroom, especially when addressing students who are performing lower academically in the content area of math (Allsopp, Mchatton, & Farmer, 2010). The research proposal suggests the need to increase the use of technology resources implemented during math instruction. The benefits of both low and high-tech technology are proven to provide numerous ways to increase student's academic

success within the classroom. Students academic success is tremendously improved when teachers integrate technology resources to assist young learners in reaching their full mathematical potential.

This study was conducted to determine the difference in the mathematical success of students when teachers use technology resources to implement the RtI program, opposed to worksheet supplemental resources. Furthermore, the study focused on the student's engagement, active questioning, and level of understanding of the concepts when the information was provided using different strategies. The researcher wanted to determine how much of the student's preference, in relation to the student's academic success within both classes. For example, do students have a preference in how they learn?

The study was guided by two research questions. The questions are as follows:

1. Does implementing high and low technology interventions improve the understanding of mathematical concepts for struggling fifth grade math students?
2. What are specific strategies that best facilitate students' learning when a deficit is identified in a current mathematical learning concept?

The study hypothesized that the integration of technology to implement interventions, for struggling students, would improve student's understanding of mathematical concepts. The interventions were used to help students be more actively engaged in the lesson, more comfortable and likely to ask questions, and have a higher level of understanding through more hands-on interactive learning. Finally, the use of technology within inventions, both high and low technology, will prove students' ability to improve their mathematical understanding and better retain new mathematical concepts.

Implementing Response to Intervention in Mathematics

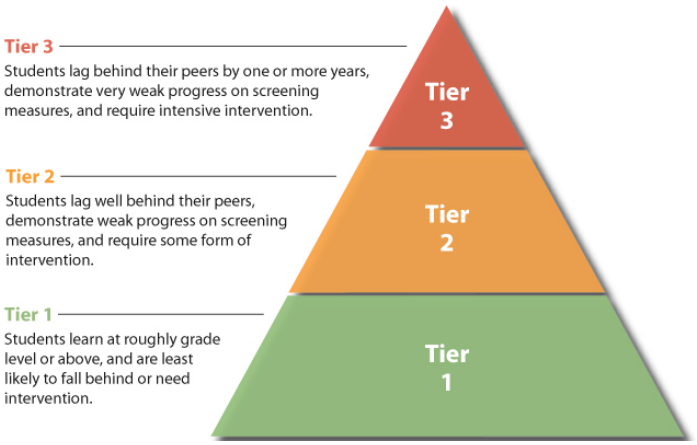
Teachers across the world strive to provide the best education for the young children within the classroom. Every year, teachers are given a new group of students to teach. Each class and student has different needs both academically and socially. Teachers strive to meet these needs by instilling interventions, support, and resources. These strategies are in place to reinforce and assist all learners in meeting the assigned curriculum expectations for their grade. However, teachers repeatedly are conflicted with obstacles that prevent and limit their ability to effectively implement beneficial interventions for their students within the classroom. This literature review will analyze obstacles teachers and students face when learning mathematics and strategies that will improve student's understanding of mathematical concepts.

Response to Intervention

Response to Intervention (RtI) is a three-tiered program that is used to identify students needs for academic support within the classroom (Gresham & Little, 2012). The Individuals with Disabilities Education Improvement Act (IDEA) of 2004 outlines RtI as a process for continuously improving achievement for students struggling to learn and to reduce the number of students who are being referred for special education services (Gresham & Little, 2012). RtI is an intervention system that requires teachers to continuously monitor student's learning and behavior to identify any weaknesses of the students. Tier 1 within RtI the level of instruction is within the classroom, students are being monitored, and data is being collected. During Tier 2, more specific and direct instruction is being given to students based on areas of weaknesses. Students in Tier 2 are given explicit instruction to support learning concepts that are weak. Tier 3 instruction becomes intense and provides additional instruction outside of the classroom. The instruction is provided specific to the students needs and reoccurs regularly to improve students

concept development (Gorski, n.d.). Refer to Figure 1 to further understand the tiers of the RtI process (Gorski, n.d.).

Figure 1



The goal for RtI is early identification of students who need support or who are struggling in mathematics and/or reading. Students who are identified with a deficit, are provided with interventions. The interventions are provided in three tiers. The three tiers provided support students at increasing levels of intensity based on the needs of the students. Students can progress out of each tier depending on their ability to acquire the knowledge of concepts required by their teacher. These services may be provided by a variety of educators within the school building, including general education teachers, special educators, and specialists (Gorski, n.d.). Due to the RtI process requiring the use of a variety of support personnel, and a variety of leveled interventions, the RtI process can only be successfully implemented by quality teachers who are capable of delivering high-quality instruction (Gorski, n.d.).

The benefits of RtI begin with requiring students to be continually evaluated and assessed in the classroom, in order to ensure students are academically and socially meeting their grade

level standards. In addition, RtI promotes early identification that will reduce and limit the amount of school failure for students who are at risk or have a disability. By actively supporting students who are struggling to meet grade level benchmarks, school will be able to decrease special education referrals and increase the success of individual students (Alahmari, 2019).

Furthermore, through RtI implementation, teachers and support staff collaborate on the needs of the students based on assessments, behaviors, and classroom observations. The data is then discussed with a team and the level of services is determined based on tiers. Tier 1 is the first and least intense intervention. Within Tier 1, students are identified as being below average academic competency levels within the classroom, and require further reinforcement to assist the students to reach the level of their peers. Tier 1 interventions are completed within the general education classroom by implementing high-quality, scientifically based instruction provided by qualified personnel (Gorski, n.d.). This instruction is differentiated in the classroom, regularly monitored, and is primarily the responsibility of the general education teacher. Some students in Tier 1 are considered "at risk," however the deficit of the child is minimal. The length of a Tier 1 intervention is approximately eight weeks, however all interventions need to be completed based on the needs of the students, and continue until their benchmark standards are fully acquired (Gorski, n.d.).

After approximately eight weeks, if the student isn't making adequate gains and still needs additional support, the student(s) will be further assessed to determine if Tier 2 interventions would meet their needs more efficiently. Within Tier 2 the intensity, frequency, and duration of intervention increases. These services and interventions are provided in small-group settings and are an addition to general education instruction (Gorksi, n.d.). Throughout each tier, students progress is monitored to ensure they are making appropriate gains

academically toward their target learning goals. However, after the student receives Tier 2 support for approximately nine weeks and the student continues to struggle, Tier 3 services will be required. The level of intensity continues to increase in Tier 3. Tier 3 instruction is delivered in small groups of no more than three students per group. A Tier 3 intervention requires elaborate, focused instruction that reinforces repetition and modeling of specific standards (Alahmari, 2019). At this level, students receive individualized, intensive interventions that target the students' skill deficits. Students placed in a Tier 3 intervention who do not progress consistently through this intervention will then be referred for a comprehensive evaluation. The comprehensive evaluation will determine the students eligibility for special education services under the Individuals with Disabilities Education Improvement Act of 2004 (IDEA 2004);(Gorski, n.d.).

Implementing RtI

Consistent and routine processes are proven to be more effectively utilized throughout a range of professional occupations. Research supports that RtI interventions consistently improve students academic success and decrease the amount of referrals of students to receive special education services. However, RtI is defined and implemented inconsistently throughout different states, districts, and individual schools (Regan, Berkeley, Hughes, & Brady, 2015). Implementing RtI intervention services needs to be clear, well communicated, and consistent across districts and states in order to be effective. However, implementation of RtI is thorough and has caused a lot of challenges for educators due to lack of training and resources needed to successfully provide these explicit interventions for students. The challenges of implementing RtI include the general educator and support staff being unsure of the roles and responsibilities of implementing interventions. Another challenge is knowing who is responsible for collecting

and finding research-based resources and assessments to use during the intervention and progress monitoring (Regan, Berkeley, Hughes, & Brady, 2015). In addition, teachers find scheduling time issues when trying to determine when interventions can be held for the students in need. Finally, teachers need time to communicate the students needs, communicate with interventionist, collect and analyze data, and compile a detailed success plan for the students who are struggling, which will vary depending on the student (Regan, Berkeley, Hughes, & Brady, 2015).

Therefore, in order to increase student's academic mathematical achievement, districts need to implement a team of teachers with assigned roles that is clear to all members in the building. Teachers will then feel supported by other staff members, which will aide in the success of implementing interventions. The use of external supports are crucial when implementing change into a general education classroom. Staff and building support is extremely necessary in order for teachers to implement such a vigorous detailed intervention system that requires new ways of evaluating students with continuous progress monitoring and evaluating of students (Regan, Berkeley, Hughes, & Brady, 2015). When teachers fully understand their professional responsibilities, they are more effective teachers and more likely to engage regularly in assessing the needs of their students. The best way to ensure teachers are confident in implementing RtI and to support teachers consistently implementing the RtI process, schools need to provide regular professional development to better educate teachers. Professional development will provide teachers with knowledge of evidence-based instruction, tiered instruction, multiple assessment tools, progress monitoring, and fidelity of implementation that will increase the academic success of both the teacher and the student (Alahmari, 2019).

Teacher Anxiety

As stated above, issues develop when teachers don't feel confident teaching the subject area of mathematics. This instructional confusion can then lead to anxiety. Teachers and students often experience anxiety that can be a large barrier when instructing or learning mathematical concepts. To begin with, teachers with anxiety aren't always aware how complex their anxiety is or how it is affecting them personally, as well as their ability to educate their students. Research supports that most often, teachers are anxious when teaching the subject area of math. When a teacher is anxious when teaching a particular subject area there are potentially large consequences. These consequences have been proven to be associated with poor teacher instructional practices and low student math achievement (Ganley, Schoen, Lavenia, & Tazaz, 2019). When seeking and determining if a teacher is experiencing anxiety toward teaching mathematics in the classroom, we need to survey and preview the teachers feelings when instructing the subject area. However, based on research regarding math anxiety, the anxiety can affect the teachers instruction in multiple ways (Ganley, Schoen, Lavenia, & Tazaz, 2019). Teachers who feel anxious or uneasy when teaching math may cause teachers to rush through instruction, explain solutions incorrectly, or can limit teachers patience when assisting students in need. Research also supports that teachers with math anxiety can lead to math avoidance. Math avoidance in the classroom can cause a teacher to spend less time teaching math, avoid giving examples, explain solutions incorrectly, or provide limit assistance to their students (Ganley, Schoen, Lavenia, & Tazaz, 2019).

Overall, the two most common problems that arise when discussing teacher anxiety are; teachers being unaware and teachers not knowing how to improve these feelings that are leading to bad habits. School buildings, counselors, peer teachers, and individuals need to work together

to identify teachers in need. Research supports teachers identifying their own math anxiety. Furthermore, research promotes professional development to better educate teachers in math subject matter to reduce stress, which will then lead to more positive classroom environments (Ruff & Boes, 2014). If teachers anxiety is directly related to students mathematical success, then teachers need to be supported to improve themselves so that teachers in return can better help students. In correlation, if teachers are not confident within their own routine subject matter instruction, the implementation of RtI interventions will be unsuccessful and the needs of students will be jeopardized. As stated above, the RtI process relies on high-quality, proactive teachers who can employ instructional problem solving to create dynamic instructional and intervention plans that will support and guide students to academic success (Gresham & Little, 2012).

Student Anxiety

Student anxiety is often more common than teacher anxiety in the classroom (Ruff & Boes, 2014). However, student anxiety is also more commonly identified in the subject area of mathematics. Consistently mathematics is a troublesome subject area for students. Math anxiety is directly correlated to low achievement in mathematics. Similar to teachers math avoidance, math anxiety includes social, cognitive, and academic factors (Ruff & Boes, 2014). Regularly educators are challenged to find reasons and patterns to why students struggle in their academic classes. Research supports that often teachers overlook students emotional state and immediately look for understanding barriers or learning disabilities. RtI interventions suggest a variety of different interventions strategies to assist struggling learners. Some examples of interventions through RtI include curriculum changes such as group work, open discussion, real-life applications, and group or peer assessments. These nontraditional approaches are offered to

replacement of some anxiety provoking traditional math routines (Ruff & Boes, 2014). When traditional RtI interventions are unsuccessful, teachers are challenged to look deeper into what is causing the students to lack the basic mathematical skills required at their grade level in order to create a suitable intervention.

Research supports the use of a school counselor. Traditional interventions are focused on curriculum needs, not psychological and emotional aspects of the students. School counselors are an excellent resource to support students with academic stressors (Ruff & Boes, 2014). Using school counselors to assist with academic success is foreign for some educators. Often school counselors are considered to be a valuable resources that assist classroom students social and emotional needs. Furthermore, if counselors can instill positive mindsets for students and make real-life connections to math, this will assist students in understanding the value and importance of math. As students engage in the importance of math in their own personal lives, they will then be more likely to exert more effort in improving their math knowledge. There are numerous factors and reasons for students to develop math anxiety. Although, math anxiety is consistently results in low math achievement for a student (Ruff & Boes, 2014).

Professional Development

The ongoing issues of implementing RtI interventions and teacher anxiety can be solved by providing professional development regularly to educators. Teachers need to be supported by each other, their schools, and school districts through professional development. To efficiently meet the needs of RtI, teachers need to possess knowledge of evidence-based instruction, tiered instruction, multiple assessment tools, progress monitoring, and fidelity of implementation (Alahmari, 2019).

Professional development is needed to educate teachers in the process of RtI, the roles of RtI, research-based resources that are adequate for different kinds of learners, and need to learn about different ways to provide mathematical instructional support. Research supports that often elementary school teachers choose to teach lower grades to avoid complex mathematical concepts. Specifically, elementary teachers have a higher rate of math anxiety due to college elementary degree stipulations requiring minimal math courses (Ganley, Schoen, Lavenia, & Tazaz, 2019). In stating that prerequisite courses often don't require teachers to take numerous math classes, therefore basic math instruction and resources could be foreign to a large range of teachers. This directly correlates the need of general mathematical professional development.

Math professional development focused on general grade level content, manipulative options, resources, real-life applications, and procedural instructional strategies would be extremely valuable to several teachers across numerous districts. Numerous studies support that participation in a math methods course decreases math anxiety for teachers (Ganley, Schoen, Lavenia, & Tazaz, 2019). This would be an excellent resource and supportive avenue at a regional level to assist teachers success in the classroom.

In addition to mathematical professional development, teachers need to be trained regularly to review the standards of the RtI process. Professional development at a regional and district level should occur with interactive teacher practice in reviewing the details of how to properly implement RtI and to ensure teachers are following the appropriate process to best support struggling students. Following the review of the RtI standards and procedures, teachers need to meet with their building teams to consider additional intervention choices, ensure all roles of the intervention process are understood and feasible, and make any updates needed to ensure individual buildings are implementing the RtI process according to the state requirements.

Additional professional development should be provided to allow teachers to learn and reflect on their own practices in order to develop a more conscious awareness of their personal habits (Alahmari, 2019).

Intervention Implementation

The RtI approach has been researched repeatedly and supports that the entire classroom benefits from the implementation of intervention resources connected to the use of the RtI approach in classrooms. RtI interventions are structured to improve students' mathematical progress by engaging students in evidence-based instruction, interventions, and continuous progress monitoring (Gresham & Little, 2012).

If studies prove that an entire class benefits from the RtI approach, this further supports the need to reinforce student and teacher mental anxiety conditions to allow teachers and students to fully benefit from this program. Through different research, specific teaching strategies are not consistently better than others. Whole group instruction, small group instruction, manipulatives, and videos are all beneficial teaching strategies for a range of students, but instruction can't be limited to the most common strategies in teaching. Mathematical success is consistently improved when students are given many opportunities to practice, demonstrate, explore, explain, and fail multiple times when learning a new concept (Gersten, 2014).

Often teachers are responsible for developing and implementing interventions. Within the Tier 1 intervention, teachers need to implement differentiation and create support within the classroom. A recent research supported an intervention called peer-assisted learning strategies (PALS). The peer-assisted learning strategies (PALS) has been proven to improve students' mathematical mindset. The use of peer-assisted learning strategies, in addition to other methods

of instruction, proves to positively influence student attitudes towards mathematics(Kroeger & Kouche, 2006). The PALS program uses peer-tutoring to assist students with difficult curriculum. The students practice and learn how to have mathematical discussions and support their peers different learning abilities. This infrastructure of this program reduces the pressure of everyday mathematics and allows students to use their peers as active resources (Kroeger & Kouche, 2006). The PALS program is supported through research as a teaching method that provides students with a range of resources to assist them in learning a new concept. The main tool to use is the students peers which assists both low and higher level math students when students engage in conversations about math. This intervention would be valuable for a range of teachers when differentiating, implementing RtI, and a way to assist students with math anxiety. This program wouldn't need to be utilized on a daily basis, but should be communicated among RtI teams and educators as a beneficial resource that supports both high and low achieving students.

Technology

Technology is an intervention strategy that benefits mathematical learners in the classroom. There are many math resources that can be used in correlation of learning new math concepts that provide an extreme benefit to students when learning new concepts. The use of math manipulatives are basic resources that are used to represent mathematical situations to assist students in problem solving. Although manipulatives are not typically thought of as a "technology," they are considered a low-tech application used to aid students in understanding in the classroom. High-tech supportive math applications are technology resources that most educators refer to when seeking ways to support students' mathematical learning (Allsopp, Mchatton, & Farmer, 2010). This concept is crucial for teachers. Implementing technology

doesn't need to be funded high-tech resources that have bells and whistles. Low-tech technology resources are beneficial as well. Simply making math come to life by grouping pencils, using manipulatives, and allowing students to visually understand math is extremely effective. However, high-tech technology is equally effective to enhance the learning process in more extreme circumstances. Therefore, teachers should seek opportunities to write grants or provide high- tech experiences for students if possible. Finally, technology no matter low-tech or high-tech will not be effective unless the teacher is implementing the resources correctly. Teachers need to know the purpose of research-based resources and learn how they can be utilized most efficiently within the classroom. Overall, using technology incorrectly in the classroom is not valuable. However, the proper use of technology is important and can be a vital resource to support struggling math learners achieve (Allsopp, Mchatton, & Farmer, 2010).

Conclusion

From studying the research, implementation of RtI interventions is crucial for students academic success. However, the issues and challenges of implementing RtI interventions create barriers that restrict teachers effectiveness in the classroom. Many resources and studies suggest the need to provide support for teacher and student anxiety towards mathematics. This research encourages counselors and support systems to alleviate those anxious emotions to allow the teacher or students to reach their full potential. Furthermore, teachers use professional development to increase their mathematical understanding and build teachers confidence when teaching math classes. In addition, teachers need to request professional development to continually educate and update teachers on the RtI procedures. However, teachers need to take initiative in seeking support staff to assist them in fully implementing the RtI process, as well. Also, teachers need to continue to seek new and beneficial implementation strategies to support

their low achieving or at risk students. The research supports several ways to accomplish supporting learners through peer-assistance and use of low and high technology resources. Overall to increase our mathematical scores and to create life-long learners who can apply mathematical concepts to everyday professional occupations, we need to ensure to hire high quality teachers who can efficiently and effectively implement RtI interventions while using a variety of resources to educate all types of learners.

Methods

The research design of this study utilized the quantitative approach and employed a quasi-experimental design. The research focused on two fifth grade math classes. The first class consisted of eleven total students, four with current academic IEP's, and the second class had fifteen students, two with academic IEP's. To measure growth of understanding and to assess the success of the intervention, the students were given a pre and post-assessment before and after the intervention. In addition there was one additional formative assessment given halfway through the unit to identify any additional academic needs of the students. The participants who qualify for interventions were based on the pre-assessment initially, and the formative assessment so that students were identified throughout the unit. The post-assessment was specifically used to measure the success of the interventions used to support struggling learners, and evaluated the content knowledge of the students. The participants of the study learned how to use manipulatives to better understand mathematical concepts, and were exposed to a variety of technological learning avenues that best suited their academic needs.

In addition, overtime, technology programs have progressively developed into a vital resource for educators. Mathematical programs have developed to meet the interests of students and be aligned to appropriate grade level math standards. Within the classroom, students enjoy

using both high and low technology opportunities. High technology math programs consist of the use of math games and concept drill practice using a device (Scharaldi, 2018). High technology instructional math programs provide teachers additional options to support learning mathematical concepts within instruction or interventions. Low technology resources include manipulatives and the opportunity for students to show what they have learned (Research on the Benefits of Manipulatives, 2019). The researcher used multiple learning avenues in order to provide a range of interventions to improve the understanding of new mathematical concepts. Based on the pre-assessments and informative quizzes, the teacher placed students in interventions. These students were grouped by their educational needs. Students who qualified for interventions received additional instruction to assist their understanding of difficult concepts.

Participants and Setting

The participants of this study were purposely selected from the researcher's fifth grade math class in central Illinois. The sample included both male and female students who ranged from 10-12 years in age. A total of 26 students participated in this study. This study sample consisted of 16 girls and 10 boys. In addition, the sample selection had 6 students with academic IEP's and one student with a 504 plan. Within these two classes, 5 students are diagnosed with ADD/ADHD and take medicine daily to help focus. Finally, 12 students were in the low/basic reading class that averages at a beginning to middle fourth grade reading level.

Table 1.

Demographic Information on Participants. (n= 26)

	Class I		Class II		Total
	Gender	Girl	Boy	Girl	Boy
IEP	2	2	1	1	6
504	1	0	0	0	1
ADD/ADHD	1	2	0	2	5
Other Participants	3	0	7	4	14

The setting of this study took place in a rural general education public school in central Illinois. The elementary school is located in a rural town in southeastern Illinois. This study was conducted within a fifth grade classroom in an elementary K-6 school building. This rural town is a predominantly German-Catholic farming community where education is focused and supported by teachers and parents.

This small community consists of approximately 1,600 residents. The school district consists of PreK-6 elementary school, 6-7 junior high school, and 9-12 high school. The classrooms average approximately ninety students per grade level, and a one to twenty-two teacher to student ratio. In 2019, according to the Illinois school report card, the enrollment of students consisted of 98% Caucasian, 0.6% Black, 0.3% Hispanic, and 0.2% Asian (Illinois Report Card, 2019). The overall graduation rate of the district is 92%, and the district has an attendance rate of 98% (Illinois Report Card, 2019). According to the report, 11.3% qualified for free and reduced lunch and 14.3% qualified for Special Education services. This demographic picture supports the high standards and expectations of education within this community. See Table 2 and Table 3 below.

Table 2.

Teutopolis CUSD 50 Student Achievement in ELA and Math

A Data Picture of Our Schools						
School Name: Teutopolis CUSD 50						
Student Achievement Results						
Indicator	**Year 2016-2017**		**Year 2017-2018**		**Year 2018-2019**	
	ELA	MATH	ELA	MATH	ELA	MATH
Based on Our Schools Assessment Data	45%	44%	58%	58%	60%	61%
Based on Our Districts Assessment Data	43%	43%	59%	54%	57%	56%
Based on Our State Assessment Data	36%	32%	37%	32%	37%	32%
Based on Our National Assessment Data	62%	74%	60%	71%	63%	70%
Average Daily Attendance	98%		98%		98%	
Percentage of Students in Extracurricular Activities	78%		82%		79%	
Percentage of Students Enrolled in Rigorous Courses	35%		35%		35%	
Percentage of Students Graduating Without Retention	90%		90%		90%	

Table 3.

Teutopolis CUSD 50 Student Engagement Data

A Data Picture of Our Schools			
School Name: Teutopolis CUSD 50			
Student Engagement Data (continued)			
Indicator	**Year 2016-2017**	**Year 2017-2018**	**Year 2018-2019**
Percentage of Students Who Drop Out of School	0%	0%	0%
Number of Referrals/ Top Three Reasons for Referrals	96%	88%	86%

Number of Parent Conferences Regarding Discipline	88%	86%	78%
Number of In- School Suspensions	14%	12%	11%
Number of Detentions/ Saturday School	96%	88%	86%
Number of Out-of-School Suspensions	2	1	1
Number of Expulsions	0	0	0

Data Source and Research Materials

The researcher used two different instruments to conduct this study. The instruments included:

1. **Saxon Math- intermediate five course assessments.** This assessment provided students with one or two mathematical questions focused over the course of ten lessons. In addition, 1-3 questions focused on lessons previously learned. The students were given the pre-assessment prior to the first day of the unit. Each unit was ten lessons long. Ten lessons were covered over two - three weeks time. Throughout this time, Class I students were given detailed lessons using a range of technological tools and using interventions that aligned with RtI to support struggling learners. Class II was instructed traditionally in front of the classroom given multiple practice problems and simple verbal explanations. After five lessons, the students were given a formative assessment that identified struggling topics. Class I students received specific interventions aligned with the RtI program with a range of resources and technological support. The use of a range of technological teaching strategies and interventions was predicted to show an increase of academic understanding in Class I. In comparison, Class II students received interventions that consisted of basic, traditional re-teaching practices that were provided to the students who qualified for academic support.

2. **Intervention supplemental resource.** This data will be collected from Class I and Class II. Class I received instructional interventions daily using a range of high and low technology resources based on the concepts of need and the concepts being learned in class. Students in Class I had educational opportunities electronically with the use of a range of math games, practice, and quizzes that were used as formative assessments. For the students in Class I, the teacher researcher used observations, participation, and technology program data to document and assess students growth throughout the interventions. Class II received instructional interventions daily using supplemental worksheets opposed to high and low technology. The students in Class II were assessed based on observations, participation, and completion on supplemental worksheets.

Procedures of Data Collection

The time frame for this study was six weeks. Students participating in this study completed two math units, totaling twenty lessons. Students were pre-assessed prior to each unit, were given a formative assessment within the unit, and a post-assessment upon completion. The students were actively taught new concepts and practiced those concepts four to five days a week for 40-50 minutes a day. For Class I, the teacher researcher implemented a range of technological resources while providing interventions that modeled and explained in depth to new mathematical concepts based on the Illinois Common Core State Standards. Class I RtI interventions were provided with the use of technological resources. However, Class II students who qualified for RtI interventions were provided support and supplemental learning opportunities to assist their understanding using basic traditional teaching approaches.

The first week started with a pre-assessment that was used to identify student's prior knowledge and assess the needs of the students. The data collected from these assessments

allowed the teacher researcher to then place the students into groups and reflect on the extent of depth the students needed for each lesson. Five full lessons were taught and students in Class I were given additional technological support after each lesson based on their needs. Class II received extra worksheet practices to support understanding.

The second week the teacher researcher administered a formative quiz to monitor progress, growth, and needs of the students. Five additional lessons were covered this week. Additional students were identified in needing instructional support based on their formative quiz and interventions in both classes continued.

The third week included one day of a review and the post-assessment. Data was collected from both classes to analyze the progress of the students based on the interventions that were being received. A new unit was started in the middle of the week, and the same lesson and assessment pattern continued from the remaining weeks four through six.

In conclusion of the study, an identical, final summative test was given to both classes. Both unit summative assessments were graded by a fellow teacher. This is to avoid bias and ensure quality data was collected.

Data Analysis and Results

The data collected from the research was analyzed using the quantitative approach and employed a quasi-experimental design. Participants in this study consisted of two separate classes taught at the same level, following the same curriculum, and by the same teacher. The researcher collected scores from homework, pre-assessments, formative quizzes, post-assessments, computer based supplemental games and classroom observations that were used to support learning new concepts. The researcher collected scores from a total of eleven students in Class I and fifteen students in Class II, for a total of twenty-six students. In both classes, the

homework and assessment results analyzed the amount of content knowledge that they were gaining from the unit lessons and the interventions provided by the teacher. In addition, both the control group and the experimental group were given identical assessments, including homework. However, different interventions were implemented to analyze the effectiveness of how the Response to Intervention program is implemented.

Data Analysis

This study analyzed data using a quantitative approach. Daily the researcher collected data and analyzed each class's learning growth throughout each lesson. Through observations, resources, conversations, participation, homework, and assessments, the researcher was able to quantitatively analyze the data from both Class I and Class II. The data collected was documented and organized by students and classes. The researcher collected pre-tests, checkpoint assessments, and post-tests focused on two ten lesson math units. The participants data was acquired over six weeks. During this time period, both classes were given the same assessments and were taught the same lessons for the entire six weeks. However, Class I was provided with technology enrichment during interventions to support struggling students. Class II was given written supplemental support without the use of technology manipulatives to reinforce difficult learning concepts.

The research used the quantitative approach and utilized a quasi-experimental design. The researcher used pre-and post tests to collect data each week that focused on the growth and abilities of the participants. As data was collected, the researcher used the assessments to report and organize two different graphs. Figure 1 and Figure 2 both were created to display the assessments raw scores using colored bar graphs in Microsoft Excel. The first graph represents the raw scores of Class I and the second graph displays the data of Class II. Both graphs are

organized by participants and include all three assessments given. The research recorded in the graph shows each participants' scores during the six weeks time frame of the study.

To further analyze the data, two tables were made to show growth in the participant's pre-and post test scores. The scores of each participant's assessments were calculated to find the mean score for each individual. In addition, the difference of the pre- and post-test scores was included to show the participants average growth in each class. Table 4 represents the scores of the participants in Class I and Table 5 represents the scores of the participants in Class II.

The study hypothesized that the integration of technology interventions, for struggling students in Class I, would result in data that proved a greater growth than Class II. In addition, the researcher hypothesized that the interventions used would improve mathematical understanding for students who struggle understanding daily math concepts and would encourage students to ask more questions. The increased amount of resources and participation would then lead to the student's improved ability to solve mathematically and retain new mathematical concepts. Therefore, the researcher created an additional table that focused on the identified low achieving participants to better compare their growth throughout the six week study. This table also calculated the participants mean pre-and post test scores. Additionally, the researcher included the difference of the pre-and post test data to better identify the growth of the students from the beginning to the end of the study. To better analyze the hypothesis, the following information is provided to discuss and explain the results of the study based on the research questions.

Results

Research Questions One: Does implementing high and low technology interventions improve the understanding of mathematical concepts for struggling fifth grade math students?

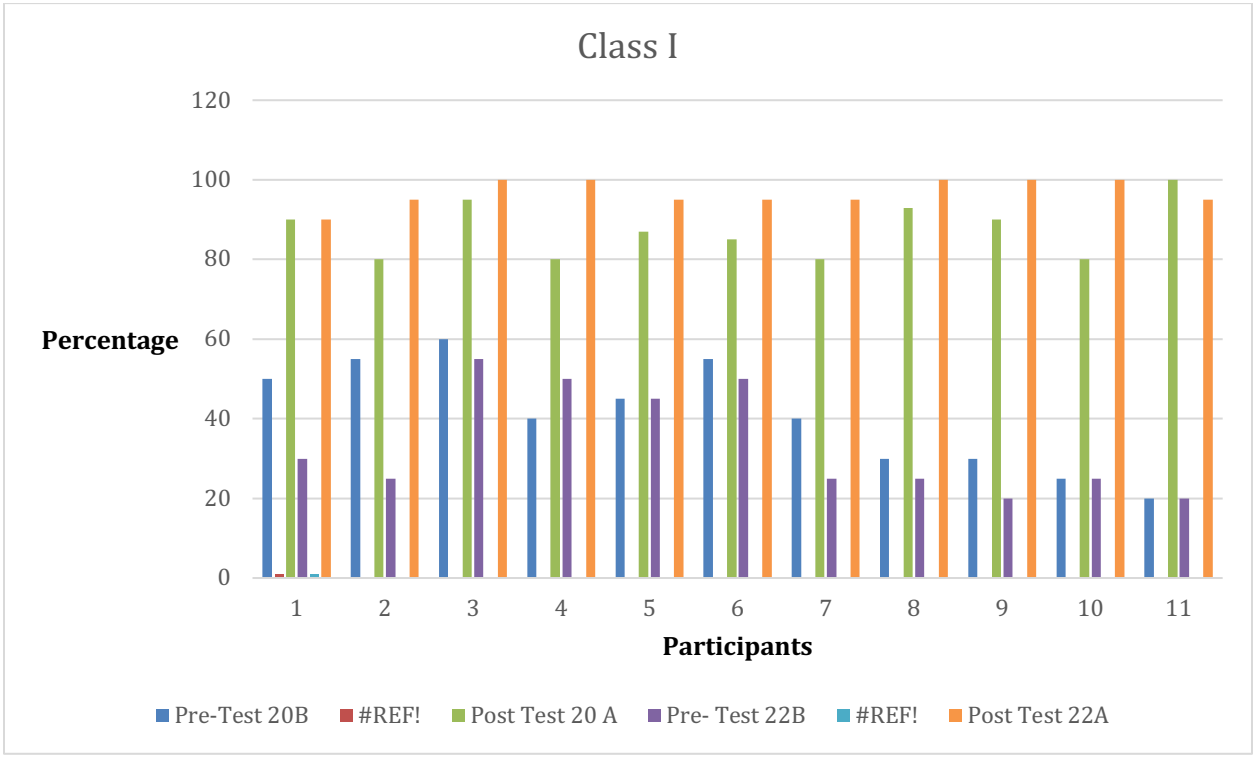
The results of the study revealed that the participants in Class I made greater gains from their pretest to their post-test than the participants in Class II. Therefore indicating that the interventions implemented in Class I were successful in improving students mathematical understanding. The mean pretest score for Class I and Class II were both 40%. However, the mean post-test score for Class I was a score of 92%, and for Class II was an 88%. These mean scores reflect all of the data collected over the six weeks study. According to these mean scores, Class I shows to have a higher post-test score by four percentage points. Furthermore, the mean growth rate in Class I resulted in the participants improving by an average of 52%. The Mean growth rate for Class II was 48%, once again with a difference of 4%. Concluding that Class I improved more than Class II, in both the mean post-test and growth gains over six weeks. Also, in Class I there were six perfect scores on post-test throughout the study. In comparison to Class II participants recording only two perfect scores. Class I's data results show that the students identified as ADD/ADHD had the highest pretest scores in Class I, but have similar pretest scores as average students in Class II. However, in Class II, participant eleven, had a mean pretest score of 47.5 resulting in a more average pretest score as well. Overall, Class I intervention participants with IEP's achieved consistent post-test scores in the nineties, exceeding the majority of all of the participants' mean post-test scores in Class II. Also in Class I, the six perfect post-test scores were all acquired by students with IEP'S, a 504 Plan, or students with ADD/ADHD. The two perfect scores in Class II were acquired by average

participants. Figure 1 and Figure 2 displays the results of the data collected in more details below.

Class I Results. Figure 1 below represents the percentage scores recorded from the six assessments administered over the six week study. Figure 1 displays eleven students in the class. The assessments recorded include the pre-and post-test, and the checkpoint assessments. The highest pretest score was 60% and the highest post-test score was 100%. All participants improved their mathematical knowledge and increased their scores by 30% or more. The lowest post-test score in Class I was 80%. Participants 1, 8, 9, 10, and 11 all increased their score by 60% or more, which truly supports the educational gains that these participants endured throughout these units.

Figure 1.

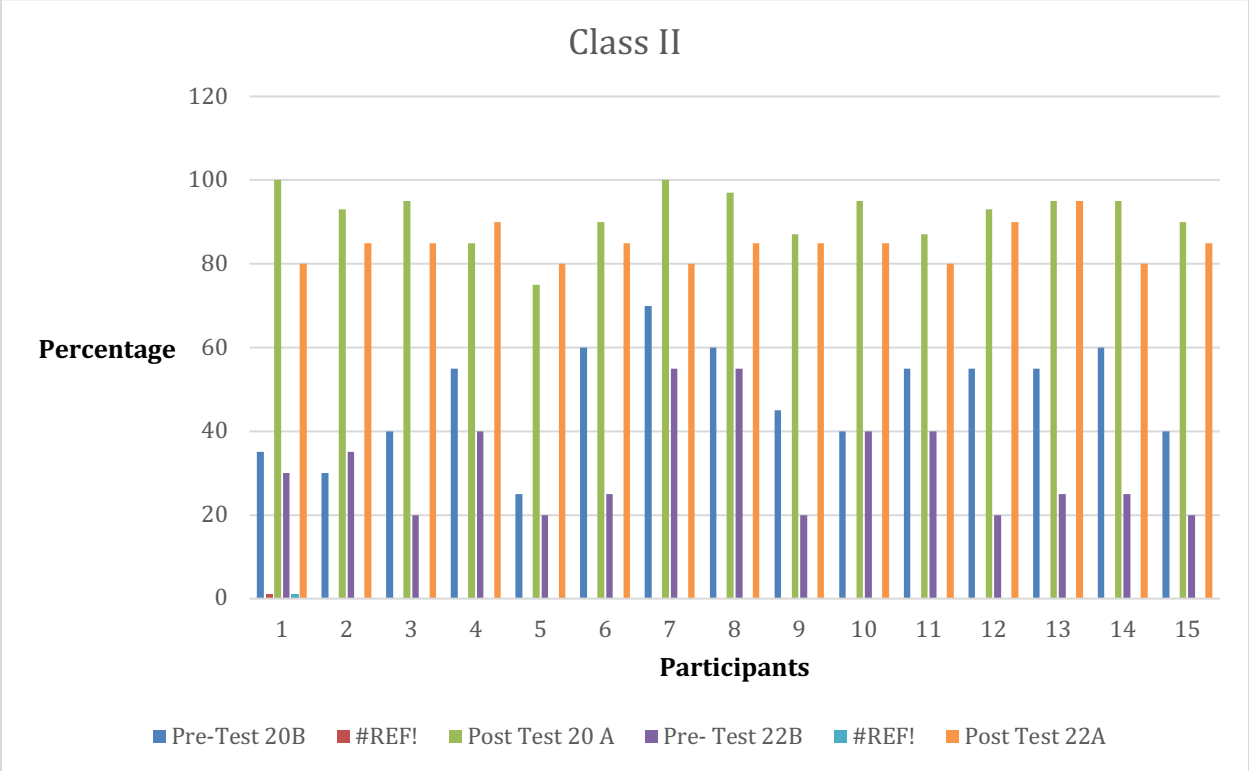
Class I Participants' Percentages for the Entire Six-Week Study



Class II Results. Figure 2 below represents the percentage scores recorded from the six assessments administered over the six week study. Figure 2 displays fifteen students in the class. The assessments included are the pre-and post-test, and the checkpoint assessments. The highest pretest score was 70% and the highest post-test score was 100%. All participants improved their mathematical knowledge and increased their scores by 27.5 % or more. The lowest post-test score in Class II was the same as Class I, 80%. However, the Mean improvement score for Class I was 4 percent higher than Class II.

Figure 2.

Class II Participants' Percentage for the Entire Six-Week Study



Comparison of Class I and Class II Results. Table 4 and 5 below compares each of the participants pretest and posttest scores during the six week study. Table 4 represents Class I and Table 5 represents Class II. Each table also includes the differences of the pretest and post-test

to display the amount of growth the participants made throughout the study. For example, participant 11 growth difference increased from 20% to 97.5%, resulting in a 77.5% score increase. According to the data recorded reflecting the participants' scores, Class I received higher post-test scores and a higher mean difference representing the growth of each participant. Class I's mean post-test scores was 92% and Class II's post-test score was 88%. Class I's post-test scores was 4% higher. Therefore, the use of high and low technology interventions proved to increase the level of understanding of the students. This is supported by Class I's data being four percentage points higher than Class II.

Table 4.

Class I: Participants' Mean Scores from Pretests and Post-tests. n=11

Participant	Pretest Score	Post-test Score	Difference
1	30	90	60
2	40	87.5	47.5
3	57.5	97.5	40
4	60	90	30
5	45	91	46
6	52.5	90	37.5
7	60	87.5	27.5
8	27.5	96.5	69
9	25	95	70
10	25	90	65
11	20	97.5	77.5
Overall	40	92	52

Note: Participants in green have IEP's and participants in yellow are identified as ADD/ADHD..

Table 5.

Class II: Participants' Mean Scores from Pretests and Post-tests. n=15

Participant	Pretest Score	Post-test Score	Difference
1	32.5	90	67.5
2	32.5	89	56.5
3	30	90	60
4	47.5	87.5	40
5	22.5	77.5	55
6	42.5	87.5	45
7	62.5	90	27.5
8	57.5	91	33.5
9	32.5	83.5	51
10	40	90	50
11	47.5	83.5	36
12	37.5	91.5	54
13	40	95	45
14	42.5	87.5	45
15	30	87.5	57.5
Overall	40	88	48

Note: Participants in green have IEP's and participants in yellow are identified as ADD/ADHD.

Table 6 shows the comparison of identified struggling math learners in both classes. Class I consisted of four students with IEP's, one student with a 504 Plan, and three students identified with ADD/ADHD. Class II consists of two students with IEP's and two students identified as ADD/ADHD. The mean scores focus on the assessments given throughout the six week study and the difference of the participants' scores. Table 6 further supports the answer to the first research question in representing Class I scored higher on both the post assessments and the difference in mean growth, representing the amount of gained knowledge obtained. For example, Class I's mean post-test score was 93% and Class II scored 84%. Class I scored 9% greater than Class II. In addition the level of growth scores, Class I improved by a mean score of

48.5% and Class II improved only 46.75%. This concludes that the use of high and low technology interventions proved to increase the level of understanding for the students in Class I.

Table 6.

Demographic Information on Participants. (n= 26)

Types of Participants	Class I			Class II		
	Pretest	Post-Test	Difference	Pretest	Post-Test	Difference
IEP	29.4	94	64.4	30.5	80.5	45.5
ADD/ADHD	59	92	32.5	56	88	48
Total	44.2	93	48.5	42	84	46.75

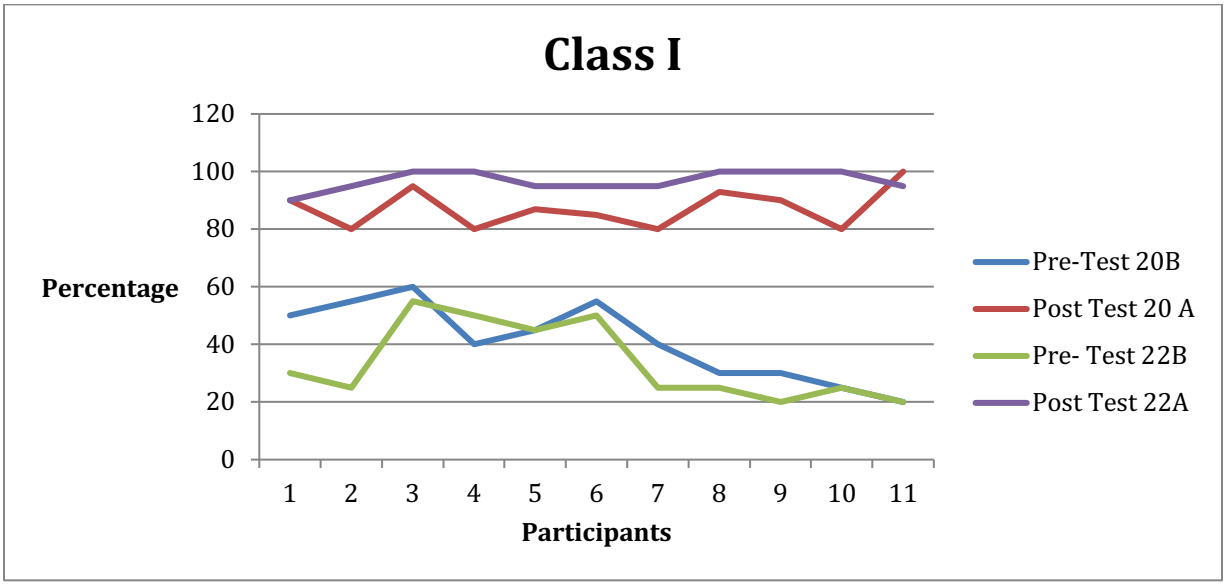
Research Questions Two: What are specific strategies that best facilitate students' learning when a deficit is identified in a current mathematical learning concept?

Class I Results. Figure 3 below shows Class I's recorded data focused on both pretests and post-tests given during the six weeks study. The teaching strategies used during both weeks varied based on the instructional concept. Both low technology and high technology resources were used to enhance learning opportunities for struggling participants only in Class I. The low technology resources consisted of rulers, counting blocks, and number counters. The high technology resources used the online program, IXL Math that provided extra skill practice on the concept. During these two units, Figure 3 supports the improvement of the participants' math knowledge and understanding. Figure 3 shows all participants scores resulting in a 60% or below on the pre-test assessments. Improvement can be observed when visually seeing the above red and purple lines that display all students scoring above 80% on the post-test. Observing the line graphs below, there are significant gains from the participants' scores from the beginning pretest to the final post-test scores. For example, student 9 pretest score was 20% displayed

using the green line. Student 9, then scored a post-test score of 100, displayed by the purple line. The space between these lines visually supports the growth that this students and the class endured during these units. Furthermore, the researcher observed in the classroom and through recorded data, that the students became more accustomed to the small group interventions. This routine resulted in more significant gains during the second unit, which was during the final three weeks of the six week study. For example, when observing the purple line in Figure 3, participants 3, 4, 8, 9, and 10 all received 100% scores on their post-test.

Figure 3.

Class I Participants Pre-and Post-Test Comparison.

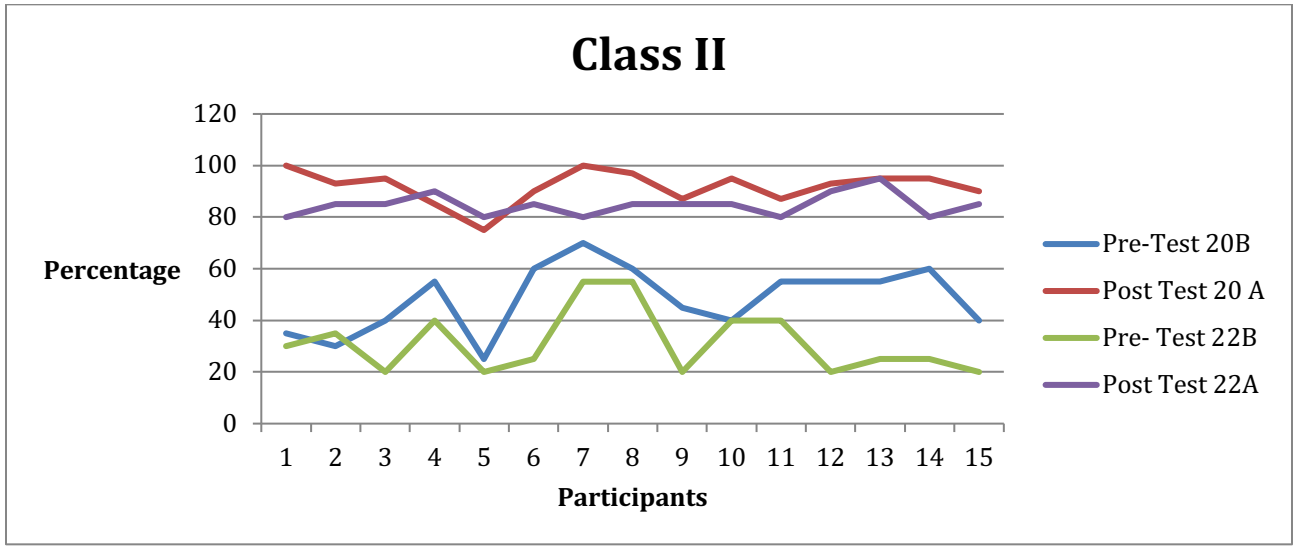


Class II Results. Figure 4 below shows Class II's recorded data focused on both pretests and post-tests given during the six week study. The teaching strategies used during both weeks were routine and basic. Participants' needing academic support were verbally instructed and learning strategies were repeated based on the instructional concept of the day. During these two units, Figure 4 suggests that the participants in this study still improved significantly. For example, student 9 in Class II increased their score from a 20% pre-test score to an 85% post-test

score, resulting in a 65% gain. In reference to the line graphs below, all participants made gains from the beginning pretest to the final post-test scores. For example, student 7 received the smallest gains with a pretest score of 55% and a post-test score of 80%. However, the researcher noted in the classroom that the depth of their understanding was below students in Class I. However, based on the assessments given students in Class II were still successful in the classroom and on the assessments. In reference to the graph, all participants scored above a 75% on both post-tests.

Figure 4.

Class II Participants Pre-and Post-Test Comparison



Comparison of Class I and Class II Results. Table 7 below compares the mean participant scores of both classes using the pretest and post-test scores organized by units during the six week study. Unit 20 is the math unit studied during the first three weeks, and Unit 22 was completed during the final three weeks of the study. Table 7 shows the participants calculated growth from the beginning of the unit and during the pretest, and then compares the classes mean post-test score at the end of the unit. Class I shows a growth difference of 46% during Unit 20, and a growth difference of 63% during Unit 22. Class II shows a growth difference of 39.9%

during Unit 20, and a growth difference of 53.6% during Unit 22. Class I's growth during both units exceeds the growth scores of Class II. In addition, as stated earlier, Class I scores improved significantly from one unit to the next. This shows that the students began acquiring habits to new learning strategies and responded positively to the implementation of technology interventions being used. Furthermore, the Unit 22 post-test for Class I resulted in a mean score of 97%. In comparison to Class II, the participants mean Unit 22 post-test score was 85%. Class I participants' overall scored better on the assessment calculating a 12% difference in the post-test scores. The assessment growth and percentage comparisons support a higher level of understanding and an increased amount of knowledge retained and acquired by the participants. According to Table 7, the answer of the second research question would conclude that low and high technology interventions reduce the deficit of students who struggle to understand current mathematical learning concepts. The researcher supports that with the use of low and high technology resources during interventions, that students' scores will improve consistently and participants will better retain new math concepts.

Table 7.

Class I and Class II Assessment Growth Data

	Class I		**Class II**	
Assessments	Unit 20	Unit 22	Unit 20	Unit 22
Pretest	41	34	51.4	31.4
Post-test	87	97	91.3	85
Total Difference	46	63	39.9	53.6

Further Analysis.

The research questions for this study were developed to ensure students with mathematical deficits, similar to the fourteen indentified students in the study, were given adequate interventions in order to make substantial gains. Math interventions vary in resources, instruction, and time frames. Therefore, the goal of this research is to show how implementing high or low technology resources would affect and benefit the participants when receiving interventions. Additional observations and data was recorded by the researcher during the instructional time of the participants. The observations noted by the researcher includes Class I students being more engaged. The teacher recorded that the students looked forward to the small group interventions and appeared more confident in answering questions. Furthermore, during Class II the researcher noted that the students were less motivated to attend the interventions and participation was limited. Interactions with the students in Class II resulted in completing the work to have it finished, opposed to Class I participants making connections to develop a more in depth understanding. Therefore, in reflection of research question number one, participants classroom observations, participation, and desire to learn supports that implementing high and low technology interventions do improve the understanding of mathematical concepts for struggling fifth grade math students. The motivation and devotion to learning observed by the researcher are crucial elements that contribute to the improvement of math understanding. In addition, research question number two was supported by Class I during the participants personal interactions during the lesson. The participants desire to improve their mathematical capabilities reflects that specific learning strategies, such as low and high technology resources, benefit math students.

Findings, Implications, Limitations

Findings

The findings of this research study were positive. Based on the data collected during the study, implementing high and low technology interventions do improve the understanding of mathematical concepts for struggling fifth grade math students. The research data displays a positive effect on Class I due to the increased post-test assessments and the average growth gains throughout each unit. Reflecting that both scores in the data set were greater than Class II leads the researcher to support this conclusion. Additionally, specific strategies, such as low and high technology resources, do facilitate students' learning when a deficit is identified in a current mathematical learning concept. The data contributed a positive effect on Class I showing significant gains throughout the unit and over the entire six week study. In correlation to Class II, the basic interventions provided to this control group were positive, but not as drastic or significant as the increased scores of Class I.

The purpose of the study was to determine the difference in the mathematical success of students when teachers use technology resources to implement interventions, opposed to basic reteaching strategies. The goal of the study was focused on the student's engagement, active questioning, and level of understanding of concepts when the information was provided during interventions. The first research question focused on the data supporting improvement of the student's assessment scores when implementing high and low technology interventions to support math deficits for struggling students. Furthermore, the researcher focused on the participants receiving interventions to facilitate students' learning in order to improve a participant's current mathematical understanding and perception of their mathematical knowledge. The study hypothesized that the integration of technology to implement

interventions, for struggling students, would improve student's understanding of mathematical concepts. The purpose of the interventions were to help students be more actively engaged in the lesson, more comfortable and likely to ask questions, and have a higher level of understanding through more hands-on interactive learning. The conclusion of the results of this study indicate that the use of technology within inventions does improve students' mathematical understanding. In addition, these interventions increase students' ability to better retain new mathematical concepts, and promotes a more intuitive connection between in depth concept learning and the individual student.

Implications

Teachers are driven individuals that strive to meet the needs of their students daily. Teachers receive a new class list every year full of new students with different learning needs and abilities. Furthermore, teachers are motivated by their district administrators to continue to implement a range of teaching avenues that supports struggling learners and meets the needs of a range of learning styles within the classroom. In response to these needs, teachers evaluate their lessons and revise their instruction to better accommodate students by using different resources and technology. Traditionally, teachers resort to small group instruction to support struggling learners across all subjects. However, math instruction and learning concepts can be more complex than other core educational material. Therefore, the implementation of small groups to assist struggling learners needs to be reviewed and evaluated. Teachers need to seek a larger variety of ways to connect with their struggling math learners. Therefore, teachers need to decide if implementing technology within their small group interventions is beneficial for math students to obtain and retain mathematical concepts better. Furthermore, the results of this study showed that participants in Class I, improved at a higher rate from their pretest to their post-test

than those in Class II. Additionally, the post-test scores of the participants in Class I were overall higher than Class II as well. The study supports that using low or high technology resources within interventions does result in the students obtaining more mathematical knowledge and improves the student's cumulative math assessment scores.

To further support the study, the use of specific strategies, such as low and high technology resources, improved all students' learning including average students and students labeled with IEP's, ADD/ADHD. or have a 504 Plan. The study reflects the Class I participant's desire to receive math interventions as well. In addition, the participants' participation within the interventions and the engagement during the inventions was reflected in the data that shows significant gains of students with additional identified math concept deficits. Speculatively, this implies that when students take ownership in their learning, they are then more motivated, and make connections to their learning that in return increases their ability to learn and retain new mathematical concepts.

Limitations

A limitation of the study was the number of sample participants in both groups. Class I only consisted of 11 students. In addition, Class II only consisted of 15 students. A larger sample group would result in more data that would provide the researcher with more opportunities to assess the study. Performing the study with a range of different grade levels or conducting the study with the entire grade would provide more beneficial results to the researcher. Finally, assessing the students over only two units could skew the data based on the concepts that were being taught within those units. Furthermore, the two units only lasted six weeks. If the study were to be performed over more units, the study would be researched over a

longer period of time. A longer time frame would increase the amount of data collected and would further support the results and the conclusions of the data.

Reflection and Action Plan

Reflection

Creating more involved, focused interventions through the use of low and high technology resources proved to be a beneficial teaching strategy to assist struggling math learners within the classroom. The results of this study reflected that student's assessment scores significantly improved their mathematical knowledge throughout the unit. Additionally, students became more connected to their math learning experience which resulted in the participants being more engaged and involved in the learning of new concepts. The results of this study confirmed the researcher's hypothesis. During the study, the researcher observed the difference of student involvement during the interventions. Initially, the researcher was curious if Class I responded more positively because the resources were new. However, Class I continued to actively seek answers and engage in using resources to solve difficult learning concepts. The researcher observed that Class I needed only small corrections or guidance, whereas Class II appeared that the intervention was more work. The researcher observed the participants in Class II nodding along to the teachers instructions and simply repeating steps to follow. The researcher observed basic understanding in Class II that was mostly teacher led and required minimal effort from the students.

Even though there were differences in regards to student observations during math interventions, both classes made significant gains throughout both units. Throughout the entire six week study all participants made gains consistently. Therefore, the researcher reflects that even though the integration of low and high technology resources is more beneficial, both

interventions improve students' ability to improve their understanding of difficult math concepts. The researcher's final reflection of the study is that more research is needed. In addition, the researcher will continue to use low and high resources to benefit math student's ability to better understand difficult and complex concepts within their math classroom.

Action Plan

The researcher plans to continue the use of low and high technology resources within their math intervention groups. The researcher was pleased with the results of the study and genuinely feels that using these resources to aid students understanding during intervention time is what is best for students. The researcher is eager to observe the use of these interventions in the future and hopes to observe the students making substantial gains in their mathematical understanding. The researcher anticipates that the interventions will continue to follow the same trend as the data recorded in this study.

The researcher plans to present this study to the fifth grade mathematics committee. Following the fifth grade team members implementing additional resources within their intervention groups, the researcher will then seek to share the results of the study with the school mathematics department committee. The researcher will share the data and results of the study, including the observations made within the classroom. The researcher will also use this opportunity to share resources to be used across grade levels. Furthermore, the research, data, and findings of this study will be presented to an action research committee at Eastern Illinois University using PowerPoint slides and a professional poster. In conclusion of this action research study, the researcher again suggests that more research is needed in order to better evaluate the success of low and high technology resources being implemented during interventions for students who are identified with a deficit in certain mathematical concepts.

This study could be continued and enhanced with the use of larger participant groups, multiple grade levels, and a longer time frame to conduct the study. However, this study enhanced the knowledge of the researcher and positively influenced multiple fifth grade math students during the collection of data. Furthermore, the researcher will continue to positively influence struggling math learners with intense, specific, and appropriate resources that will improve the learning experience for students.

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Appendix A

Unit 1- Pretest Page 1 of 2

Name _____

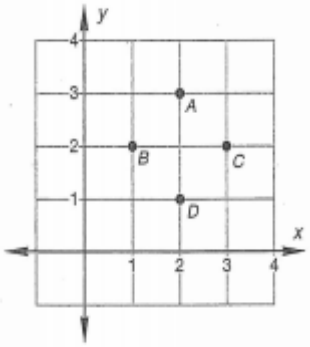
Score _____

Cumulative Test 20B

Also take ***Power-Up Test 20***

Unit 1-Pretest pg.1

1. (Inv. 8) Which letter names the point at (3, 2)?

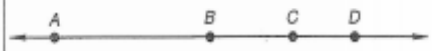


2. (11) A new bat costs $21.45. Wade has $16.75. How much more money does he need to buy the bat?

3. (97) There are 18 girls and 12 boys in Ms. Webster's class. What is the ratio of boys to girls in her class?

4. (74) Carl jumped 8 meters. Eight meters is how many centimeters?

5. (61, 73) *AB* is 2.8 cm. *BC* is1.8 cm. *CD* equals *BC*. Find *AD*.



6. (85) **a.** A cup is what fraction of a pint?

b. A pint is what fraction of a quart?

c. Use the answers from part **a** and **b** above to determine what fraction of a quart a cup represents.

7. (82) Estimate the product of 517 and 291.

8. (100) Simplify this decimal number: 005.0700

9. (95) What is the reciprocal of $\frac{7}{5}$?

Unit 1- Pretest - pg. 2

Cumulative Test 20B

10. (91) Reduce: $3\frac{8}{12}$

11. (28) $3.4 + 0.25 + .6$

12. (78) 2^4

13. (73) $4.356 - 0.21$

14. (70) $10 \times 36¢$

15. (78) $\sqrt{100}$

16. (92) $23\overline{)500}$

17. (24, 63) $6 - \left(1\frac{1}{3} + 2\frac{1}{3}\right)$

18. (95) $\frac{2}{3} \div \frac{3}{4}$

19. (91) $\frac{5}{8} + \frac{5}{8}$

20. (95) $\frac{3}{4} \times 2$

Name _____

Score _____

Cumulative Test 19A

Also take ***Power-Up Test 19***

Unit 1 - Formative Quiz /pg.1

1. (63) What is the reciprocal of $\frac{4}{5}$?

2. (73) Write fractions equal to $\frac{1}{7}$ and $\frac{1}{2}$ with denominators of 14. Then add the fractions.

3. (21) Diego had 2 dozen model cars which he kept in 3 cases. How many cars were in each case?

4. (86) **a.** What number is $\frac{1}{5}$ of 80?

b. What number is $\frac{2}{5}$ of 80?

5. (71) Name the shaded part of this rectangle

a. as a reduced fraction.

b. as a decimal number.

c. as a percent.

6. (69) List the numbers below in order from least to greatest.

$1, 0.2, \frac{2}{3}$

7. (56) Write the length of this segment

a. in centimeters.

b. in millimeters.

8. (91) Reduce: $\frac{24}{16}$

9. (79) $\frac{4}{7} = \frac{r}{21}$

10. (73)
$$\begin{array}{r} 32.14 \\ 3.89 \\ +\ 10.2 \\ \hline \end{array}$$

Cumulative Test 19A

Unit 1 - Formative Quiz pg. 2

11. (8) $\begin{array}{r} 5083 \\ -\,4235 \\ \hline \end{array}$

12. (51) $\begin{array}{r} \$13.21 \\ \times\quad 27 \\ \hline \end{array}$

13. (54) $20\overline{)\$26.00}$

14. (78) $\sqrt{64}$

15. (54) $23\overline{)1173}$

16. (90) $4\frac{5}{8} - 2\frac{3}{8}$

17. (91) $2\frac{2}{3} + 3\frac{2}{3}$

18. (86) $\frac{5}{6} \times 5$

19. (70) $\$8.23 + 21¢ + \$4$

20. (70) $16 \times 25¢$

Unit 1-Post-Test pg.1

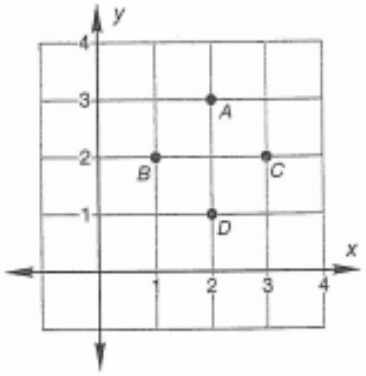
Name _____

Score _____

Cumulative Test 20A

Also take ***Power-Up Test 20***

1. (Inv. 8) Which letter names the point at (2, 3)?

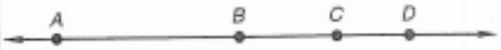


2. (11) A new racket costs $86.50. Mariam has $63.75. How much more money does she need to buy the racket?

3. (37) Lakeisha has 15 iris bulbs and 25 tulip bulbs in her flower bed. What is the ratio of iris bulbs to tulip bulbs in her flower bed?

4. (74) The grasshopper jumped 25 cm. How many millimeters is that?

5. (51, 73) *AB* is 2.7 cm. *BC* is 1.9 cm. *CD* equals *BC*. Find *AD*.



6. (65) **a.** A pint is what fraction of a quart?

b. A quart is what fraction of a gallon?

c. Use the answers from parts **a** and **b** above to determine what fraction of a gallon a pint represents.

7. (52) Estimate the product of 496 and 351.

8. (100) Simplify this decimal number:

0400.203000

9. (25) What is the reciprocal of $\frac{9}{7}$?

Unit 1 Post Test pg. 2

Cumulative Test 20A

10. (91) Reduce: $4\frac{5}{15}$

11. (59) $2.7 + 0.33 + 4$

12. (73) 2^5

13. (73) $13.459 - 0.36$

14. (73) $20 \times 16¢$

15. (73) $\sqrt{81}$

16. (52) $27\overline{)330}$

17. (24, 63) $5 - \left(2\frac{1}{3} + 2\frac{1}{3}\right)$

18. (96) $\frac{2}{7} \div \frac{3}{5}$

19. (91) $\frac{9}{10} + \frac{7}{10}$

20. (86) $\frac{2}{3} \times 6$

Appendix B

Unit 2- Pre- Test Page 1 of 2

Name _____

Score _____

Cumulative Test 22B

Also take ***Power-Up Test 22***

Unit 2- PreTest pg.1

1. (106) Which digit in 6.1375 is in the thousandths place?

2. (74) A football field is 100 yards long. How many feet long is a football field?

3. (105) Which of these figures has no line of symmetry?

A. 

B. 

C. 

D. 

4. (97) There are 8 girls and 12 boys in the class. What is the ratio of girls to boys?

5. (71, 90) Write 25% as a reduced fraction.

6. (107) In a roll of 50 pennies, 15 were minted before 1985. What percent of the pennies in the roll were minted before 1985?

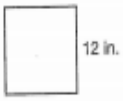
7. (101, 104) Round parts **a** and **b** to the nearest whole number.

a. $6\frac{5}{8}$

b. 98.631

8. (108) Compare: 0.25 ◯ 0.025

9. (53) What is the perimeter of this square?



10. (72) What is the area of the square problem **9**?

Unit 2- Pre- Test Page 2 of 2

Cumulative Test 22B

Unit 2 - Pretest pg.2

11. (88) $3.42 + 12 + 0.367 + 5$

12. (99) $2.5 - 1$

13. (102) $5 - 1.36$

14. (105) 1.2×0.3

15. (110)
$$\begin{array}{r} 0.15 \\ \times\ 0.5 \\ \hline \end{array}$$

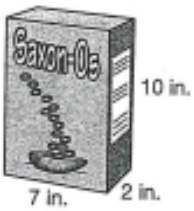
16. (83, 90) $3\frac{1}{4} + \left(5 - 1\frac{1}{4}\right)$

17. (86, 91) $\frac{3}{4} \times \left(2 \times \frac{2}{3}\right)$

18. (91) $3\frac{3}{4} + 3\frac{3}{4}$

19. (90, 96) $\frac{8}{9} \div 2$

20. (103) What is the volume of a box of cereal with the dimensions shown?



130

 Saxon Math Intermediate 5

Name _____

Score _____

Cumulative Test 21A

Also take ***Power-Up Test 21***

Unit 2- Formative Quiz -Pg.1

1. (104) Round $48.91 to the nearest dollar.

2. (101, 104) **a.** Round 9.671 to the nearest whole number.

b. Round $7\frac{2}{3}$ to the nearest whole number.

3. (69) Arrange these numbers in order from least to greatest: 0.1, 2, and $\frac{2}{3}$.

4. (46) Two thirds of the 18 cars were new. How many cars were new?

5. (61) The length of $\overline{AD}$ is 6.4 cm. The length of $\overline{AB}$ is 3.9 cm. The length of $\overline{BC}$ is 1.4 cm. Find the length of $\overline{CD}$.

6. (63) A shoe box has the shape of what geometric solid?

7. (Inv. 10) Which of these angles could measure 120°?

A.

B.

C.

8. (99) 4.39 + 1.8 + 3

9. (73) 9.14 − 0.8

Cumulative Test 21A

Unit 2- Formative - pg. 2 Quiz

10. (102) $2 - 0.8$

11. (51) 309×14

12. (83, 90) $7 - \left(2\frac{5}{6} - \frac{1}{6}\right)$

13. (91) $4\frac{8}{12} + 3\frac{6}{12}$

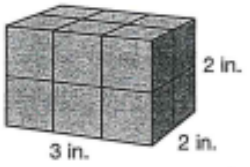
14. (34) $\frac{4028}{4}$

15. (54) $953 \div 30$

16. (96) $\frac{1}{5} \div \frac{1}{2}$

17. (85, 91) $\frac{3}{5} \times 10$

18. (103) Find the volume of this rectangular solid.



19. (105) Draw an equilateral triangle and show its lines of symmetry.

20. (72, 90) The denominator of $\frac{11}{12}$ is 12. Write a fraction equal to $\frac{2}{3}$ that also has a denominator of 12 and subtract that fraction from $\frac{11}{12}$. Then reduce the answer.

Name _____

Score _____

Cumulative Test 22A

Also take ***Power-Up Test 22***

Unit 2- Post Test pg.1

1. (108) Which digit in 1.3725 is in the thousandths place?

2. (74) A bolt of cloth is 40 yards long. How many feet long is a bolt of cloth?

3. (105) Which of these figures has no line of symmetry?

A. 

B. 

C. 

D. 

4. (97) There are 7 boys and 14 girls in the class. What is the ratio of boys to girls?

5. (71, 93) Write 40% as a reduced fraction.

6. (107) In a roll of 50 dimes, 8 were minted before 1983. What percent of the dimes in the roll were minted before 1983?

7. (101, 104) Round parts **a** and **b** to the nearest whole number.

a. $3\frac{2}{7}$

b. 101.496

8. (106) Compare: 1.25 ◯ 12.5

9. (53) What is the perimeter of this square?

10. (72) What is the area of the square in problem **9**?

Cumulative Test 22A

Unit 2 post test page 2

11. (59) $4.76 + 8 + 0.241 + 3.6$

12. (99) $3.4 - 1$

13. (103) $9 - 8.94$

14. (103) 1.7×0.6

15. (71)
$$\begin{array}{r} 0.21 \\ \times\ 0.4 \\ \hline \end{array}$$

16. (82, 90) $3\frac{5}{7} + \left(2 - 1\frac{4}{7}\right)$

17. (86, 91) $\frac{3}{5} \times \left(6 \times \frac{11}{12}\right)$

18. (91) $2\frac{2}{3} + 3\frac{2}{3}$

19. (90, 96) $\frac{6}{7} \div 3$

20. (103) What is the volume of a box of cereal with the dimensions shown?

Appendix C

Teutopolis Community Grade School
309 E Main Street * Teutopolis, IL 62467 * (217) 857-3232

January 23, 2020

Dear Institutional Review Board Members,

As principal of Teutopolis Grade School, I approve the appropriateness of Mrs. Brittany Meyer's project study called Implementing Technological Resources to Support Response to Intervention in Fifth Grade Mathematics. Mrs. Meyer discussed the components of the study as well as the expected outcomes. I understand that the curriculum of the student participants of her fifth grade math class will not be altered. The project is age appropriate for Mrs. Meyer, fifth grade math teacher, to implement mathematical interventions for those students who are identified as needing additional support when learning new math concepts. Conducting the project at Teutopolis Grade School is very feasible and should be completed by the end of the spring semester. If you have any questions, please contact me.

Sincerely,

Angela Sheehan
Teutopolis Grade School Principal

Appendix D

Parent Notification

Dear Parents/Guardians:

As a part of my graduate work in Curriculum and Instruction at Eastern Illinois University, I am participating in an Action Research project as part of my master's degree classes. My Action Research project will include data analysis and the use of new instructional strategies within my classroom this semester. This research project is a requirement to fulfill for my master's degree course work.

My research study will assess students' mathematical understanding over the next two units, twenty lessons. I will be using pre-tests, formative quizzes, and post-tests to identify struggling students and concepts that are more difficult for the students. If students need assistance on concepts throughout the unit I will be providing in class interventions to assist students in better understanding difficult concepts. Students will be continuing our classes regular curriculum as planned and receive the same general instruction as the rest of the 5th grade classes.

This study will span over 5-6 weeks starting the first week in February. The results gathered from this study will be used for the purpose of this project. All data collected will be confidential and the results that will be presented will not contain any specific identifying information of the participants. As parents or guardians you have the option to exclude your child from the study. Please contact me if this is the case.

I have been granted approval by the school to conduct this research project in my classroom. However, if you have any questions or concerns about this project, please feel free to contact me at any time.

Thank you,

Mrs. Brittany Meyer
Fifth Grade Teacher
Teutopolis Grade School

Appendix E

January 27, 2020

Brittany Meyer
Sham'ah Md-Yunus
Teaching Learning and Foundations

Dear Brittany,

Thank you for submitting the research protocol titled, "Technological Resources to Support Response to Intervention in Fifth Grade Mathematics" for review by the Eastern Illinois University Institutional Review Board (IRB). The IRB has reviewed this research protocol and effective 1/27/2020, has certified this protocol meets the federal regulations exemption criteria for human subjects research. The protocol has been given the IRB number 20-012. You are approved to proceed with your study.

The classification of this protocol as exempt is valid only for the research activities and subjects described in the above named protocol. IRB policy requires that any proposed changes to this protocol must be reported to, and approved by, the IRB before being implemented. You are also required to inform the IRB immediately of any problems encountered that could adversely affect the health or welfare of the subjects in this study. Please contact me, or the Compliance Coordinator at 581-8576, in the event of an emergency. All correspondence should be sent to:

Institutional Review Board
c/o Office of Research and Sponsored Programs
Telephone: 217-581-8576
Fax: 217-581-7181
Email: eiuirb@www.eiu.edu

Thank you for your cooperation, and the best of success with your research.

John Bickford, Chairperson
Institutional Review Board
Telephone: 217-581-7881
Email: jbickford@eiu.edu