Summer 2021

Does the Implementation of Bridges Math Intervention Show Growth in Student Learning?

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Does the Implementation of Bridges Math Intervention Show Growth in Student Learning?

A Project Presented to the Graduate Faculty of
Minnesota State University Moorhead

By
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In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in
Curriculum and Instruction

May 2021
Moorhead, Minnesota
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Abstract

This study focuses on the effectiveness of the Bridges Intervention program as a tier two intervention for 4th grade elementary school students in the area of mathematics. The intervention was delivered via instructional videos and follow up activities through the SeeSaw application. The focus of the study was to see if the implementation of Bridges Intervention increases students’ success when working with numbers in base 10 and if students’ have an increase in their STAR MATH scores. Students were be given placement assessments via the SeeSaw application based on the recommendations of the Bridges Intervention program. Once students were assessed they received two instructional videos and follow up activities a week via the SeeSaw application. This research took place in a North Dakota elementary school, specifically to seven 4th grade students. All seven students demonstrated growth in at least one of the two standards assessed in the area of numbers in base 10.
Dedication

It is with great please that I dedicate this action research to my husband, John. John has been my number one supporter from the beginning. There is no way that I would be the person, teacher, or mother I am today without his love, support, and dedication. Thank you John for always being my rock, my person, even when times are difficult I know that you will always be there for me.
Chapter 1

Introduction

Mathematics has always been an area of struggle for many students. Unfortunately, there are very few resources for students that struggle with mathematics. Many educational institutions focus on providing tier two interventions for reading but fail to provide any intervention outside of special education for students in the area of mathematics. There is often a lack of tier two intervention in math due to lack of funding and teaching staff. Tier two interventions are interventions that are provided for students who are not proficient in an academic area, but do not qualify for special education services. Due to the lack of math intervention options for students at the researcher’s current school, the researcher decided to research the effectiveness of mathematics intervention for students who struggle in this content area, but do not qualify for special education. The researcher utilized the Bridges Intervention program that is provided by their school district for this intervention.

Due to the current COVID-19 pandemic, the intervention was implemented via instructional video and follow up activities. This was a model of instruction that students were familiar with since it was utilized in the Spring of 2020 for distance learning as well as Fall of 2020 for instruction during the hybrid model. Providing intervention via instructional video also allowed for consistency within the intervention since the researcher and students could quickly change from one instructional model (distance learning, hybrid learning, full in person learning) to another.
Brief Literature Review

The research that has been written about math interventions, stresses the importance of strengthening students’ abilities before it is too late. Students that fail to develop proficiency and automaticity in computational skills (addition, subtraction, multiplication, and division) and problem solving will often continue to fail without additional support (Pool et al., 2012). These students often fail because they either struggle with academic failure (they can’t perform the skill) or they simply refuse (they purposely won’t complete the skill) (Codding et al., 2019). Therefore, it is important to evaluate students and create a plan for needed interventions as soon as possible.

Research has also discussed how mathematical interventions should be structured. It is important that as an instructor plans intervention, they address the three types of mathematical knowledge (conceptual, procedural, and declarative) (Miller et al., 2011). The concept of conceptual knowledge focuses on creating a deeper understanding of the meaning of mathematical operations as well as making connections between the relationships among the operations (Miller et al., 2011). Procedural knowledge explores the ability to solve math problems by utilizing a step-by-step process (Miller et al., 2011). This step-by-step process should result in students finding the correct solution (Miller et al., 2011). Declarative knowledge encourages students to memorize information that is factual (looking at a number and knowing its name, looking at a math fact and immediately knowing the answer without having to figure it out) (Miller et al., 2011).

Lastly, research has discussed the importance of the instructor being present in instructional videos. When an instructor embeds a video of themselves in the main frame of the video, this provides visual stimuli that allows the instructor to provide nonverbal communication
cues (Wang & Antonenko, 2017). Nonverbal cues play a huge role in how we as individuals interpret interaction, therefore including a visual of the instructor creates an environment similar to face-to-face learning (Wang & Antonenko, 2017). This also allows students to activate their social interaction schema since the instructor is visually present (Clark & Mayer, 2016).

Statement of the Problem

The research problem is measuring if Bridges Intervention would help increase students’ mathematical abilities in the area of numbers in base 10, as well as to determine whether it would increase their STAR MATH scores. STAR math is a digital assessment that is utilized in the researcher’s school district to monitor progress in the area of mathematics (Star Math Renaissance, 2016).

The researcher often noted seeing students entering fourth grade lacking abilities to successfully add, subtract, multiply and divide. Since the researcher’s school does not offer tier two math intervention for students, the researcher wanted to discover ways to provide additional support for students in the area of mathematics. Therefore, the researcher researched if utilizing Bridges Intervention increased students’ abilities in mathematics.

The researcher utilized the Bridges Intervention curriculum to assess and provide instruction via instructional video for 4th grade students. Bridges Intervention focuses on the four mathematical operations (addition, subtraction, multiplication, and division). Students would begin with assessments in addition and then move onto subtraction, multiplication and division assessments and instruction. Bridges Intervention is an instructional curriculum provided through the Math Learning Center that supports students through targeted instruction in
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mathematics. This is done so through small group instruction and progress monitoring (Bridges in Mathematics, 2016).

Due to the COVID-19 pandemic, intervention was provided via instructional video. This not only assured consistency between intervention groups, but it will also provide consistency in intervention since the researcher and students could quickly change from one instructional model (distance learning, hybrid learning, full in person learning) to another. This also allowed students who may be home due to COVID-19 related circumstances (quarantine or testing positive) to continue intervention outside of school.

Purpose of the Study

Students entering 4th grade do not have an overall grasp on mathematical strategies across various operations in base 10. These operations include addition, subtraction, multiplication, and division. Students entering 4th grade struggle utilizing the listed strategies when presented with numerical math problems as well as story problems.

Therefore, the researcher wished to investigate if the utilization of Bridges Intervention can help students become more successful in the area of mathematics. Since the researcher’s school does not offer any mathematics intervention outside of special education, non-special education students can only receive additional support in this content area from the classroom teacher. It was the researcher’s hope that through this research they could identify if utilizing Bridges Intervention can help close the gap in students’ mathematical abilities so that they can be better prepared for 5th grade.
Implementation of Bridges Intervention

Research Question(s)

1. How does the implementation of Bridges Intervention increase students’ success when working with the numbers in base 10?

2. How does the implementation of Bridges Intervention impact students’ STAR MATH scores?

Definition of Variables.

Variable A is intervention via instructional videos. This was my independent variable. An instructional video is a pre-recorded video in which an educator provides instruction to students. Instructional videos can be produced in a variety of ways which include classroom lecture with instructor on the blackboard, talking head of the instructor, digital drawing board (Khan-style), slide presentation, studio without audience, and computer coding session (Chorianopoulos, 2018). It is important to note that including an image or video of the actual instructor has been found to deepen the cognitive learning process of the content due to the activation of social interaction schema (Clark & Mayer, 2016). Instructional videos also create a self-paced, student centered learning experience for students (Persson et al., 2017).

Variable B is the development of mathematical abilities. The development of mathematical skills is crucial in order to function in today’s society. If students fail in proficiency and automaticity of computational skills (addition, subtraction, multiplication, and division) and problem solving they will experience difficulties in mathematics throughout life (Pool et al., 2012). Mathematics skills can be strengthened by ensuring that students understand what the specific operations mean, acquire the ability to follow step-by-step processes for obtaining accurate answers, and become fluent when solving problems (Miller et al., 2011).
Significance of the Study

When looking at current trends in education, many schools only offer tier two intervention in the area of reading. Many schools lack the financial resources to offer tier two intervention in the area of mathematics. Therefore, if students do not qualify for special education, they do not receive additional support in mathematics.

Through this research the researcher hoped to provide students that struggle with mathematics a chance to increase their skills in this content area before transitioning to fifth grade. As an educator, the researcher understands that having a mastery of addition, subtraction, multiplication and division skills are not only important for students transitioning to fifth grade, but these skills will be an important part of the students’ life as they continue through school and into adulthood. Since these skills are of lifelong importance, the researcher believed that it is their job as an educator to give students as many opportunities as possible for them to advance in these skill areas.

Research Ethics

Permission and IRB Approval. In order to conduct this study, the researcher will seek MSUM’s Institutional Review Board (IRB) approval to ensure the ethical conduct of research involving human subjects (Mills & Gay, 2019). Likewise, authorization to conduct this study will be seek from the school district where the research project will be take place (See Appendix C).

Informed Consent. Protection of human subjects participating in research will be assured. Participant minors will be informed of the purpose of the study via the Method of Assent (See Appendix D) that the researcher will read to participants before the beginning of the
IMPLIMENTATION OF BRIDGES INTERVENTION

study. Participants will be aware that this study is conducted as part of the researcher’s Master Degree Program and that it will benefit her teaching practice. Informed consent means that the parents of participants have been fully informed of the purpose and procedures of the study for which consent is sought and that parents understand and agree, in writing, to their child participating in the study (Rothstein & Johnson, 2014). Confidentiality will be protected through the use of pseudonyms (e.g., Student 1) without the utilization of any identifying information. The choice to participate or withdraw at any time will be outlined both, verbally and in writing.

Limitations.

There are potential limitations that could affect the results of the study. The first is that instruction may only happen two or three times a week. Ideally, an intervention would be done daily, but since intervention will be delivered via instructional video, the researcher can only provide students two- or three-times during school a week to complete the intervention. A second limitation is that students are unable to use concrete manipulatives. Due to the COVID-19 pandemic, my school district has asked classroom teachers to carefully consider using digital manipulatives only in hopes of reducing the spread of COVID-19. Using concrete manipulatives is an important part of mathematical instruction, therefore, not being able to use them could affect the outcome of the study.

Conclusions

In this chapter the researcher has described the importance of math intervention and why they wish to implement it with fourth-grade students. Due to the lack of intervention in the area of mathematics, the researcher felt that this research may encourage others in their school, district, and field of education to try implementing math intervention for tier two mathematics
students. In the next chapter the researcher will discuss the literature that has been found in relation to intervention, math skills development, and instruction via instructional videos.
Chapter 2

Literature Review

Introduction

Math intervention offers students the opportunity to grow in mathematical abilities. It has been shown that students who do not demonstrate grade level abilities in mathematics and do not receive intervention may not develop the skills necessary to become proficient in math (Pool et al., 2012). Therefore, the Response to Intervention (RTI) framework offers teachers a variety of ways to implement intervention. There are three tiers of intervention within RTI. The first tier is the core instruction that is done in the classroom (Pool et al., 2012). All students that receive math in the general education setting would automatically be receiving tier one intervention. When students receive tier two intervention, they are receiving supplemental instruction that is only provided to students who are at risk, who are struggling, or are not currently meeting grade-level expectations in tier two (Pool et al., 2012). The third tier of the RTI model provides intensive instruction for students that have significant disabilities or needs (Pool et al., 2012). Upon successful implementation, RTI can help educators focus on improving student response to instruction and student outcomes (Pool et al., 2012).

Body of Review

Context

It is essential that students have the basic math foundation skills mastered by the time they transition to middle school. Many schools do not have the funds for intervention in mathematics at a tier two level. Tier two students are students who struggle to be proficient in an academic area, but they do not score low enough to qualify for special education services.
Therefore, students who are at risk for falling behind are unable to receive the support they need. Since there is such a lack of intervention services, the researcher found it necessary to investigate current trends in mathematics intervention. Due to the COVID-19 pandemic, the researcher also researched instruction via instructional video since this was a common way to deliver instruction to students at the time.

**Increasing Mathematical Skills**

When working with students to increase their mathematical skills, it is important to focus on a variety of concepts. There are four main concepts that an educator should focus on. These concepts include foundational skills, various knowledge areas, and the transition from concrete thinking to abstract thinking.

It is important that a curriculum design includes basic foundation skills (Pool et al., 2012). This design should focus on foundational skills that can be used across a variety of mathematical practices and operations (Pool et al., 2012). One example of a foundational skill would be checking one’s work (Pool et al., 2012). This skill can be used across operations (addition, subtraction, multiplication, and division) as well as across mathematical applications (story problems, numerical problems, pattern solving, etc.).

Another important concept to keep in mind, is the concept of balanced instruction. When focusing on balanced instruction, there are three areas of mathematical knowledge to encompass (Miller et al., 2011). These include conceptual knowledge, procedural knowledge, and declarative knowledge (Miller et al., 2011).

Conceptual knowledge is encouraging students to have a deeper understanding of the meaning of mathematical operations (Miller et al., 2011). It also involves the understanding of
connections and relationships between the mathematical operations (Miller et al., 2011). When developing a conceptual understanding of a concept, the educator should focus on a specific skill (Miller et al., 2011). For example, if an educator is focusing on subtraction, they would be working with the student to build their understanding of subtraction as well as the relationship subtraction has with addition before beginning introducing the procedural steps of subtraction.

Once the educator lays a foundation for conceptual knowledge, they then transition to procedural knowledge. For procedural knowledge, the educator is focusing on teaching the students the steps to solve a math problem using the strategy or operation covered during the conceptual knowledge phase (Miller et al., 2011). When teaching in the procedural knowledge phase, the educator is introducing a step-by-step process for students (Miller et al., 2011). The end goal for the procedural knowledge step is for students to be able to use the step-by-step process successfully to solve the desired mathematical problem (Miller et al., 2011).

Once students have a good understanding of the procedural skills for a concept, they then transition to the development of declarative knowledge (Miller et al., 2011). Declarative knowledge focuses on the ability to memorize information in a factual nature (Miller et al., 2011). Examples of declarative knowledge may include being able to see a number and automatically knowing its name or seeing a math fact (ex: 7x5) and automatically knowing the answer without needing time or resources (paper/pencil or various manipulatives) to solve it (Miller et al., 2011).

When working to increase students’ mathematical skills, it is important to also focus on the gradual release of concrete to abstract concepts. The concrete-representational-abstract (CRA) teaching sequence helps students gain conceptual understanding of concepts in phases (Miller et al., 2011). In the CRA sequence, students begin learning a concept in the concrete
learning model. When in the concrete model, students are able to use physical mathematical manipulatives (pattern blocks, tangrams, base 10 pieces, etc.) in order to help them understand and solve problems. Students are better able to gain a basic understanding of concepts when utilizing the concrete manipulatives since they are able to physically manipulate the materials. This helps students gain a concrete understanding of the concept. Once the concrete concept is mastered, the educator would then transition to the representational portion of the CRA model. The representational model eliminates the physical mathematical manipulatives and replaces it with visual representations (Miller et al., 2011). Examples of visual representations would include the use of tally marks and picture drawing. Students would use tallies or draw pictures to help them solve and understand problems instead of the use of physical manipulatives (Miller et al., 2011).

Lastly, students would transition to the abstract portion of the CRA model once they master the representational phase. During the abstract phase, students would not utilize manipulatives or visual representations. Students would solve mathematical problems through the utilization of numbers (equations) only (Miller et al., 2011). Students would then remain in this phase once it is mastered.

**Instructional Videos**

Instructional videos are a unique tool that can help enhance student learning. The use of instructional videos allows students to have a self-paced, student centered learning experience (Persson et al., 2017). Students are able to access the instructional content when it is best for them. It also allows them to re-watch parts of the lesson for missed or misunderstood content.
Multiple studies have concluded that the use of instructional videos allows students to engage their audio and visual stimuli. There are three memory stores. They include sensory memory, working memory, and long-term memory (Persson et al., 2017). When students are presented information through the use of multimedia, the sensory memory is engaged through the ears and eyes (Persson et al., 2017). Since most instructional videos feature both the instructor (visually or just through narration) as well as visual representations, the two unlock the auditory and visual parts of the sensory memory (Wang & Antonenko, 2017). Since information is being processed through two different channels, this has the ability to enhance the comprehension of the concepts being taught (Wang & Antonenko, 2017).

Visual and audio stimuli also help stimulate the working memory (Persson et al., 2017). When working with working memory, it is important to remember that words can be seen as spoken or pictures (or text), therefore, creating a relationship between images and sounds in the working memory (Persson et al., 2017). The working memory has a limited capacity, therefore the amount of information that can be processed through audio and visual is limited (Persson et al., 2017). In order for the student to utilize the information in working memory, the student must be presented with the opportunity to engage in the act of processing the information (Persson et al., 2017). By engaging with the information, this gives the student the ability to integrate the information into the long-term memory (Persson et al., 2017).

When creating an instructional video, there are a variety of models that an instructor can choose from. These include lecture (with the instructor and the blackboard), a video with the head of the instructor at their desk (in the corner of the screen), digital drawing board, slide presentation, a studio setting (audience free), or a computer coding session (Chorianopoulos, 2018).
Numerous studies have also concluded that instructional videos that visually include the instructor offer more advanced learning (Chorianopoulos, 2018). Wang and Antonenko (2017) state:

in fact, instructor narration and visual presence in the form of instructor video possibly complement each other as they are processed by different channels (e.g., auditory and visual) and could potentially support information processing in two separate channels resulting in enhanced comprehension of the material. (p.80)

By providing the instructor in the video, it creates the opportunity for the instructor to provide nonverbal communication. It is important to remember that nonverbal communication plays a vital role in interpersonal interaction and helps create the feeling of a face-to-face learning environment (Wang & Antonenko, 2017). By creating this environment, the instructor is able to engage deeper cognitive processing of the content by the student (Wang & Antonenko, 2017). This is done because the presence of the instructor on screen activates the social interaction schema, which also stresses the interpretation of nonverbal communication (gesturing, facial expressions, etc.) (Wang & Antonenko, 2017). Nonverbal cues support the cognitive processing of verbal information, which in turn improves the cognitive processing of the student (Wang & Antonenko, 2017). It is also important to note, that students not only reported higher engagement in instructional videos where the instructor was present, they also outperformed those who watched instructional videos where their instructors were not present (Wang & Antonenko, 2017).

It is also important to note that the physical detail of the instructor plays a vital role in the creation of an instructional video. Chorianopoulos studied the replacement of the instructor in the instructional video with human alternatives (2018). These human alternatives included animated
humans, animated robots, and real robots (Chorianopoulos, 2018). Chorianopoulos’ (2018) finds note that learners preferred a real human or an animated human to a real or animated robot, therefore, students prefer to learn from either a human or something relating to the human condition (2018).

The physical placement of the instructor also plays a role in the creation of an instructional video. Wang and Antonenko (2017) studied the placement of the instructor in instructional videos. They studied videos where the instructor was in a fixed position (ex. the bottom left corner) and videos where the instructor was near the instructional content (2017). Their results discussed that students prefer to watch videos where the instructor is placed near the content, in a way that the instructor is able to interact with the presented content (Wang & Antonenko, 2017). In their work, Wang and Antonenko suggest that by having the instructor within eye-gaze of the content, the learner has a better opportunity to engage with the instructor’s social cues (2017). When discussing the instructor’s physical location in the video, Wang and Antonenko also note that it is likely that the instructor’s face will attract a large amount of the viewer’s attention (2017). Therefore, it is important that within the video frame, to provide access to other important visual components such as diagrams, text, and other visual representations of the content (Wang & Antonenko, 2017).

When creating instructional videos, it is important to include breaks within the video. The utilization in breaks creates opportunities for learners to mentally process and organize the information presented (de Koning et al., 2018). It also allows them time to integrate the newly learned content with their prior knowledge surrounding the content of the video (de Koning et al., 2018).
Instructional videos are a unique tool that can help enhance student learning. The use of instructional videos allows students to have a self-paced, student centered learning experience (Persson et al., 2017). Students are able to access the instructional content when it is best for them. It also allows them to re-watch parts of the lesson for missed or misunderstood content.

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Numerous studies have concluded that instructional videos that visually include the instructor offer more advanced learning (Chorianopoulos, 2018). By providing the instructor in the video, it creates the opportunity for the instructor to provide nonverbal communication (Wang & Antonenko, 2017). It is important to remember that nonverbal communication plays a vital role in interpersonal interaction and helps create the feeling of a face-to-face learning environment (Wang & Antonenko, 2017). By creating this environment, the instructor is able to engage deeper cognitive processing of the content by the student (Wang & Antonenko, 2017). This is done because the presence of the instructor on screen activates the social interaction schema, which also stresses the interpretation of nonverbal communication (gesturing, facial expressions, etc.) (Wang & Antonenko, 2017). Nonverbal cues support the cognitive processing of verbal information, which in turn improves the cognitive processing of the student (Wang & Antonenko, 2017). It is also important to note, that students not only reported higher engagement in instructional videos where the instructor was present, they also outperformed those who watched instructional videos where their instructors were not present (Wang & Antonenko, 2017).

**Implementation**

When implementing tier two interventions, the overall goal is to prevent student problems or academic failure from increasing in intensity in order to avoid the need of a more intense support and intervention (Pool et al., 2012). Tier two is composed of three general characteristics that include (1) the use of screening data (2) interventions that are created using strong instructional design principles, and (3) continual and frequent progress monitoring (Pool et al., 2012). Therefore, when designing a tier two intervention, it needs to be aligned with critical mathematical content that is essential to student success (Codding et al., 2019).
Several researchers have shared similar views on how mathematical interventions should be established. Pool believes that intervention should begin with guided practice (2012). Once completing the guided practice portion of the lesson, one should then transition to independent practice and then to progress monitoring (Pool et al., 2012). When beginning an intervention lesson, Pool also discusses how the educator should begin with warm-up activities from the previous lesson (2012).

Miller described a very similar concept of how one should implement mathematical interventions (2011). He discusses that when an educator introduces a concept, they need to begin with practices that help create an initial understanding of the skill being taught (Miller et al., 2011). Then the educator should then focus on the procedural understanding of the concept (similar to guided practice) (Miller et al., 2011). Once there is a good understanding of the procedure, the educator can then begin to branch out and cover topics related to the same skill (Miller et al., 2011). The type of instruction that Miller suggests, helps ensure that students understand what the operation or skill being taught means, ensures that students gain the ability to follow the necessary processes to find the correct answer, and gives them the opportunity to become fluent in the ability to solve problems using this operation or skill (2011).

Lastly, Codding (2019) believed that similar principles of Pools and Miller should be followed when planning mathematical interventions. Codding believes that intervention should begin with modeling (2019). Once modeling is complete, the educator should transition to guided practice (Codding et al., 2019). Corrective feedback follows next, along with providing visual representations of quantities and then ending with explicit timing (Codding et al., 2019).

Pool, Miller, and Codding’s concepts surround the idea of the “I do,” “We do,” “You do,” model of teaching that we often see in education. The educator should begin by modeling
and discussing the concept. Then the educator transitions into guided practice with the student. Lastly, the student works on the concept or task independently. Once they can independently complete the task or concept successfully, you can begin to build on that skill with related concepts.

**Theoretical Framework**

Throughout numerous research studies on math intervention, Pool, Miller, and Codding have very similar viewpoints on how math intervention should be structured. All three believed in similar practices that surround the “I do,” “We do,” “You do,” model of instruction. This is the educational model of instruction that is commonly seen throughout education. Pool and Codding focused on beginning with the teacher modeling instruction and then transitioning to guided practice. Since the researched provided instruction via instructional video, it was difficult to provide students with guided practice opportunities. Miller’s structure of intervention, however, had a slight variance from guided practice. Miller discussed how instructors need to begin instruction by creating an initial understanding of the skill being taught (this can be seen as the “I do” portion of the previously mentioned model) (2011). Once the educator lays down the foundation, they transition to the procedural understanding (again, this can also be seen as the “I do”) (Miller et al., 2011). As the students are learning the procedure for the mathematical concept, this in a way can combine the “We do,” “You do,” portion of the model because the researcher could provide feedback on online assignments and guided students through the process until they could accurately solve problems independently. It wasn’t necessarily guided practice since the researcher wasn’t working with students in real time, but via the online program they were able to work on assignments together. Once students mastered the procedural aspects of the concept, they were able to restart the process with concepts similar to the one just
mastered (Miller et al., 2011). Since Miller’s work provided the flexibility needed with online instruction, it was more attainable to pursue his methodology vs. Codding and Pool.

Research has also discussed the importance of how instructional videos are created. Wang and Antonenko, along with Chorianopoulos have all described the importance of having the instructor physically present in instructional videos. This provided students with the opportunity to interpret nonverbal cues such as gesturing and facial expressions. Nonverbal cues play a vital role in how our students learn by engaging a deeper cognitive thinking process and by activating their social interactive schema (Wang & Antonenko, 2017). Since nonverbal communication plays such a vital role in learning, the researcher ensured that they were physically present in the instructional videos.

The location of the instructor is also important when creating instructional videos. Wang and Antonenko studied the placement of the instructor in instructional videos. When studying the placement, they discovered that having the instructor near the content was more beneficial then having the instructor in a fixed location (such as the bottom corner of the screen) (Wang & Antonenko, 2017). By having the instructor located near the content, it helps the learner see the instructor interacting with the content (Wang & Antonenko, 2017). Wang and Antonenko suggest that by having the instructor within eye-gaze of the content, the learner has a better opportunity to engage with the instructor’s social cues (2017). Therefore, since having the instructor near the content helps students better understand social cues, as well as keeping them within eye-gaze of the content, the researcher utilized the practice of placing themselves near the content while making a video vs. in a fixed location at the bottom of the screen.
Research Question(s)

In response to the review of literature, the review of students’ needs, and the researcher’s passion for mathematics, the researcher developed the two following questions, how does the implementation of Bridges Intervention increase students’ success when working with the numbers in base 10 and how does the implementation of Bridges Intervention impact students’ STAR MATH scores?

Conclusions

This chapter reviewed literature that focused on mathematical intervention, concepts that can be utilized to help increase students’ mathematical skills, and important factors while making instructional videos. By utilizing the information this information, along with data that collected the researcher determined if utilizing Bridges Math Intervention increases students’ ability in the area of numbers and numbers in base 10, along with increasing their STAR Math scores. In the upcoming chapter the researcher will be discussing how they will be collected, interpreted, analyzed, and utilized the data from the research study.
Introduction

Students today face a variety of challenges. One subject area that tends to cause these challenges for students is the area of mathematics. Generally, students only qualify for additional support in mathematics if they meet the testing requirements for special education services. Since there is a need for tier two intervention (additional support outside of special education) for students in mathematics, the researcher investigated the effectiveness of weekly mathematics intervention with fourth grade students.

The Bridges Intervention System was utilized by the researcher. Bridges Intervention is a mathematics curriculum that focuses on providing struggling students with additional support in mathematics by focusing on the four major operations (addition, subtraction, multiplication, and division).

Students received intervention via instructional videos posted on the SeeSaw application. They also had follow-up activities to complete after the lesson. The researcher utilized the concept of instructional videos due to the COVID-19 pandemic. This is a model of instruction that the students were familiar with since it was utilized in the Spring of 2020 for distance learning as well as Fall of 2020 for instruction during the hybrid model. Providing intervention via instructional video will also allow for consistency within the intervention since we could quickly change from one instructional model (distance learning, hybrid learning, full in person learning) to another.
Research Question(s)

1. How does the implementation of Bridges Intervention increase students’ success when working with the numbers in base 10?

2. How does the implementation of Bridges Intervention impact students’ STAR MATH scores?

Research Design

For this study, the researcher utilized practical action research. This method was chosen because the researcher set out to address the specific problem they were noticing in the classroom. The problem the researcher is addressing is the lack of intervention for students in the area of mathematics. The researcher’s overall goal was to find a way to provide students with intervention in mathematics that do not qualify for special education services. When conducting the study, the researcher was evaluating the effect of an independent variable (Math Intervention via pre-recorded video instruction via SeeSaw application) on the dependent variable (development of mathematical abilities). The researcher’s need to address a specific problem in relation to math intervention determined that the practical action research design would be the most beneficial for the study.

Setting

This study took place at an elementary school in a small to midsize metropolitan area in North Dakota. The city has numerous four-year universities, two-year colleges, and a variety of additional technical and trade schools within a 100-mile radius. The area is also supported by a variety of local, regional, and national businesses. The city’s population is approximately 37,000, however, the total population of the metropolitan area is approximately 204,000. The school
district in which the study takes place serves four cities, two being in the small to midsize metropolitan area and two being rural communities.

The school district in which the elementary school where this study took place is located has approximately 11,000 students. 73.2 percent of the students are Caucasian. 16.2 percent of the students are Black. 4.4 percent of the students are Asian. 3.5 percent of the students are Hispanic. 2.7 percent of the students are American Indian/Alaskan Native, and 0.1 percent of the students are Pacific Islander. Of those students, 12.8 percent receive special education services. Eight percent of the students receive English Language Learner services. Due to the COVID-19 pandemic, all students are receiving free lunch during the 2020-2021 school year, the school year during which the study was done.

Participants

There were 7 students that participated in the study. Students were between the ages of nine and ten years old and were in the 4th grade during the 2020-2021 school year. There were 4 female students and 3 male students that participated in the study. None of the students involved in the study qualified for special education services in the area of mathematics. Six of the students identified as Caucasian and one student identified as African American.

Sampling

The study was comprised of 7 students. Students from the researcher’s classroom, along with students from two additional fourth grade classrooms from within the same school were a part of the study. This would make the students a purposive sample because they were assigned to specific classrooms. Students were selected based off of testing results, classroom performance and teacher request.
Instrumentation

Placement assessments were given to students to determine which volume of the Bridges Intervention kit was utilized. Students were given the placement assessment at the beginning of the unit of study (also referred to as volume) and then again at the end of the volume to monitor growth. The placement assessment consisted of three parts. If a student did well in part one, they transition to part two. If they did well in part two, they transitioned to part three. Students’ scores on parts one, two, or three determined the lesson they began on for that particular unit of study. Each part of the assessment took less than ten minutes for the participants to complete. The assessment asked students to answer mathematical questions that related to the concepts taught in the particular unit of study. An example of a placement assessment can be found in Appendix A.

Student data were tracked via excel spread sheet. The data tracked in the spread sheet was used to track how many students grew from the beginning of the unit of study to the end of the unit of study. It also tracked how many points they grew by.

The STAR Math assessment will also be utilized as a data point of information. STAR Math is digital assessment that is utilized by the school district to monitor student progress in the area of mathematics. This assessment provides valuable information on students’ strengths and weaknesses in the area of mathematics. Students overall percentile scores that are determined by STAR Math were also tracked in the excel document to track growth in the area of mathematics.

Data Collection.

Data were collected throughout the 6-week study. At the beginning of each unit of study, a placement test was given to students to determine which area of the unit to begin. After four
lessons, a progress monitoring assessment was given. The results of the progress monitoring assessment then determined if students were able to continue onto the next lesson, or if content needed to be reviewed and reevaluated before continuing. The progress monitoring assessment reviews concepts that were taught in the previous four to five lessons. Students were given the progress monitoring assessment via the SeeSaw application. Students also periodically took the STAR Math test in order to track student progress. An example of the progress monitoring assessment and assessment score guide can be found in Appendix B.

**Data Analysis.**

Student data were monitored and recorded throughout the study. The researcher of this study mainly focused on the number of students who successfully made gains in the area of mathematics. Therefore, the percentage of students that made growth in each unit was analyzed. These data were monitored and collected in an excel document. The researcher used the scores of the placement assessment (given at the beginning and the end of the unit) as well as the scores from the progress monitoring tools in order to determine if growth was made.

The researcher also determined the mean of the number of percentile points students gained on the STAR Math assessment. Students took the STAR Math assessment throughout the study. The scores from the Bridges Intervention assessments and STAR Math were both used to determine the effect the implementation Bridges Intervention had on students’ mathematical abilities.

**Research Question(s) and System Alignment.** The table below (i.e., Table 1.0) provides a description of the alignment between the study Research Question(s) and the methods used in this study to ensure that all variables of study have been accounted for adequately.
Table 1.0
Research Question(s) Alignment

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Variables</th>
<th>Design</th>
<th>Instrument</th>
<th>Validity &amp; Reliability</th>
<th>Technique (e.g., interview)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ1</td>
<td>IV: Math Intervention via pre-recorded video instruction via SeeSaw application.</td>
<td>Practical Action Research</td>
<td>Bridges Math Assessments (Included in Intervention Curriculum)</td>
<td>For this study, the researcher used the same curriculum and instructional videos for all participants. All participants were given the same placement tests, progress monitoring tests, and STAR Math tests. They also took the tests utilizing the same format.</td>
<td>A variety of achievement tests were given to students at the beginning of a unit of study, as well as throughout. These assessments were given via the SeeSaw application. An example of the placement assessment can be found in Appendix A and an example of a progress monitoring assessment can be found in Appendix B.</td>
<td>Fourth grade students that are in the general education setting for mathematics. Sample Size: Approximately 7 fourth grade students.</td>
</tr>
<tr>
<td>RQ2</td>
<td></td>
<td></td>
<td>STAR Math test (a computerized test)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. The STAR Math computerized test is traditionally taken by students three times per year (fall, winter, and spring), but maybe used additionally throughout the year as a form of progress monitoring.
Procedures

The study took place over a six-week period. Students began each unit of study by taking the placement assessment via the SeeSaw application (Appendix A). After completing the placement exam, students were assigned two Bridges Intervention lessons via the SeeSaw application in their area of need based off of the placement exam. Lessons were assigned every Monday morning at 8:00 A.M. Students had Monday at 8:00 A.M. to the following Monday at 8:00 A.M. (one week) to complete their lessons. Progress monitoring assessments would be assigned to students every four lessons. These were also assigned on Mondays at 8:00 A.M. and were to be completed the following Monday by 8:00 A.M.

The weekly student lessons contained an instructional video that was created by the researcher. The researcher was physically present in the video and utilized the Bridges Intervention system curriculum when teaching the lessons. The researcher included a follow-up activity for the students to complete with each video that would demonstrate student learning.

Throughout the study, the researcher collected data from the students’ placement assessments (before and after each unit of study, Appendix A) as well as progress monitoring assessments (Appendix B). The researcher entered this data into an excel document where the percentage of students that made growth in each unit was analyzed. Student data from the STAR Math assessment was also collected. The researcher also determined the mean of the number of percentile points students gained on the STAR Math assessment. The scores from the Bridges Intervention assessments and STAR Math were both used to determine the effect the implementation Bridges Intervention had on students’ mathematical abilities.
Ethical Considerations

Throughout the study, the researcher noted the importance of the students’ overall wellbeing. The researcher frequently checked in with the students to determine if the workload was appropriate. Due to the COVID-19 pandemic, the researcher also offered flexibility with lesson completion if a student were in quarantine or recovering from COVID-19.

Conclusions

In this chapter, the researcher discussed the logistics of the study. The chapter described the participants, their demographics, and the setting in which the study took place. The researcher also discussed the processes of collecting, interpreting, and analyzing data from the study. The researcher also discussed what assessments were used when collecting data and how frequently it was collected. In the next chapters, the researcher discusses the results of the study as well as how the information was shared with others in the field of education.
CHAPTER 4

RESULTS

When students enter 4th grade, they often lack the ability to work with mathematical concepts involving the four math operations (addition, subtraction, multiplication, division). The math standards for 4th grade students expects them to utilize the four operations with story problems and numerical problems. Due to the lack of strategies and skills presented by the 4th grade students, the researcher implemented the Bridges Intervention System to investigate if students would become more successful in the area of mathematics.

Data Analysis and Interpretation

Description of Data. This study utilized two methods of data collection. The first method of data collection was utilizing students’ STAR Math percentile ranks (scores). STAR Math is a digital assessment that is utilized by the school district to monitor student progress in the area of mathematics. STAR is a computerized assessment that students take on their school issued iPad. This assessment is usually given to students in the fall, winter, and spring, but can also be utilized throughout the school year in order to progress monitor students. Therefore, the participants were familiar with the assessment.

The second method of data collection was the utilization of the progress monitoring (PM) assessments that are a part of the Bridges Intervention system. The progress monitoring (PM) assessments were converted into activities for students to complete on the SeeSaw application. The researcher included a video for each assessment that featured the researcher explaining the directions, as well as reading aloud any story problems that were included in the assessment. Students were given an assessment after every fourth lesson they completed. For example,
students would complete lessons one through four and then complete a progress monitoring assessment. Figure 1 below shows an example of a progress monitoring assessment.

**Figure 1**

*An Example Of A Progress Monitoring Assessment SeeSaw Activity*

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**Baseline Data.**

Prior to the start of the intervention participants took the STAR Math assessment on their school issued iPad. This helped the researcher determine who would be eligible for the intervention. Since the intervention was to be implemented as a tier two intervention, the researcher selected participants that tested in the 15th-45th percentile range. Table 2 below describes each participants’ percentile scores before beginning the intervention.
Once students were selected based off of their STAR Math percentile rank, students were given the unit 6 placement test (Appendix A) that is a part of the Bridges Intervention curriculum. Based off the students’ grade level and where they were in the academic school year (winter), the Bridges Intervention program recommended testing students on unit 6. Students took the placement assessment on their iPads via the SeeSaw application. The researcher included a video that described the directions and read aloud any story problems that would have been included on the assessment.

Once the placement assessment was completed, the researcher was able to decide which module within unit 6 to begin instruction. Out of seven participants, three were placed in module one and four were placed in module three. The three students who were placed in module one are referred to as group one and students who were placed in module 3 are referred to as group 2. Table 3.0 below displays the breakdown of students in group one and group two.

<table>
<thead>
<tr>
<th>Student</th>
<th>Percentile Rank Before Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>31</td>
</tr>
<tr>
<td>2</td>
<td>42</td>
</tr>
<tr>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>4</td>
<td>31</td>
</tr>
<tr>
<td>5</td>
<td>29</td>
</tr>
<tr>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>7</td>
<td>27</td>
</tr>
</tbody>
</table>
The following research questions were asked at the onset of the action research.

**RQ1: How does the implementation of Bridges Intervention increase students’ success when working with the numbers in base 10?**

Students were assessed through the usage of progress monitoring (PM) assessments throughout the intervention (an example of a PM can be found in Appendix B). There were two main standards assessed throughout the assessments 4.NBT.1 which is “demonstrate an understanding that in a multi-digit number, each digit represents 10 times what it represents in the place to its right” (Bridges in Mathematics, 2016, p.62) and 4.NBT.5 which is “multiply 1- and 2-digit numbers by 1- and 2-digit numbers” (Bridges in Mathematics, 2016, p.62). The number of times each student was assessed on each standard varied by group. Group 1 was assessed on standard 4.NBT.1 three times, but group 2 was only assessed on the standard twice. Standard 4.NBT.5 was assessed three times for group 1 and four times for group 2. Table 4 below describes the data collected on standard 4.NBT.1 throughout the intervention for group 1. The table describes each assessment and the percent accuracy each student achieved on that standard for that specific assessment. Table 5 below covers the same data, but for group 2.

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students 1,3, and 4</td>
<td>Students 2,5,6, and 7</td>
</tr>
</tbody>
</table>

**Table 3**

_**Breakdown Of Students In Groups One and Two.**_

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students 1,3, and 4</td>
<td>Students 2,5,6, and 7</td>
</tr>
</tbody>
</table>

---

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Table 4

**Group One 4.NBT.1 Bridges Intervention Assessment Data**

<table>
<thead>
<tr>
<th>Student</th>
<th>Placement</th>
<th>PM 6-2</th>
<th>PM 6-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0%</td>
<td>67%</td>
<td>100%</td>
</tr>
<tr>
<td>3</td>
<td>0%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>4</td>
<td>25%</td>
<td>67%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 5

**Group Two 4.NBT.1 Bridges Intervention Assessment Data**

<table>
<thead>
<tr>
<th>Student</th>
<th>Placement</th>
<th>PM 6-3</th>
<th>PM 6-4</th>
<th>PM 6-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>50%</td>
<td>90%</td>
<td>70%</td>
<td>80%</td>
</tr>
<tr>
<td>5</td>
<td>80%</td>
<td>100%</td>
<td>100%</td>
<td>90%</td>
</tr>
<tr>
<td>6</td>
<td>30%</td>
<td>40%</td>
<td>60%</td>
<td>80%</td>
</tr>
<tr>
<td>7</td>
<td>40%</td>
<td>70%</td>
<td>90%</td>
<td>80%</td>
</tr>
</tbody>
</table>

Table 6 below describes the data collected on standard 4.NBT.5 throughout the intervention for group 1. The table describes each assessment and the percent accuracy each student achieved on that standard for that specific assessment. Table 7 below covers the same data, but for group 2.

Table 6

**Group One 4.NBT.5 Bridges Intervention Assessment Data**

<table>
<thead>
<tr>
<th>Student</th>
<th>PM 6-1</th>
<th>PM 6-2</th>
<th>PM 6-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>33%</td>
<td>75%</td>
<td>80%</td>
</tr>
<tr>
<td>3</td>
<td>67%</td>
<td>100%</td>
<td>80%</td>
</tr>
<tr>
<td>4</td>
<td>100%</td>
<td>50%</td>
<td>100%</td>
</tr>
</tbody>
</table>
### Table 7

*Group Two 4.NBT.5 Bridges Intervention Assessment Data*

<table>
<thead>
<tr>
<th>Student</th>
<th>Placement</th>
<th>PM 6-3</th>
<th>PM 6-4</th>
<th>PM 6-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>50%</td>
<td>90%</td>
<td>70%</td>
<td>80%</td>
</tr>
<tr>
<td>5</td>
<td>80%</td>
<td>100%</td>
<td>100%</td>
<td>90%</td>
</tr>
<tr>
<td>6</td>
<td>30%</td>
<td>40%</td>
<td>60%</td>
<td>80%</td>
</tr>
<tr>
<td>7</td>
<td>40%</td>
<td>70%</td>
<td>90%</td>
<td>80%</td>
</tr>
</tbody>
</table>

*Interpretation.*

The researcher expected to see growth within these two standards throughout the intervention. When analyzing the data for standard 4.NBT.1, the researcher was pleased to see that six out of seven students ended the intervention at 100% accuracy. Student six appears to be an outlier. One aspect that the researcher believes may have affected student six’s score was their lack of fact fluency in the area of multiplication. The student would have the number model set up correctly, but lacked the basic facts needed to solve the problem accurately. For example, student six was given the math problems 8x3 and 80x3. Student six wrote that 8x3=16 and 80x3=160. In this scenario, student six realizes that problem two is ten times as many as problem one but lacks the answer to the basic fact of 8x3. Since they answered both problems incorrectly, they could not obtain 100% accuracy on the assessment.

When analyzing the data for standard 4.NBT.5 all seven students achieved growth when comparing their first assessment score to their last assessment score. The researcher does note that there is some inconsistency in some of the scores. For example, student 2’s scores were 50%, 90%, 70%, 80%. Student 2 did have growth overall since they started at 50% and ended at 80%, but their middle scores (90% and 70%) do not demonstrate consistent growth.
There are two factors that the researcher believes could have created inconsistent scores. The first factor is a lack of multiplication fact fluency. When students are multiplying 1- and 2-digit numbers by 1- and 2-digit numbers, they rely on utilizing math facts that they already know. For example, if a student is presented with 5\times70, they would rely on the basic fact of 5\times7 to help them answer 5\times70. If they do not know that answer to 5\times7, this will greatly affect their ability to answer 5\times70.

The second factor that the researcher believes may have created inconsistent scores is that some of the assessments required students to justify or explain their work. Therefore, it added another layer of difficulty to the assessment. If a student could not explain that they could use 5\times7 to solve 5\times70, they could not receive 100% accuracy on the assessment. Since this skill was required for some assessments, but not others, it has the potential to create an inconsistency in scores.

**RQ2: How does the implementation of Bridges Intervention impact students’ STAR MATH scores?**

At the conclusion of the intervention, participants were re-assessed using the STAR Math assessment. The participants took the assessment on their school issued iPads. Six out of the seven participants demonstrated growth in their percentile scores. Student 4 achieved the highest growth by increasing their percentile rank by 34 percentile points. Student 6 had the second highest growth by increasing their percentile rank by 31 percentile points. Student 7’s percentile rank decreased by 8 percentile points. Student 7 is the only student who did not achieve growth on the STAR Math assessment. Figure 2 describes each participant’s STAR Math percentile before and after the intervention.
Interpretation.

Overall, the researcher was pleased to see that six out of the seven participants demonstrated growth in their percentile scores. Student 7 did decrease by 8 percentile points. When analyzing the STAR Math scores, the researcher needed to take into consideration that STAR Math tests a student’s overall ability in math. Therefore, other standards besides numbers in base 10 are being assessed on the STAR Math assessment. This means that a drop in percentile scores could be due to struggles in other areas of math such as geometry or operations and algebraic thinking. Since there is no way to know for sure, the researcher focused more on
the progress monitoring data for student 7 to determine if the intervention was effective for this participant.

Student 2 only demonstrated a growth of 3 percentile points. The researcher was hoping to see more growth, but also recognizes that this student had the highest starting percentile score. Therefore, the researcher believes that since student 2’s percentile score was higher than any of the other participants, the intervention may not have been as effective for this student.

Students 4 and 6 demonstrated the greatest amount of growth on their STAR Math assessment. Student 4 grew by 34 percentile points and student 6 grew by 31 percentile points. Both students originally tested below the 35th percentile before beginning the intervention. A trend that the data demonstrates is that students who originally tested and achieved lower percentile scores, demonstrated a greater growth than those who tested at higher percentile scores before intervention.

**Conclusion**

After collecting data and analyzing the results, the researcher believes that this was an effective intervention. Throughout the intervention the researcher noticed that students were demonstrating a stronger ability to work with multi-digit multiplication problems. They also gained an understanding that when one multiplies a number by 10, they are simply moving a place value. The researcher does acknowledge that students continue to struggle with justifying or explaining their work. If the intervention were to continue, the researcher would increase the amount of instructional time spent on modeling justifying or explaining answers to mathematical problems.
The researcher also acknowledges that instruction via instructional video is not the ideal way to deliver an intervention to students. When delivering instruction via instructional video, the researcher acknowledges that it eliminates the opportunity to work directly with the students. This is a crucial portion of the gradual release or the “I do, we do, you do” model of instruction. When delivering an intervention via instructional video, the researcher was able to implement the “I do” and “you do” portions of the model, but not the “we do.” This forced students to go straight from instruction to independent work. This often created gaps in learning that the researcher would have to address with follow up videos for students.

Lastly, the researcher believes that the Bridges Intervention curriculum maybe better implemented during in-person learning so that students have access to physical manipulatives. During the intervention, students had access to digital manipulatives, but nothing physical. Research has shown that the use of physical manipulatives is a vital part of learning, therefore since the intervention was done digitally, students did not have all of the tools necessary to have a full learning experience.
Chapter Five

Implications for Practice

Action Plan

The researcher will continue to utilize the Bridges Intervention curriculum as needed as a tier two intervention. The researcher acknowledges that there are a variety of ways that the curriculum can be utilized. The researcher can continue to utilize the curriculum via instructional videos on the SeeSaw application or the researcher can utilize the curriculum for in person instruction. Due to COVID-19 restrictions and the unpredictability of instructional models (distance learning, hybrid, or full-time in person) the researcher acknowledges that intervention may need to continue via instructional videos for the foreseeable future. Since the SeeSaw activities and instructional videos are already created, the researcher can continue to use the intervention materials with additional students.

Plan for Sharing

The results of this study will be shared with the researcher’s grade level team. The researcher will also share intervention materials with the grade level team. Once the results have been shared with the grade level team, the researcher will also share the information and intervention materials with their school’s curriculum coach.
REFERENCES

Bridges in Mathematics. (2016, February 26). The Math Learning Center. https://www.mathlearningcenter.org/bridges-intervention?gclid=CjwKCAiA5IL-BRAzEiwA0lcWYmfVMMpCVa8r9AXGJtcWWn2l84NMVMYR0HLZ_gefd0YvDkBcXxYiARoC4VkQAvD_BwE


Appendix A

Volume 6 Placement Assessment Part 1

1. The ribbon is 5 times as long as the bandage. The bandage is 3 inches long. How many inches long is the ribbon? Show your work.

   

   The ribbon is _______ inches long.

2. The black strip is 6 times as long as the crayon. The crayon is 4 inches long. Which equation would you use to find the length of the black strip? Fill in the bubble and write the answer to the equation.

   

   $\bigcirc \quad 6 + 4 = \underline{_______} \quad \bigcirc \quad 6 \times 4 = \underline{_______} \quad \bigcirc \quad 5 \times 4 = \underline{_______}$

3. Multiply.

   $8 \times 10 = \underline{_______} \quad 10 \times 10 = \underline{_______} \quad 9 \times 10 = \underline{_______} \quad 10 \times 6 = \underline{_______}$

4. Fill in each blank with the correct number word.

   a. Thirty tens is the same as __________ hundred.

   b. Seventy tens is the same as __________ hundred.

   c. Four hundred is the same as __________ tens.

   d. Six hundred is the same as __________ tens.
Volume 6 Placement Assessment  Part 2

5  Multiply.

15 × 10 = _______  24 × 10 = _______  4 × 40 = _______  7 × 30 = _______

6  Use the array to solve the multiplication problem. Draw loops around groups of lines and dots (tens and ones) and write equations to show your thinking.

5 × 13 = _______

7  Finish labeling each array frame below. Then fill it in with a rectangle split into two parts. Write and solve a multiplication equation to find the area of each part. Add the partial products, and write a multiplication equation to match the array.

<table>
<thead>
<tr>
<th>Labeled Array Frame &amp; Rectangle</th>
<th>Add the Partial Products</th>
<th>Multiplication Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Volume 6 Placement Assessment Part 3

8  Multiply.

\[
\begin{array}{ccccccc}
20 & 50 & 30 & 60 & 40 & 90 \\
\times 3 & \times 5 & \times 4 & \times 40 & \times 50 & \times 30
\end{array}
\]

9  Follow these steps to multiply \(26 \times 34\).

- Label each of the regions in the sketch with its area.
- Write and solve an equation for each of the partial products.
- Add the partial products to get the total.

\[
\begin{array}{c}
a \\
20 \\
6
\end{array}
\quad \quad \quad \quad
\begin{array}{c}
b \\
30 \\
4
\end{array}
\quad \quad \quad \quad
\begin{array}{c}
3 \\
4 \\
\times 26
\end{array}
\]

\[
\begin{array}{c}
= \\
= \\
= +
\end{array}
\]
### Volume 6 Placement Assessment Scoring Guide

<table>
<thead>
<tr>
<th>Skill Assessed</th>
<th>CCSS</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part 1</strong></td>
<td></td>
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</tbody>
</table>
| 1. Solves a story problem involving a multiplicative comparison; shows work. *The ribbon is 15 inches long; work will vary.* | 3.OA.7, 4.OA.2 | 2 pts.:  
- 1 pt. for the correct answer  
- 1 pt. for showing work that reflects the information in the problem |
| 2. Selects and solves an equation to represent a multiplicative comparison. *5 \times 4 = 20* | 3.OA.7, 4.OA.1 | 1 pt. |
| 3. Multiplies single digits by 10; multiplies 10 by single digits. *80, 100, 90, 60* | 3.OA.7 | 4 pts. |
| 4. Fills in number words to make true statements about tens and hundreds. (three, seven, forty, sixty) | 4.NBT.1 | 4 pts.  
(Do not penalize for incorrect spellings.) |

**Part 1 Total Score (11 pts. possible)**  
0–8: Start with Volume 6, Module 1; 9–11: Proceed to Part 2

<table>
<thead>
<tr>
<th><strong>Part 2</strong></th>
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</thead>
</table>
| 6. Uses an array sketched on base ten grid paper to solve a 1-by-2-digit multiplication combination. Shows work. *65; work will vary* | 4.NBT.3 | 2 pts. possible:  
- 1 pt. for the correct answer  
- 1 pt. for work that involves keeping the tens and the ones and writing equations to match |
| 7a-b. Multiplies 1-digit by 2-digit numbers, using strategies based on place value and properties of operations. Shows work.  
*5 \times 14 = 70; 4 \times 16 = 64*  
*Work will vary somewhat* | 4.NBT.5 | 4 pts.  
2 pts. per problem:  
- 1 pt. for the correct answer  
- 1 pt. for work that includes correctly labeled array and the use of partial products by place value (tens and ones) |

**Part 2 Total Score (10 pts. possible)**  
0–7: Start with Volume 6, Module 3; 8–10: Proceed to Part 3

<table>
<thead>
<tr>
<th><strong>Part 3</strong></th>
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</thead>
</table>
| 9a-b. Uses an area sketch and the partial products algorithm to solve 26 \times 34.  
*a) 600, 80, 180, 24*  
b) 20 \times 30 = 600, 20 \times 4 = 80, 6 \times 30 = 180, 5 \times 4 = 20; 884* | 4.NBT.5 | 3 pts.  
- 1 pt. for labeling each region with the correct area  
- 1 pt. for the correct answer [884]  
- 1 pt. for listing and solving the 4 partial products correctly |

**Part 3 Total Score (9 pts. possible)**  
0–6: Start with Volume 6, Module 5; 7–9: Start with Volume 6, Module 8
Progress Monitoring 6-3 Record Sheet

1. Multiply.
   \[15 \times 10 = \underline{\phantom{00000}}\quad 24 \times 10 = \underline{\phantom{00000}}\quad 36 \times 10 = \underline{\phantom{00000}}\quad 52 \times 10 = \underline{\phantom{00000}}\]

2. Solve these multiplication problems.
   \[2 \times 40 = \underline{\phantom{00000}}\quad 3 \times 40 = \underline{\phantom{00000}}\quad 4 \times 40 = \underline{\phantom{00000}}\quad 7 \times 30 = \underline{\phantom{00000}}\]

3. Use the array to solve each multiplication problem. Draw loops around groups of lines and dots (tens and ones) and write equations to show your thinking.

   a.
   \[
   \begin{array}{c|c|c}
   \text{4} & \text{14} & \text{4 \times 14 = \underline{\phantom{00000}}} \\
   \end{array}
   \]

   b.
   \[
   \begin{array}{c|c|c}
   \text{5} & \text{13} & \text{5 \times 13 = \underline{\phantom{00000}}} \\
   \end{array}
   \]
## Progress Monitoring 6-3 Scoring Guide

<table>
<thead>
<tr>
<th>Skill Assessed</th>
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<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part 1</strong> Written Progress Monitoring</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 1. Multiplies 2-digit numbers that are not multiples of 10 by 10. ISO, 240, 360, 520 | 4.NBT.1, 4.NBT.5 | 2 pts. 4 correct  
1 pt. 2-3 correct  
0 pts. 0-1 correct |
| 2. Multiplies 1-digit numbers by multiples of 10. 80, 120, 160, 210 | 4.NBT.5 | 2 pts. 4 correct  
1 pt. 2-3 correct  
0 pts. 0-1 correct |
| 3a-b Uses arrays sketched on base ten grid paper to solve 1-by-2-digit multiplication combinations. Shows work. d) 56, b) 65, work will vary. | 4.NBT.5 | 4 pts. 2 pts. for each problem:  
1 pt. for the correct answer  
1 pt. for work that involves looping the tens and the ones and writing equations to match |
| **Part 2** Individual Interview |      |         |
| 1. Agrees that \(5 \times 30\) is equivalent to \((5 \times 3) \times 10\). Explains why using words, models or sketches, and/or equations. Explanations will vary. Example 1: Student solves both expressions correctly, and points out that the answer to each is 150, so the two must be equal. Example 2: The student demonstrates that \(5 \times 30\) equals \(5 \times (3 \times 10)\) and notes that the grouping of the factors can be changed to yield \((5 \times 3) \times 10\). | 4.NBT.1 | 2 pts.  
1 pt. for agreeing that \(5 \times 30 = (5 \times 3) \times 10\)  
1 pt. for a reasonable explanation using any combination of words, models or sketches, and/or equations |

**TOTAL SCORE** | 10 pts.
Appendix C

Institutional Review Board

DATE: February 12, 2021
TO: Ximena Suarez-Sousa, Principal Investigator
     Heidi Lunde, Co-Investigator
FROM: Lisa Karch, Chair
       Minnesota State University Moorhead IRB
ACTION: DETERMINATION OF EXEMPT STATUS
PROJECT TITLE: [1708734-1] Does the Implementation of Bridges Math Intervention Show Growth in Student Learning?
SUBMISSION TYPE: New Project
DECISION DATE: January 25, 2021

Thank you for your submission of New Project materials for this project. The Minnesota State University Moorhead IRB has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations under 45 CFR 46.104.

We will retain a copy of this correspondence within our records.

If you have any questions, please contact the Minnesota State University Moorhead IRB. Please include your project title and reference number in all correspondence with this committee.

This letter has been issued in accordance with all applicable regulations, and a copy is retained within Minnesota State University Moorhead’s records.
Appendix D

Method of Assent

Hello 4th graders! Your parents have given permission for you to participate in my math group for my research study. You will be receiving two videos with follow up activities a week to complete on SeeSaw. This is completely voluntary. If you choose not to participate, it will not have any effect on you, your grade or our relationship. The purpose of this study is to help me better understand how to work with students in the area of math. Please let me know if you have any questions.