EMPIRICALLY VALIDATING THE MEASURES AND INTERVENTIONS OF NUMERACY DEVELOPMENT (MIND): REMEDIATION PACKET TO INCREASE BASIC MATH FLUENCY SCORES

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Title of Study: EMPIRICALLY VALIDATING THE MEASURES AND INTERVENTIONS OF NUMERACY DEVELOPMENT (MIND): REMEDIATION PACKET TO INCREASE BASIC MATH FLUENCY SCORES

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Abstract: With the majority of fourth grade students failing to achieve proficiency in math, educational researchers need to focus on class-wide and group interventions that can be efficiently and effectively used by general education teachers. The MIND: Skill remediation Packet utilizes two empirically validated interventions (Cover, Copy, Compare, & Explicit Timing) to build basic math fact accuracy and fluency among students. The purpose of this study is to empirically validate sections 1.11-1.13 of the MIND: Skill Remediation packet to increase DCPM scores on basic subtraction and division facts using group administration. The group-wide average DCPM scores were plotted on a time series graph and visual analysis was used to interpret the data. Results show that the MIND intervention showed significant DCPM growth for both division and subtraction. Indicating that the MIND: Skill Remediation packet increase student DCPM scores across skills.

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CHAPTER I

INTRODUCTION

Mandated Testing Results

The No Child Left Behind Act (NCLB; Daly & McCurdy, 2002) mandated that school districts become more accountable for student academic achievement. As a result, there has been an increased focus on empirically-validated academic interventions among educational researchers (VanDerHeyden & Burns 2005). While a vast amount of research has focused on reading instruction, relatively much less attention has been paid to improving math instruction (VanDerHeyden & Burns 2005). There is a clear need to further research in the area of mathematics.

Student performance in mathematics is frequently tested throughout elementary to track student progress towards educational goals (Fontenelle IV, Poncy, Duhon, Stinnett, & Davis, 2015). The National Mathematics Advisory Panel (NMAP) was developed in 2006 to assess student math performance and ways to improve math instruction and performance (NMAP, 2008). Based on the final report from NMAP, the panel recommended that the ability to recall basic math facts automatically may help performance on more complex problems (NMAP, 2008). Test scores reported by the National Assessment of Educational Progress (NAEP, 2015) revealed a decrease in the math proficiency level scores. It was shown that only 40% of fourth-grade students and 33% of eighth-grade students performed at or above the proficiency level in math. In addition, that more than 50% of fourth grade students are currently struggling in math, with 18% performing below the basic proficiency level.

With these scores, it is not surprising that the National Mathematics Advisory Panel reports that students need assistance with the three following skills; computational fluency, procedural fluency, and conceptual understanding (NMAP, 2008). Computational fluency is the ability to accurately solve basic math facts (Codding, Chan-Iannetta, Palmer, & Lukiot, 2009) while, procedural fluency is the understanding of the sequence of steps or rules to solving a problem (Walick, Burns, Christ, Clarkson, & Hansen-Burke, 2015). Conceptual understanding refers to the ability to understand the relationships and underlying concepts of the math equation (Byrnes & Wasik, 1991). Though all of these are important skills, computational fluency is needed to develop and practice the other two, as evidenced in numerous research studies which have repeatedly shown that students with deficits in computational fluency also struggle with more complex math skills (Codding et al., 2009; Powell et al., 2013; VanDerHeyden & Burns, 2009).

Student Outcomes and The Need for Effective Math Interventions

Students classified with low academic achievement or as learning disabled generally struggle with accuracy and fluency in math (Garnett & Fleischner 1983). The ability to accurately and fluently recall basic math facts is a core skill needed before moving to higher level mathematical skills. This is consistent with the findings from the National Mathematics Advisory

Panel (2008), National Council of Teachers of Mathematics (2006), and the State Standards for Common Core Initiative (2010), further demonstrating a need for math interventions, specifically, those targeting basic numeracy skills.

For these reasons, the Measures & Interventions of Numeracy Development (MIND): Remediation Packet was created to provide teachers with efficient interventions and materials to remediate computation skills (Poncy & Duhon, 2017). The packet is intended to supplement existing math instruction by providing teachers with resources needed to implement intensive intervention procedures targeting computation skills. The MIND: Skill Remediation Packet is a scripted intervention procedure that provides computation instruction to remediate skill deficits. The MIND was developed as supplemental curriculum for teachers to easily implement classwide while addressing individual students' skill deficits. To accomplish this, the MIND: Skill Remediation packet includes assessment sheets and placement grid. Once students are assessed the grid tells the teacher which packet to use for each student. Allowing each student to receive intervention on their identified skill deficit through classwide administration (Poncy & Duhon, 2017).

The MIND was developed utilizing empirically validated, intensive, and short duration interventions with purposefully sequenced curricular objectives, uses formative assessment data to monitor progress, and guide educational decisions (Poncy & Duhon, 2017). Cover, Copy, Compare and Explicit Timing are two empirically validated interventions available to increase accuracy and fluency of basic math facts (Van Houten & Thompson, 1976; Poncy, Skinner, & Axtell, 2010; Skinner, Shapiro, Turco & Cole, 1992) and is utilized throughout the MIND. Although the instructional components and procedures (i.e. CCC & ET) incorporated are empirically validated, the MIND has not directly been evaluated yet.

In light of federal education law and the alarming number of students struggling in math, math remediation procedures are necessary. Yearly reports from the NAEP (2015) have indicated minimal to no growth in math proficiency outcomes in almost a decade. As a result, more than half of fourth grade students have scores below proficiency on state math tests. This is an alarming statistic, especially considering basic math fact fluency is an essential skill needed for many life skills (Codding et al., 2009). With the majority of fourth grade students failing to achieve proficiency in math, educational researchers need to focus on class-wide and group interventions that can be efficiently and effectively used by general education teachers. The purpose of this study is to empirically validate sections 1.11-1.13 of the MIND: Skill Remediation packets.

CHAPTER II

REVIEW OF LITERATURE

Instructional Hierarchy

It is important to have a foundational understanding of the sequential process in which students achieve mastery of a skill, one model that attempts to explain this is the Instructional Hierarchy (IH). Haring and Eaton (1978) developed a four-stage model of skill mastery that included the following levels: acquisition, fluency, generalization, and application. The first stage, acquisition, concentrates on improving accuracy. During this stage, students will be slow and inaccurate at the skill. Additionally, procedures designed to improve accuracy may affect succeeding hierarchical stages. For instance, if students are taught finger counting strategies for addition it may help increase their accuracy but it can cause them to become strategy dependent, which can affect their fluency and generalization (Stokes & Baer 1977; Poncy, Skinner, & Jaspers, 2007).

Intervention and instructional procedures used during this stage focus on building accuracy and include the use of demonstration, modeling, cues, prompts, and immediate corrective feedback. Once accuracy is built, the student will need to build fluency. Fluency is the second stage and consists of the ability to quickly respond to academic stimuli with little effort, otherwise known as automaticity (Poncy et al., 2007). Research suggests that as students build fluency, they are likely becoming “automatic” in their responding to certain problems (Poncy et al., 2007). This indicates that students will likely need assistance on some problems but not others as they build automaticity across problems. This is important for identifying specific skill deficits or target behaviors needing remediation (Shapiro, 2004). Instructional components that are needed to build fluency include drill, practice, and reinforcement (Haring & Eaton, 1978).

The third stage is generalization. In this stage the student is accurate, fluent, and begins to apply what was learned to new, albeit similar, stimuli (Haring & Eaton, 1978). For example, in math, a student that achieves mastery with basic addition facts will begin to generalize, or apply, this skill to other similar skills such as multi-digit addition. Similarly, students will be able to apply the learned skill across differentiated presentations of the task (e.g., presenting math problems vertically rather than horizontally). Interventions and instruction can facilitate generalization by diversifying materials used to remediate skill deficit.

The final stage of the IH is adaptation, during this stage the student applies the information learned to solving novel problems (Burns, Codding, Boice, & Lukito, 2010: Haring & Eaton, 1978). Although the student is now accurate, fluent, and able to generalize learned skill to general task demands; the student still lacks the ability to modify or adapt the skill to new task demands or situations (Haring & Eaton, 1978). Each stage of this model is completed sequentially, in that the student will move to a subsequent stage as skill level increases (Axtell, 2009). As previously noted, the importance of matching intervention and instruction to student response patterns is a crucial component needed to achieve the most effective outcome. Hence, understanding the foundation behind skill development is needed to determine the appropriate procedures needed to remediate skill deficit. The procedure used needs to match the students corresponding learning stage for specific skill. This can be achieved using the MIND: Skill

Remediation procedures. The MIND: Skill Remediation packets were purposefully designed to match empirically-validated intervention and instruction procedures with student response patterns.

Interventions

There have been a number of empirically validated interventions that increase accuracy and/or fluency (Fontenelle IV et. al., 2015; Van Houten & Thompson, 1976; Poncy et. al., 2010; Skinner et. al., 1992). Cover, Copy, Compare (CCC) is an effective procedure at improving accuracy and fluency in students across all hierarchical domains (Skinner et al., 1997). While researchers have used several variations of this procedure to build math fact accuracy and fluency in students across educational settings (Poncy et al., 2007; Skinner, McLaughlin, & Logan, 1997), the structural components have remained the same. Specifically, CCC requires the student to study a problem with the answer provided, cover the problem, write the problem, and compare the written problem to the model. Some studies required students to write the correct answer more than once (Poncy, Skinner, & O'Mara, 2006) while others have used verbal responses (Skinner et al., 1997).

Regardless of version, CCC provides multiple opportunities for students to practice problems and allows them to immediately correct errors (Haring, 1978; Skinner, McLaughlin, & Logan, 1997) ensuring that students do not practice an inaccurate answer (Axtell et al., 2009). Cover, Copy, and Compare is a simple, yet empirically validated procedure shown to increase math fact performance in group and individual settings (Parkhurst et al., 2010; Poncy et al., 2007; Poncy, Skinner, & McCallum, 2012; Skinner et al., 1997).

Explicit timing (ET) is an empirically validated intervention used to build math fact fluency (Duhon, House, & Stinnett, 2012; Poncy, Duhon, Lee, & Key, 2010; Katrina N. Rhymer

& Morgan, 2005; Rhymer, Skinner, Henington, Reaux, & Sims, 1998; Rhymer et al., 2002; Schutte et al., 2015) and should only be used on students with above 90% accuracy. Van Houten and Thompson (1976) evaluated the effects of timing math fact completion among 20 second grade students that had been identified as behind in math performance. Their study utilized a reversal design to determine the effect timing had on work rate and accuracy. Results showed that the class average increased from 3.5 and 5.5 problems correct per minute during baseline phases to 10.5 and 11.5 problems correct per minute during intervention phases. Student accuracy remained 90% and above throughout all conditions. In summary, the results of this study indicate that ET is an effective intervention to increase basic math fact fluency (Van Houten & Thompson, 1976).

ET is comprised of two simple steps: (1) worksheets with basic math facts are passed out to the students and (2) the students are instructed to complete as many problems as they can in an explicitly stated amount of time (Fontenelle IV et. al., 2015). Both CCC and ET are empirically based, effective, intervention procedures for remediating math fact skill deficits. Nevertheless, despite that both interventions are empirically validated, their effectiveness relies on being paired with the appropriate skill deficit needing remediation (Poncy & Duhon, 2017; Poncy, Fontenelle, & Skinner, 2013).

Standard Protocol Approach

Even though researchers have identified empirically validated interventions to remediate math skill deficits, there is still a need for a standardized protocol approach (i.e., procedures and materials are already constructed). Furthermore, if researchers expect teachers to implement their interventions it is important for researchers to validate that the interventions will be effective in the teachers “context” (Skinner, 2013). Skinner coined the term of contextual validity in his 2013 article, *Contextual Validity: Knowing What Works is Necessary, but not Sufficient*. In this article, he refers to contextual validity as a third validity measure in addition to internal and external validity (Skinner, 2013). Internal validity evaluates how a study is implemented and is used to verify that independent variable is what causes the change on the external variable. External validity refers to the generalizability of the study. For example, can the study be generalized to other populations or situations. Both internal and external validity are important however, Skinner argues that context validity is equally important.

Standardized protocols can be implemented across settings and do not require adaptations (Hawken, Adolphson, MacLeod, & Schumann, 2009; Skinner 2013). Standardized interventions can be ideal for teachers for many reasons. First, standardized protocols can be implemented class wide as a tier 2 intervention and can benefit all students. Second, the standardized nature allows for the teacher to use a script and follow the intervention procedures instead of having to develop a new intervention. This ultimately saves time and limits the extra work from the classroom teacher. Third, they can be used to enhance current curriculum. Even though standardized protocols lower the amount of extra work for the teacher, the teacher should be prepared to supplement standardized supports (Skinner, 2013).

MIND: Skill Remediation

The Measures and Interventions for Numeracy Development (MIND): Skill Remediation is a packet of intervention and instructional materials intended to supplement existing math instruction by providing the appropriate resources needed to implement intensive intervention procedures targeting computation skills (Poncy & Duhon, 2017). The procedures utilize a standard protocol approach to provide intensive interventions and instructional procedures to remediate computation skill deficits. The MIND: Skill Remediation packets were developed using the following four guiding principles: 1) empirically-validated interventions, 2) intensive interventions administered in short durations, 3) purposefully sequenced curricular objectives, and 4) formative assessment to monitor progress and guide educational decisions (Poncy & Duhon, 2017).

MIND: Skill Remediation- The Skills

MIND: Skill Remediation consists of four packets specifically designed to remediate skill deficits in basic math facts and multi-digit operations across addition, subtraction, multiplication, and division. The two empirically validated interventions that are used throughout the skills in this packet are CCC and ET. Students will progress through the skills until they reach computational proficiency which will be demonstrated by a pre-determined Digit Correct Per Minute (DCPM) criteria. Although addition, subtraction, multiplication, and division each have individual packets within MIND: Skill Remediation, for the purpose of this paper, the subtraction and division packets will be discussed. Each skill utilizes the same procedural sections (Poncy & Duhon, 2017).

Building Computation Proficiency

Building Computation Proficiency is the first section of the packet. The objective of this section is to build student mastery of basic math facts. Throughout this section, students utilize counting strategies to solve basic math fact problems. Furthermore, problems have been reduced into three sets of 24 problems that are spread across three units to effectively teach skill. Each unit starts with building accurate responding through CCC worksheets followed by, combining

CCC with ET to incorporate structured and independent opportunities for the student to practice problems. The student must reach 20 DCPM or more before he/she can move to the second part of unit which consists of solely ET worksheets until he/she reaches 40 DCPM or more. These steps are repeated for each of the three problem sets until the student achieves mastery across all three units (Poncy & Duhon, 2017).

Part-Part-Whole Relationships

The second section of the packet focuses on Part-Part-Whole relationships. In this section, CCC worksheets are utilized for fact families and ET worksheets are used for Cloze Problems to facilitate student understanding of part-part-whole relationships. First, the CCC worksheets consist of fact families and allow the students to form problems using the fact families. Followed by the ET worksheet which utilizes Cloze Problems (i.e., 3+__=12) to provide students with practice on basic algebra concepts (i.e., a+4=12, what is = to a). Building student proficiency with these two tasks can be beneficial to help students relate problems to different settings and may be helpful with teaching future skills such as problem solving and algebra (Poncy & Duhon, 2017).

Mastering Multi-Digit Problems

The third section, Mastering Multi-Digit Problems, teaches students how to solve multi-digit computation problems through Procedural CCC worksheets (P-CCC) and scripted lessons. This section provides multiple teaching opportunities for students to learn how to accurately complete multi-digit problems. Specifically, P-CCC provides the following for students; teacher demonstrate, guided practice with visual cues, independent practice, and if needed, performance feedback. This section was purposefully developed for students that are fluent with basic math facts but are struggling to complete multi-digit problems. For example, a student that scores 40 or more DCPM on basic math fact problems but 20DCPM or fewer on multi-digit problems. (Poncy & Duhon, 2017).

Every section is comprised of units which divide the problems into smaller sets with an assessment sheet at the end of the unit. This assessment is used to progress monitor the student and determine what packet the student will move to next. Specific guidelines outlining the sequence of the interventions is included in packet materials. The MIND: Skill Remediation packet is intended to provide teachers with efficient instructional materials to supplement existing core curriculum. Empirically-validated interventions such as Cover Copy Compare (CCC) and Explicit Timing (ET) are utilized throughout a set of skills (Poncy & Duhon, 2017).

MIND: Skill Remediation- The Interventions

ET and CCC are embedded throughout the MIND: Skill Remediation packets. CCC is used for students that are above 60% accuracy but below 20 DCPM. For these students, their intervention packet consists of CCC and ET. Once the student reaches 90% accuracy and above 20 DCPM he/she then moves to an ET only packet to build fluency. Students must achieve 40 DCPM or more with basic math facts before moving to part-part-whole relationships and multi-digit computation.

Building accuracy by increasing rates of practice with accurate responding is essential to be fluent with a skill. For each variation of packets, problems were divided into three evenly disbursed sets (Set A, Set B, Set C) that make up 24 total problems per packet. The self-correction component of CCC increases the rate of accurate responding and ensures that students do not practice an inaccurate answer (Poncy & Duhon 2017).

MIND: Skill Remediation- The Structure

Scope and Sequence

The skills within the MIND: Skill Remediation packets were organized in a logical sequence to facilitate mastery across computation skills. To achieve this, each skill within the sequence is taught until specified mastery criteria are achieved before the student can move to the subsequent skill. Mastery of these skills is essential for teachers to teach students future skills (Poncy & Duhon, 2017).

Matching Intervention to Student Needs

For empirically validated interventions to be effective the intervention procedures need to be specifically aligned with the needs of the student. This can be achieved by analysis the students' response pattern. For instance, if a student is slow and inaccurate (i.e. 11 DCPM with 70% accuracy), the most beneficial route for the student would be to incorporate an intervention that focusses on building accuracy (i.e. CCC). At this point, it would not benefit the student to use a fluency focused intervention such as ET. In order for an ET intervention to be effective the student must be accurate. In contrast, if the student is accurate but slow (i.e. 11 DCPM with >90% accuracy) the most appropriate intervention would be ET. By using ET in this situation, the student would have more opportunities to respond and practice problems which would build the students fluency. With this in mind, student response patterns are key to determining what intervention procedure is the most appropriate (Poncy & Duhon, 2017).

Mastery Criteria

In order for students to learn new skills they must first be proficient with the basic components of the skill. For example, a student must be proficient with basic addition before he/she learns proceeding skills such as multi-digit addition. If the student is not proficient with the basic addition components he/she will struggle with the more complex skill concepts. For this reason, mastery criteria are used throughout the MIND: Skill Remediation packets to solidify proficiency with each skill before student can move to followings skills (Poncy & Duhon, 2017).

Intervention Selection & Construction

The intervention procedures utilized throughout the MIND: Remediation packets were empirically validated to remediate specific skill deficits. Specifically, CCC is used to build accuracy and promote errorless learning and ET is used to build fluency by increasing the students' response rates. Both of these interventions are utilized throughout the packets to teach and build proficiency across computation problems. The packets were developed to provide teachers with the materials to administer intensive intervention procedures in a short amount of time to supplement core curriculum (Poncy & Duhon, 2017).

Skill Placement

The MIND: Skill Remediation utilizes a sequenced standard protocol approach for assessment, intervention selection, and decision making. The sequence is well defined within the MIND: Skill Remediation manual provided in its material packet. The assessment procedure used throughout the packet is known as curriculum based-measurement (CBM); a form of curriculum based assessment that is more time and cost efficient with the ability to inform, implement, and monitor effective interventions (Deno, 1985; Burns, MacQuarrie, & Campbell, 1999; Fuchs, Fuchs, Hop, & Hamlett, 2003). CBM is a reliable and valid measurement tool that is used for assessment-related decision making (Deno, 1985).

Using CBM in conjunction with intervention procedures provides a systematic way of evaluating interventions effectiveness. CBM data can be utilized to inform instruction in the following four ways: (a) evaluate appropriateness of target goal, (b) evaluate students' progress and determine whether or not modifications need to be made to current instruction, (c) compare different treatments' ability to achieve target goal, and (d) inform effective modifications to improve instruction (Fuchs, 2015).

Additionally, students are assessed on individual skills (i.e. basic addition) that corresponds with the curricular instruction the student has received. The student will first be assessed on the highest-grade level skill (current) he/she is expected to have mastered. If the student does not score above an instructional level (determined by DCPM) the student will be assessed on skills previously taught, to identify the students' ability across computation skills (Poncy & Duhon, 2017).

The probes were designed, using CBM procedures, as assessment counterparts to the interventions included in the MIND: Skill Remediation packets. These probes will provide the assessment data needed to progress monitor and evaluate student proficiency as well as isolate skill deficits throughout computation skills. Interventions within the MIND: Skill Remediation packets address different levels of computation deficiencies. Moreover, pairing of empirically validated intervention procedures to the specific needs of the student is a curtail component for effective growth. Therefore, student response patterns, identified through these assessment probes are used to determine the appropriate intervention needed to remediate skill deficit (Poncy & Duhon, 2017).

Current Study

In light of the federal education law and national data suggesting skill deficits in computation skills, educational researchers need to focus on interventions that can be efficiently and effectively used by general education teachers to target these areas. Although research has been done empirically validating CCC and ET there is a need for research that combines the intervention. Furthermore, interventions that can be implemented class wide or across group settings will be more efficient for teachers. However, it is important to not lose the effectiveness of the intervention. These concerns can be addressed by using a standard protocol approach to implement individualized interventions to students in a group setting. More specifically,

The MIND: Remediation Packet was created to provide teachers with effective and efficient interventions to remediate computation skills. The packet is intended to supplement existing math instruction by providing the appropriate resources needed to implement intensive intervention procedures targeting computation skills (Poncy & Duhon, 2017). Therefore, the MIND: Remediation Packet allows for each child to receive an individualized intervention that matches the his/her skill deficit while being administered in a group setting. Moreover, the standard protocol approach and packet design allow for the intervention to be administered in less than ten minutes. For these reasons, the MIND: Remediation Packet may be a valuable tool for teachers to help remediate these math deficits among students that have been reported over the years.

Research Questions and Hypotheses

The MIND: Skill Remediation Packet utilizes two empirically validated interventions (CCC & ET) to build basic math fact accuracy and fluency among students. The purpose of this study is to empirically validate sections 1.11-1.13 of the MIND: Skill Remediation packet to increase DCPM scores on basic subtraction and division facts using group administration.

Research Question 1: Is the MIND: Skill Remediation packet effective at increasing DCPM scores on basic subtraction and division facts?

It is hypothesized that the MIND: Skill Remediation Packet will increase DCPM scores on basic subtraction and division facts.

Research Question 2: Can the MIND: Skill Remediation packet be effectively administered in a group setting?

It is hypothesized that the MIND: Skill Remediation packet can be effectively administered in a group setting.

CHAPTER III

METHODOLOGY

Participants and Setting

Participants included 6 students from one fifth grade classroom from a public school in located in the Midwest. Students ages ranged from 10-11 years, 4 students were female and 2 were male. Of the 6 students, one identified as Hispanic and 5 Identified as Caucasian. While the participants in this study were identified as being behind in math compared to their same aged peers, none were receiving special education services in the area of mathematics during the study. Prior to beginning the study, approval was obtained through the school district and university institutional review board. Additionally, to participate in the study, parents and students signed consent and assent forms. Consent and assent forms were signed for participants to be included in the study. The following was included in the consent and assent forms; a brief explanation of the study, appropriate contact information, and a statement informing the student that he or she had the ability to withdraw consent at any time of the study without penalty.

Materials

MIND Worksheets

Students completed worksheets using CCC and ET procedures targeting basic subtraction and division problems (see Appendix A). The CCC worksheets consisted of 24 (six rows of four problems) solved (answers included) subtraction or division problems per page. The CCC probes had a blank box to the right of each problem for the participant to copy the problem and answer. Explicit timing probes consisted of 48, (six rows of eight) unsolved, subtraction or division problems, per page (See Appendix B). Each probe contained a single skill, subtraction or division, not mixed between skills. Each skill was divided into three different sets of problems (Set A, Set B, and Set C), (see Table 1). Each set contained 24 problems (zeroes and ones omitted) with problems being blocked into two independent sets of 24 items to ensure that the problems were evenly distributed across the probe. Each set contained six different alternate forms of CCC and ET probes.

Procedures

The researcher used standardized curriculum based measurement procedures (Shinn, 1989) to read the instructions, provide start and stop points, and notify students of time restrictions. School psychology graduate students implemented all procedures and collected all assessment data in the students' general education classroom on consecutive school days. The MIND intervention sessions were completed in the afternoon. The classroom teacher was consulted about what time he preferred for the intervention to take place.

Intervention Probes

Each MIND intervention packet contained a total of 16 CCC and 16 ET worksheets targeting either subtraction or division problems across an 8-day period. Each day four sheets were presented to the participants in the following order; CCC, ET, CCC, ET.

Assessment Probes

Student performance on the dependent variable was collected using the worksheets from the ET condition across three sets (A, B, & C) each day. Although the probes are also used to practice facts using ET procedures, to avoid practice effects students were never assessed with, and intervened on, using the same probes within two days of each other. Each day the students completed an assessment packet that included one assessment probe for each set. Each, day the assessment probes and intervention materials were distributed in a folder to each student in the study

Skill Assignment

Although all students completed computation practice using identical procedures, students were assigned to either subtraction or division depending on their initial DCPM scores on an addition, subtraction, multiplication, and division probes containing all basic problems. Students who score at or above 20 DCPM (90% acc) on the addition probe and below 20 DCPM on the subtraction probe were placed in the subtraction group. Students who score at or above 20 DC/M (90% acc) on the multiplication probe and below 20 DCPM on the division probe were placed in the division group. Based on the assessment scores, 1 student was placed in the division group while the remaining 5 students were placed in the subtraction group.

Assessment Procedure

School psychology graduate students collected all assessment data each day directly before intervention began. Baseline data was collected for 4 consecutive days prior to implementation of the intervention. Assessment data was collected group-wide each day using a packet of three probes (one probe from Set A, one probe from Set B, and one probe from set C). The order of the probes was counterbalanced.

The researcher passed out the folders to the students, asked them to take out the first packet, and read the following directions, “The worksheets in your packet have either subtraction or division problems. When I say “begin,” start answering the problems. You will have one minute to complete as many problems as you can. Complete each problem correctly and do not skip around. If you come to a problem that you do not know, mark an ‘X’ through it and go on to the next problem. Remember to work as quickly as you can and do your best work. Ready, begin”. After 1 min elapsed, the researcher instructed the students to stop and turn to the next page. A pause was given and students were instructed to begin. These procedures were continued until all three assessment sheets were completed. After the third assessment sheet was concluded the students were instructed to place the assessment packet in their folder. Baseline data were collected across four consecutive school days. Once baseline data were stable, the researcher introduced the MIND intervention and began implementation for the next 24 school days. Assessment data continued throughout the study and was collected before starting the first intervention session of the day.

Intervention Procedure

The MIND Units 1.11 (Set A), 1.21 (Set B). and 1.31 (Set C) consist of a standard presentation of CCC and ET worksheets. Each day four sheets were presented to the participants in the following order; CCC, ET, CCC, ET. After the packet of the 32 worksheets across 8 days was completed students moved to the next Unit and new set of problems.

Each day, directly after assessment data was collected, the experimenter prompted the students to take out the second packet in their folder and read the following instructions, “Here is your CCC worksheet, I want you to complete as many problems on the page that you can in 2 minutes. If you get to the end of the page before I say stop, please sit quietly and wait for the next task. Ready, Begin.” When 2 min elapsed, the examiner read the following instructions, “Stop and turn to the next page. Now we are going to complete math worksheets using explicit timing. With explicit timing, I am going to give you 2 min to complete as many problems as you can. Complete each problem correctly and do not skip around. Push yourself to work as quickly as possible. If you get to the end of the page before I say stop, please sit quietly and wait for the next task. Ready, begin”. Once two minutes elapsed, the experimenter repeated the instructions for the CCC and ET worksheets resulting in four total intervention sheets completed per day. Once the daily packet was completed, the examiner instructed the students to place packets into folder and the researcher will collect them.

Experimental Design, Dependent Measure, & Scoring Procedures

A multiple baseline design was used across three exclusive probe sets to evaluate the effect of the class-wide implementation of MIND on DCPM scores. Given the purpose of the study to investigate the overall impact of the MIND on the entire group, the group-wide average DCPM scores were plotted on a time series graph and visual analysis was used to interpret the data. To supplement the visual analysis of the group data, individual data were also examined. To analyze individual student data, within-phase mean comparisons were used to provide descriptive data about student growth. The dependent measure used in the study was DCPM. These data resulted from student performance on experimenter constructed probes using CBM procedures with basic subtraction or division problems. A digit was scored as correct when the correct number was written in the proper column (Shinn, 1989). For example, the answer to the subtraction problem “4 x 8” is “32” which would be recorded as two points, whereas the answer of “36” would be receive 1 point since only one digit is correct and an answer of “24” would receive 0 points being that neither digit is correct.

Procedural Integrity

An independent observer was in the classroom and collected procedural integrity data during 12 of the 24 intervention sessions (50%) and 12 of the 28 assessment sessions (43%). During both the assessment and intervention sessions, the independent observer recorded the presence or absence of experimenter behaviors located on the implementation guidelines and checklist. The experimenter implemented 100% of the steps during each observation during both conditions.

CHAPTER IV

RESULTS

The present study was done using a multiple baseline design across three exclusive probe sets in order to evaluate the effect of the group-wide implementation of MIND on DCPM scores. Since the purpose of the study was to investigate the impact of the MIND administered in a group setting, the group-wide average DCPM scores were plotted on a time series graph and visual analysis was used to interpret the data. Seven students consented to participate in the study (5 females, 2 males). However, one female student moved after day one of baseline and one male students' data was not used because he missed more than five days of intervention due to in school suspension. The criteria of five days were set prior to beginning the study. All seven students were fifth grade students that attended school in a rural district in Oklahoma.

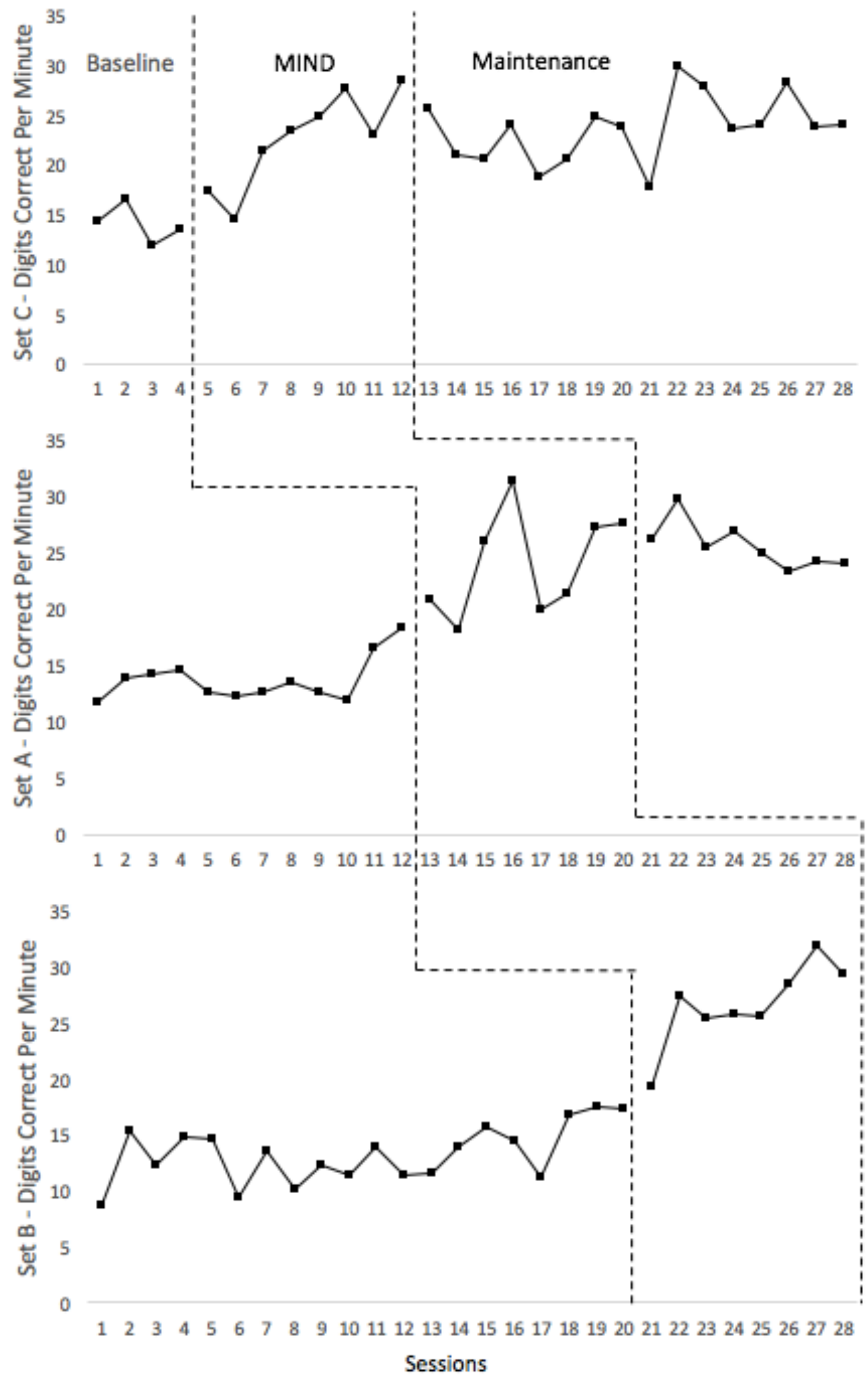
Figure 1 demonstrates the class-wide DCPM data on assessment probes across baseline, intervention, and maintenance phases. Baseline data was collected daily for four days. Baseline data show slight trend followed by a decreased trend for Set C, a stable trend followed by an increasing trend for Set A, and a slightly increased, then stable trend for Set B. The MIND intervention was introduced on day five for set C, assessment data continued to be collected across sets. Visual analysis of aggregated treatment data in Fig. 1 demonstrated a slight increase in DCPM immediately after the MIND intervention was introduced across all sets. While each set showed growth when the MIND intervention was introduced compared to baseline, sets C and A showed a decrease in DCPM after day two of the MIND packet then began an upward trend. The decrease of DCPM shown across sets on day 17 can be accounted for by a 5-day school holiday. Specifically, this decrease was greater for the set A which was in intervention phase during this break. Regardless, Fig. 1 and Table 1 showed in increased DCPM level trend across sets when the MIND intervention was introduced. This suggests that the MIND intervention can account for the increase in DCPM.

Table 1 shows the group-wide within-phase means growth between baseline and intervention and baseline and maintenance phases. The average DCPM increased from baseline to intervention by 9.3 (67%) for Set A, 13.3 (96%) for Set B, and 8.2 (55%) for Set C. Furthermore, average maintenance phase data showed no decrease when compared to intervention phase. Indicating that the MIND intervention increased DCPM across sets and maintained during maintenance phase. Maintenance data was collected throughout phase changes; however, maintenance data was not continued after the last intervention phase due to state testing. Therefore, there is no maintenance data for set B.

TABLE 1 Group-wide Within-Phase Means Growth Between Baseline and Intervention and Baseline and Maintenance Phases.

Problem Set	Baseline	Intervention	Maintenance	Baseline-Intervention Growth	Baseline-Maintenance Growth
A	13.8	23.1	25.4	9.3	11.6
B	13.5	26.5	**	13	**
C	14.8	23	24	8.2	9.2

Figure 1 Group-wide mean digits correct per minute across baseline, intervention, and maintenance phases.



Visual analysis was done at the group level because the question under investigation was the effect of the MIND as a group intervention. In addition to aggregated data Table 2 provides individual phase average data. Individual phase average data were derived by taking an average of all points during the baseline, intervention, and maintenance phases. For example, all points during baseline for student one were averaged to generated the baseline mean for that student. The same was done for each student during each phase.

When the individual student data is analyzed, the individual within mean scores provide further support that the MIND intervention increased student DCPM scores across skill sets through group administration. Table 2. shows that DCPM increased across four of the five students when the MIND intervention was introduced across sets with the exception of Set A for student three. Of the five students that participated in the study, one was on division (student 1) and four were on subtraction (students 2-5). Showing that the MIND intervention increased DCPM scores across all sets for 60% of the students and across two or more sets for 100% of the students.

As shown in Table 2, student five began increasing DCPM on set B across all sets which is shown through the increase in maintenance scores when compared to baseline for sets A and C. Set B was the last set to receive intervention. Possible reasons variance in the data is further discussed in the discussion section.

TABLE 2 Individual Within-Phase Means for Baseline, Intervention, and Maintenance Data for Probe Sets

	Probe Set A			Probe Set B			Probe Set C		
Student	Baseline	Intervention	Maintenance	Baseline	Intervention	Maintenance	Baseline	Intervention	Maintenance
1	11.7	24	25.4	11.8	25.6	**	12	23.1	20.6
2	10.9	21.3	20.6	11.2	25.1	**	15	21.8	22.1
3	16.1	15	18	13.1	19.4	**	14	22	19.3
4	23.7	46.1	48	26.5	47	**	24.3	39.9	45
5	6.8	9	14.9	4.9	15.4	**	8.5	8	13.3

CHAPTER V

DISCUSSION

Research Questions

Teaches should differentiate instruction in the general classroom setting to accommodate students with various skill levels (Poncy, B. C., McCallum, L. E., & Skinner, C. H. 2011). The MIND intervention was designed to provide individualized interventions that match students' needs simultaneously, in a group setting. Therefore, students on different skill levels can participate in the same group wide intervention. The purpose of this study was to empirically validate sections 1.11-1.13 of the MIND: Skill Remediation packet to increase DCPM scores on basic subtraction and division facts using group administration.

Research Question 1: Is the MIND: Skill Remediation packet effective at increasing DCPM scores on basic subtraction and division facts?

The current study used the MIND intervention in a group setting to improved students DCPM across skill sets. Out of the 5 students that participated, 4 were on subtraction and 1 was on division. The students were assigned to a skill based on their initial DCPM scores on an addition, subtraction, multiplication, and division probes. Table 3 shows the within-phase means for probe sets by skill (subtraction and division). Results show that the MIND intervention showed significant DCPM growth for both division and subtraction. Indicating that the MIND: Skill Remediation packet increase student DCPM scores across skills.

TABLE 3 Within-Phase Means for Baseline, and Intervention Data for Probe Sets by skill.

	Probe Set A		Probe Set B		Probe Set C	
Skill	Baseline	Intervention	Baseline	Intervention	Baseline	Intervention
Division	11.7	24	11.8	25.6	12	23.1
Subtraction	14.4	22.8	13.5	26.6	15.3	23

Research Question 2: Can the MIND: Skill Remediation packet be effectively administered in a group setting?

The current study shows that the MIND: Skill Remediation packets increased the accuracy and fluency of students' basic math facts through group-wide administration. Furthermore, that this intervention packet was successful at targeting individual skill deficits. Table 3 shows that for division average DCPM scores increased from 11.7 to 24 in set A, 11.8 to 35.6 in set B, and 12 to 23.1 for set C. For subtraction, average DCPM scores increased from 14.4 to 22.8 for set A, 13.5 to 36.6 for set B, and 15.3 to 23 for set C. In summary, the findings from this study empirically validate sections 1.11 through 1.13 of the MIND: Skill Remediation packet as an effective and efficient intervention procedure to remediate basic math fact skill deficits across skill sets through group wide administration.

Limitations and Future Research

Although the current study demonstrates that the mean DCPM scores increase when the MIND: Skill Remediation packet was introduced across sets, there are limitations that need to be discussed. To begin, one student (student 5) began increasing DCPM across all sets during intervention phase for Set B. Indicating that the baseline data collected for student 5 may not have been accurate. This student may not have been trying to complete the task during baseline. The researcher noticed that as the intervention progressed students began to track their problems correct and the students began to talk about their progress. Set B was the last set that received intervention and therefore, other students were noticeably completing their worksheets. Student 5 may have been motivated by seeing others complete their sheet which may have encouraged the student to start “trying”. That may explain why the student began growing across all set during the last intervention set. This speculation could have been avoided if a “can’t do, won’t do” assessment is done during baseline. In addition, Future research may want to add reinforcement to the MIND intervention. Adding reinforcement to the intervention or setting small self-attainable goals may help motivate student participation. This could be done by having the students count the digits they completed each day to track their progress.

The second limitation of the study was the time of day it was implemented. The intervention time that was chosen by the teacher was at the end of the day. The examiner made the best effort to accommodate the teacher, but at time the students were let out of class late. During the intervention, one student missed the bus and there were other distractions happening at the end of the day such as a bake sale. In the future, this intervention may have been more effective if it were administered at a different time. The time was chosen by the general education teacher based on the teachers’ schedule. However, being at the end of the day the students were often distracted by the announcements and the buses arriving. Additionally, the time that was chosen was during the students' math block. While the teacher communicated that the students were not missing time from their math instruction, they were missing work time. This is concerning because the students were losing math time instead of gaining an intervention time on top of their math block. The MIND was developed to supplement core curriculum, not to replace it. In addition, it was brought to the examiners attention that the students had already received tier 2 services for math prior to participating in the study and did not show growth over six weeks. The third limitation to the study is that the researcher should have intervened on Set B second instead of Set A. Set A was moving on an upward trend when the intervention was introduced whereas, set B was not.

The last limitation of the study was the small set size. Due to the single case design, there were only 6 participants in the study which limits participants across gender, grade, and skill. Among the participants, 4 were female and 2 were male. Furthermore, one of the male students that was participating in the study received in school suspension during the study and the school did not allow the student to participate during that time. This students' data was thrown out after missing more than 5 consecutive days of the intervention therefore, the data collected reflects that of 4 females and 1 male student. All students that participated were in the same grade. Moreover, subtraction and division were the only two skills accessed in this study. Specifically, only one participant was on the division skill due to placement test scores. While this was an important factor to implement the intervention that matched student needs, it is also a limitation because only one student placed in the division group. More research is needed across skill sets, gender, and grade levels.

Implications for Practice

Previous studies have used empirically validated interventions like CCC and ET to improve basic math fact fluency (Poncy & Duhon, 2017; Poncy et al., 2013) however, research is needed using these interventions collectively to increase student DCPM. The MIND: Skill Remediation packets utilize a standard protocol approach to administer both CCC and ET in a group setting. The assessment probes embedded in the intervention identify individual students' skill deficits and places the student on an intervention that matches their skill level. This allows teachers to differentiate instructions to students while administering a group wide intervention.

This study provides evidence that the MIND intervention packets can be used effectively to increase DCPM scores through group administration. Moreover, that the MIND intervention packets can be implemented in a short amount of time. The researcher was allotted 20 minutes at the end of the day to implement the intervention. This included the time it took to walk the students from their classroom to a separate classroom where the study took place, as well as, collect baseline across all three sets which took 3 minutes before starting the intervention. Showing that without these variables this intervention can be implemented within 15 minutes in the classroom setting. The intervention itself only takes eight minutes (4 sheets at 2 minutes each). Finally, the MIND is a low-cost intervention that can benefit all students through classwide administration during regular instruction time to supplement current curriculum.

Summary

Yearly outcome reports in 2015 indicated that over the last decade students have made minimal to no growth in math proficiency (NAEP, 2015). This in evidenced by student scores reported in 2015 where 40% of fourth grade and 33% of eight grade students preformed at or above proficiency level in math. These alarming statistics identify the need for math remediation procedures among students in the United States.

In order to remedy low math performance, teachers need intervention procedures and materials that are empirically validated to efficiently increase computation skills. Not only are these intervention procedures necessary, but it is important that teachers are able to implement the intervention efficiently and effectively among students. Over the past 40 years researchers have identified empirically validated interventions that build accuracy and fluency performance across basic math facts (Fontenelle IV et. al., 2015; Houten & Thompson, 1976; Poncy et. al., 2010; Skinner et. al., 1992). The MIND: Skill Remediation packet utilizes a standard protocol approach to administer two empirically validated interventions (CCC & ET) classwide. The packet is designed to be implemented by the classroom teacher, to all students simultaneously. However, the students' intervention is individualized based on his/her score on initial assessment. This allows for the teacher to easily individualize the intervention to match skill deficits.

In summary, the purpose of this study was to empirically validate sections 1.11 through 1.13 of the MIND: Skill Remediation packet. Findings from this study show that the MIND: Skill Remediation packet was effective at remediating basic math fact skill deficits across subtraction and division. The results of this study suggest that the MIND: Skill Remediation packet may offer a low-cost intervention procedure that can be implemented classwide with little extra work for the classroom teacher.

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APPENDICES

Appendix A: CCC Worksheet

13 - 9 4		10 - 8 2		8 - 4 4		10 - 2 8	
8 - 4 4		15 - 6 9		7 - 5 2		11 - 3 8	
11 - 8 3		14 - 7 7		8 - 5 3		14 - 7 7	
13 - 7 6		7 - 2 5		11 - 6 5		13 - 4 9	
11 - 5 6		6 - 3 3		13 - 6 7		15 - 9 6	
8 - 3 5		17 - 8 9		17 - 9 8		6 - 3 3	

Appendix B: ET Worksheet

17 - 9	6 - 3	7 - 5	14 - 7	15 - 9	10 - 2	8 - 5	13 - 6	11 - 6
11 - 3	8 - 4	13 - 4	14 - 7	8 - 3	13 - 7	6 - 3	11 - 8	17 - 8
7 - 2	13 - 9	11 - 5	8 - 4	15 - 6	10 - 8	17 - 9	8 - 5	13 - 6
6 - 3	10 - 5	14 - 7	15 - 9	10 - 2	7 - 5	11 - 3	8 - 4	13 - 4
6 - 3	15 - 6	8 - 3	14 - 7	11 - 8	7 - 2	11 - 5	17 - 8	13 - 7
8 - 4	10 - 8	13 - 9	11 - 3	14 - 7	7 - 5	15 - 9	13 - 4	8 - 5
13 - 6	6 - 3	11 - 6	8 - 4	10 - 2	17 - 9	14 - 7	15 - 6	8 - 3
6 - 3	8 - 4	17 - 8	11 - 8	7 - 2	13 - 9	13 - 7	11 - 5	10 - 8

Appendix C: Treatment Integrity

Procedural Checklist

1. Provide students with pencil and folder. Ask the students to take the first packet out of their folder.

2. Read the following instructions:

   "The worksheets in your packet have either subtraction or division problems. When I say "BEGIN," start answering the problems. You will have one minute to complete as many problems as you can. Complete each problem correctly and do not skip around. If you come to a problem that you do not know, mark an 'X' through it and go on to the next problem. Remember to work as quickly as you can and do your best work. Ready, begin".

3. Monitor student procedural adherence. Prompt student if directions are violated. For example, *"Please work across the page" "Do not skip problems, if you cannot answer it mark an 'X' through it", "Keep working until I tell you to stop."*

4. After 1 minute elapses, tell the students:
   "Stop and turn to the next page. Ready, begin".

5. After 1 minute elapses, tell the students:
   "Stop and turn to the next page. Ready, begin".

6. Prompt the students to take the second packet out of their folder.

   "Here is your CCC worksheet, I want you to complete as many problems on the page that you can in 2 minutes. If you get to the end of the page before I say stop, please sit quietly and wait for the next task. Ready, Begin."

7. After 2 minutes' elapses, tell the students:
   "Stop and turn to the next page. Now we are going to complete math worksheets using explicit timing. With explicit timing, I am going to give you 2 minutes to complete as many problems as you can. Complete each problem correctly and do not skip around. Push yourself to work as quickly as possible. If you get to the end of the page before I say stop, please sit quietly and wait for the next task. Ready, begin".

8. Monitor student procedural adherence. Prompt student if directions are violated. *For example, "Please work across the page" "Do not skip problems, if you cannot answer it mark an 'X' through it", "Keep working until I tell you to stop."*

9. After 2 minute elapses, tell the students, *"Stop, and turn to the next page".*

10. Repeat steps 6-9.

11. After you have repeated steps 6-9, tell the students "Stop, please put down your pencil and put your packet back in your folder." Collect probes.

Appendix D: Consent & Assent Forms

PARENT/GUARDIAN PERMISSION FORM
OKLAHOMA STATE UNIVERSITY

PROJECT TITLE: Empirically Validating the Measures and Interventions for Numeracy Development (MIND): Remediation Packet to Increase Math Fluency Scores

INVESTIGATOR(S): Brian Poncy, PhD, Angela Taylor

PURPOSE:

The purpose of the present study is to empirically validate the MIND: Skill Remediation packets to increase the accuracy and speed of students' basic math fact skills.

PROCEDURES:

For the present study, a small group intervention approach will be used. During daily sessions, each student will receive a math intervention packet based on his/her skill level. The small group will be directed to wait for instructions as packets designed to increase math fact skills are placed face down on their desks. Once packets are distributed, the teacher will read the instructions to the students explaining the math intervention procedure. While students are completing the worksheets, the teacher will walk around the classroom and make sure students are following the procedures. The teacher will instruct the students when to start, stop, and transition to a new worksheet. Once the daily packet is completed, the teacher will instruct students to place packets into folder and the researcher will collect them. The intervention session will last 8 minutes.

RISKS OF PARTICIPATION:

There are no known risks associated with this project which are greater than those ordinarily encountered at school.

BENEFITS OF PARTICIPATION:

The benefits of participation include your child potentially increasing his/her skill with completing basic math fact problems. This may help to improve performance in other areas of mathematics. If effective, the results of this study can be used to inform educators about practices that can be used to increase student computation skills.

CONFIDENTIALITY:

The records of this study will be kept private. Any written results will discuss group findings and will not include information that will identify you or your child. Research records will be stored on a password protected computer in a locked office and only researchers and individuals responsible for research oversight will have access to the records.

CONTACTS:

You may contact any of the researchers at the following addresses and phone numbers, should you desire to discuss your participation in the study and/or request information about the results of the study: Brian Poncy, Ph.D., 420 Willard Hall, Dept. of SAHEP- School Psychology, Oklahoma State University, Stillwater, OK 74078, (405) 744-4808. If you have questions about your rights as a research volunteer, you may contact the IRB Office at 223 Scott Hall, Stillwater, OK 74078, 405-744-3377 or irb@okstate.edu

PARTICIPANT RIGHTS:

I understand that my child's participation is voluntary, that there is no penalty for refusal to participate, and that I am free to withdraw my permission at any time. Even if I give permission for my child to participate I understand that he/she has the right to decline.

CONSENT DOCUMENTATION:

I have been fully informed about the procedures listed here. I am aware of what my child and I will be asked to do and of the benefits of my participation. I also understand the following statement:

I have read and fully understand this permission form. I sign it freely and voluntarily. A copy of this form will be given to me. I hereby give permission for my child ______________________ , to participate in this study.

____ __________________

Signature of Parent/Legal Guardian Date

Appendix E: Consent & Assent Forms

ASSENT FORM
OKLAHOMA STATE UNIVERSITY

Dear Student,

We are interested in learning if the worksheets used with the MIND: Remediation Packets will help you learn math fact problems. We need your permission in order for you to participate in the project. Your parent/guardian is aware of this project.

Please understand that you do not have to do this. Even if your parents have given their permission, you may still choose not to participate. You do not have to answer any questions that you do not want to. You may stop at any time and go back to your classroom.

Your name will not be on the forms you fill out, and you will be given a number that will be put on your answer sheet so no one will know whose answers they are. If you have any questions about the form or what we are doing, please ask us. Thank you for your help.

Sincerely,

Brian Poncy, PhD
Associate Professor, Oklahoma State University

I have read this form and agree to help with your project.

____
(your name)

____
(your signature)

____
(date)

Appendix E: IRB Approval Letter

Oklahoma State University Institutional Review Board

Date:	Tuesday, November 29, 2016
IRB Application No	GC1619
Proposal Title:	Empirically Validating the Measures and Interventions for Numeracy Development (MIND): Remediation Packet to Increase Math Fluency Scores
Reviewed and Processed as:	Exempt

Status Recommended by Reviewer(s): Approved Protocol Expires: 11/28/2019

Principal Investigator(s):

Angela Taylor	Brian C. Poncy
	420 Willard
Stillwater, OK 74078	Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

☐ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval. Protocol modifications requiring approval may include changes to the title, PI advisor, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms
2. Submit a request for continuation if the study extends beyond the approval period. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of the research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Dawnett Watkins 219 Scott Hall (phone: 405-744-5700, dawnett.watkins@okstate.edu).

Sincerely,

Hugh Crethar, Chair
Institutional Review Board

VITA

Angela Taylor

Candidate for the Degree of

Doctor of Philosophy

Thesis: EMPIRICALLY VALIDATING THE MEASURES AND INTERVENTIONS OF NUMERACY DEVELOPMENT (MIND): REMEDIATION PACKET TO INCREASE BASIC MATH FLUENCY SCORES

Major Field: Educational Psychology: option in School Psychology

Biographical:

Education:

Completed the requirements for the Doctor of Philosophy in School Psychology at Oklahoma State University, Stillwater, Oklahoma in May, 2018.

Completed the requirements for the Master of Science in School Psychometrics at Oklahoma State University, Stillwater, Oklahoma in December, 2014.

Completed the requirements for the Bachelor of Arts in Psychology at University of South Florida, Tampa, Florida in May, 2013.

Experience:
Doctoral Psychology Intern, Egyptian Public Health Department, Eldorado, IL
OTTIS Specialist Consultant, Behavioral Solutions, Stillwater, OK
Academic Facilitator, Oklahoma State University, Stillwater, OK
Graduate Teaching Assistant, Oklahoma State University, Stillwater, Oklahoma

Professional Memberships:
American Psychological Association (APA)
Association for Behavior Analysis International (ABAI)
National Association of School Psychologists (NASP)
Oklahoma School Psychology Association (OSPA)