# Implementing the Touch Math Program to Improve Basic Computation Skills

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## Abstract

The purpose of this study was to determine the effectiveness of the Touch Math Program in helping students increase speed, accuracy, and fact fluency while learning basic addition and subtraction facts. A single-subject research design was developed to determine whether individualized instruction with the program could help a second grade student increase the correct number of digits written during a timed two minute computation probe. Instruction occurred twice a week over the course of five weeks. Computation probes were conducted during computation instruction sessions. Results of the study show that once a student has obtained certain prerequisite skills, the Touch Math Program can help a student increase speed, accuracy, and fact fluency while learning basic addition facts. Further research needs to be conducted in order to evaluate the effectiveness of the program in teaching and obtaining subtraction skills. this is a terrific abstract

## Phase I: Identify and Define Targeted Area for Growth

### Candidate Focus

The student in this study is a second grade student at ……. The student is currently receiving Tier 3 interventions in the RTI process. She is currently having difficulty in the areas of reading and math.

At the beginning of second grade, most students will read at a DRA Level 18. This student is currently reading at a DRA Level 3, and is considered an emergent reader. The school is currently implementing homogeneous reading grouping during a two hour reading block, from 8:30 am to 10:30 am. All of the students in the second grade at this school are grouped with their peers who are reading at the same level. Students may move from one group to another as their reading skills improve. During the two hour reading block, the teacher presents whole class and small group instruction. The teacher begins by presenting a whole group lesson on word families and decoding words. Then, the students work at different stations. The activities vary and include independent reading, word study, listening to books on tape, and completing puzzles. While students are working in stations, the teacher meets with small reading groups. Each group reads a short leveled story and focuses on a specific skill. The student in the study is currently in the lowest reading group. The students in this group read short stories from the Fountas and Pinnell Reading Series. After the teacher meets with each group, the teacher presents another whole class lesson. Each week the class reads and analyzes a different poem. Finally, the teacher presents a skill that describes what good readers do when they are reading. The skill is introduced, explained, and modeled by the teacher. The students are encouraged to practice the skills they learn during reading groups and independent reading. After the two hour reading block, all of the students return to their heterogeneously grouped homeroom classrooms.

Math instruction occurs during a one hour block in the afternoon. During math lessons, the students are heterogeneously grouped. The school is currently using the Investigations Math Program. This program encourages students to learn mathematics through hands-on, inquiry based activities. The program also encourages students to explain their thinking and find additional ways to solve problems. The class is currently working in the first unit of the second grade edition. This unit focuses on addition, subtraction, and working with numbers (TERC, 2008, p. 1). The Investigations Website provides an overview of the program's second grade curriculum. Many of the units in the second grade curriculum focus on the Number and Operations Mathematics Content Standard. According to the website, in the second grade

> Students transition to thinking and working with groups, explore the composition of numbers to 100, and develop an understanding of the base-10 structure of our number system. The bulk of the work focuses on or supports the development of fluency with the operations of addition and subtraction. By the end of the year, students are expected to be fluent with the addition combinations to 10 + 10; to add 2 two-digit numbers accurately and efficiently; and to subtract two-digit numbers accurately. (TERC, 2007, p. 2)

Although the Investigations second grade curriculum focuses on developing addition and subtraction skills, these skills are not taught through drill and practice. Students are expected to obtain fact fluency through classroom practice, games, fact flash cards, and homework activities. According to the website, "Facts are presented to students as an important tool, and fluency with them is considered part of the larger work of achieving computational fluency. The work with and practice of such facts takes place in the day-to-day teaching of the curriculum…" (TERC, 2007, p. 1). Above you have this as 2008??

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The student is currently struggling in several areas of mathematics. She has trouble counting numbers in succession. She also has difficulty writing the numbers from zero to twenty. She often skips or reverses numbers. The teacher has expressed that the student often puts her head down or closes her eyes during math lessons, which suggests that she is overwhelmed. When presented with a problem, the student is unable to determine what to do with the information and cannot begin the process of solving the problem. She requires high levels of teacher assistance and guidance to solve problems.

The student in the study has exhibited weaknesses in the areas of reading and math. Selecting one area of focus is difficult, as both of these areas are critical aspects of education. The student is currently receiving multiple intervention strategies during the two–hour reading block, while math is addressed during a one hour time slot each afternoon. It is important to remember that mathematics is "a multidimensional, cumulative process in which skills and concepts become increasing complex and abstract" (Spinelli, 2006, p. 348). The current mathematics curriculum does not focus on explicitly teaching and reinforcing the basic math facts. The student must learn to master the basic math facts in order to progress through the curriculum. As Spinelli states, "Skills learned during the earliest school years provide the foundation for mathematical conceptual development as well as the structure for subsequent higher level skill mastery" (2006, p. 348). For these reasons, this study will focus on mathematics as the area of targeted growth.

In order to help the student develop fact fluency and improve computation skills, she will be introduced to the Touch Math Program. The student struggles with counting, sequencing, and writing numbers. This program helps students understand that a symbol represents a quantity. Students practice counting in sequence and learn how to add using the count all and count on

strategies. They learn how to subtract by counting backwards. After time, it is expected that the student will be able to retain basic facts so that they can be introduced to more difficult addition and subtraction problems (Innovative Learning Concepts Inc., n.d.).

Through this intervention process, it is expected that the student will improve in the area of targeted growth. As a result of the study, the student should make gains in the areas of counting and computational skills. The student will master counting and writing the numbers from zero to twenty. The student will also learn how to use the touch point process to add and subtract numbers from zero to ten. Once these skills have been mastered, the student will begin practicing more advanced problems, such as adding 2 two-digit numbers without regrouping. It is hoped that the student will learn to generalize the strategy and use the strategy during regular math instruction, as well as retain the information once the intervention has ended.

The purpose of this study is to incorporate the Touch Math Program to supplement the current mathematics program. The objective is to answer the following questions: Can the Touch Math Program help students learn basic addition and subtraction facts? Does the Touch Math Program improve speed, accuracy, and math fact fluency? Your first section is just fine – you guide the reader to your student's problems and conclude with your research questions

## Literature Review

In 1989, the National Council of Teachers of Mathematics (NCTM) released a document entitled *Curriculum and Evaluation Standards for School Mathematics.* This document created a shift in the way educators viewed and taught mathematics. The document outlined the goals of a successful math program and encouraged educators to help students become confident in their mathematical abilities (Polloway, Patton, & Serna, 2008, p. 265). This important document is considered "…a benchmark event in school mathematics. No other document has ever had such

an enormous effect on school mathematics or on any other area of the curriculum" (Van De Walle, 2004, p. 2).

The NCTM released an updated version of the document in 2000. It is commonly referred to as "Standards 2000" (Polloway et al., 2008, p. 265). This document outlined content and process standards that should be included in the mathematics curriculum. Polloway et al. explained, "The Content Standards describe what knowledge and skills the students should learn, and the Process Standards highlight the ways of acquiring and using content knowledge" (2008, p. 265). The updated document describes six principles that should be incorporated into mathematics instruction. These principles address the needs of diverse students as well as students with disabilities and special needs. One underlying principle, the Equity Principle, encourages "high expectations and strong support for all students" (Polloway et al., 2008, p. 265). Educators are encouraged to create modifications and adaptations to meet the needs of all students. With the passage of the No Child Left Behind (NCLB) Act of 200l, schools are increasingly accountable for meeting the needs of all learners (Polloway et al., 2008, p. 265).

In 2006, NCTM published *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics: A Quest for Coherence.* This was created as "…an initial step toward providing a more coherent and focused curriculum (preK-8) and begins a collaborative dialogue regarding what students should know and be able to do in mathematics" (Polloway et al., 2008, p. 268). The document outlines a scope and sequence for teaching mathematics.

The state of Rhode Island has created Grade Level Expectations (GLEs) which help guide the curriculum and assessment. The GLEs represent both the content and process standards described by NCTM. One of the major content areas addressed in the primary grades is the

Number and Operations Content Standard. As stated in the Rhode Island Mathematics K-8 Grade Level Expectations,

> Numbers and operations remain a cornerstone for the study of mathematics in grades K – 12. Students use numbers to quantify sets, identify location, measure, quantify the probability of an event, analyze data, and describe and interpret real-world phenomena. Having students know basic facts and having students compute fluently (i.e., accurately and efficiently) continues to be an important goal in mathematics education. (2007, p. 3)

The Rhode Island GLEs outline the skills that second grade students should acquire. However, it is important to remember students use previously learned skills in order to master higher level skills. As it is the beginning of the school year, it is helpful to look at the skills that students should have acquired in first grade. According to the Math Content Standard M(N&O)–1–2, a student "Demonstrates understanding of the relative magnitude of numbers from 0 to 100 by ordering whole numbers; Demonstrates understanding of the relative magnitude of numbers from 0 to 100 by ordering whole numbers" (2007, p. 3). We look to the Math Content Standard M(N&O)-1-3 to see what computational skills students should obtain by the end of first grade. According to the standard a student "Demonstrates conceptual understanding of mathematical operations involving addition and subtraction of whole numbers (from 0 to 30) by solving problems involving joining actions, separating actions, part-part whole relationships, and comparison situations; and addition of multiple one-digit whole numbers" (2007, p. 4).

The student in this study is working to achieve the skills that most students would master by the end of first grade. The student has trouble counting and writing numbers above thirty. She also struggles to develop basic fact fluency. NCTM stresses the importance of high expectations for all students in mathematics and NCLB holds teacher accountable for meeting the needs of all

learners. As this student is currently performing below grade level, specific accommodations and modifications need to be made in order to help this student succeed and progress to more difficult mathematical skills.

The Touch Math Program was created by Janet Bullock and is a product of Innovative Learning Concepts Inc. The program associates the numbers zero to nine with touch points. These touch points help students make the connection between a symbol and numerical meaning (Innovative Learning Concepts Inc., n.d.). Duris stated, "It can also reinforce the counting skills that are taught on a concrete level (by using real objects) by advancing it to a semi-concrete level" (2002-2003, pp. 18-19). Once the student is able to identify each of the numbers and count using the touch points, the student can be taught various computation skills. As student ability increases, the touch points are faded away. It is expected that the student will continue to count touch points even after they have been faded away. The student is able to incorporate the technique on a daily basis (Duris, 2002-2003, p. 20).

The Touch Math Program is described as a multisensory program. Students look at the touch points, physically touch the points on numbers, and count out loud (Calik, 2010, p. 196). Duris described how the program can be helpful for a variety of students. She explained that the technique helps develop number identification and counting skills. The author also explained that the program includes a variety of resources so that the classroom teacher can make various accommodations with the program in order to meet the needs of individual students (2002-2003, pp. 18-19).

Various studies have been conducted to evaluate the effectiveness of the program when taught to elementary students with various disabilities. These studies usually involved a small

number of participants who varied in age and ability level. Much of the research focused on using Touch Math to improve addition computation skills.

A study by Wisniewski and Smith focused on evaluating the effectiveness of the program when teaching basic addition skills to students with special needs (2002). The participants in the study were third and fourth grade students with a mild intellectual disability, learning disability, or health impairment. All of the students had math goals on their IEPs and received special education resources (Wisniewski & Smith, 2002, p. 5). Student progress was monitored using Math Mad Minutes. The students completed a timed test in which they had one minute to solve as many addition problems as possible. Wisniewski and Smith concluded "the results of this action research study suggest that Touch Math was effective in improving students with disabilities academic achievement as measured by Mad Minute Tests. Furthermore, students with disabilities were able to complete their math facts in less time as the semester progressed" (2002, p. 3).

The previous study focused on teaching basic math facts to students. Research by Simon and Hanrahan (2004) involved evaluating the effectiveness of the Touch Math Program to teach more advanced math skills. This study focused on teaching three-row, double-digit addition problems. The participants in the study were three fifth grade students who were described as having learning disabilities in math and "functioning at least two to three grade levels below what would be expected according to their ages" (Simon & Hanrahan, 2004, p. 196). The study began by introducing the touch points to students. Then, the researchers followed the levels of addition problems that are outlined by the Touch Math Program. Once a student mastered one level, they were introduced to a more difficult type of problem (2004, pp. 197-198). Simon and

Hanrahan concluded, "Results indicate that the three subjects were able to learn and apply the dot-notation method successfully" (2004, p. 191).

The researchers also described some of the advantages of the program. They explained that this method uses strategies that are commonly used by children, such as the count all and count on strategies. The program also encourages children to commit facts to long term memory and helps them advance to more difficult levels of problem solving. They also stated that the method does not involve finger counting, so students can use the method without their peers noticing. The researchers also noted that the students used the method in other settings (Simon & Hanrahan, 2004, p. 194 & 205).

The study also provided some information about the difficulties that arose when using the method. The researchers explained that sometimes numbers are written in different ways. According to the researchers, this caused some confusion for students. They also explained that once the touch points were removed, some students had difficulty remembering where the touch points were located, and would add or omit touch points on larger numbers (Simon & Hanrahan, 2004, p. 206).

The first two studies focused on implementing the Touch Math Program with students in the upper elementary grades. A study conducted by Calik and Kargin measured the effectiveness of the Touch Math Program with younger students (2010). The participants in the study were three second grade students. The students in the study were described as having mild disabilities, and "all of the participants were seen to perform quite lower than the average in the classroom concerning issues, such as maintaining their attention for a long time, [and] carrying out the four mathematical operations and literacy skills" (Calik & Kargin, 2010, pp. 196-197). The researchers gathered baseline data and then implemented the intervention. During the

intervention, “Both the correct and incorrect reactions were recorded and collected, and the percentage of correct reactions was calculated” (2010, p. 199). Although students may have mastered a skill, it was reviewed again during maintenance sessions. After the intervention, the participants completed a post-test in order to evaluate whether students were able to incorporate the information into their everyday lives. After reviewing the data, the researchers stated

> Based on the findings of the research, the teaching provided in line with the Touch Math technique based on a direct teaching approach is found to be effective in teaching the basic addition skills to the students with mild intellectual disabilities in general education classrooms...All of the subjects were observed to generalize the skills they had learnt to different number combinations and different environments. (2010, p. 203)

As part of their research, Calik and Kargin also distributed surveys to teachers to determine the teachers’ views and attitudes regarding the Touch Math Program. After reviewing the data, they observed that the information “demonstrated that all teachers have positive views towards the Touch Math technique and express that they would use this technique in their classrooms” (2010, p. 1).

Cihak and Foust also completed a study that focused on teaching basic addition facts to younger elementary students (2008). However, this study focused on students with autism and other developmental disabilities. The participants were taught basic addition facts using two strategies, the Touch Math Program and The Number Line. The researchers compared the effectiveness of the two strategies when teaching students with autism. Both methods were introduced to students and then data was collected regarding the number of problems answered correctly using each technique (Cihak & Foust, 2008, pp. 132-133). After reviewing the data, the researchers concluded

> The touch-points strategy was used successfully to teach students with autism single-digit addition problem solving skills. The alternating-treatments design indicated that these students preferred touch points to number line for acquiring single-digit addition skills. The touch-points strategy was functionally more effective than the number-line strategy when the strategies were compared and replicated. (2008, p. 135)

In conclusion the researchers agreed that the Touch Math Program was an effective tool that helped students with autism acquire basic math skills. The research also showed that students preferred this method over other methods.

A majority of the research regarding the Touch Math Program focuses on the effectiveness of the program when teaching addition skills. One study conducted by Kristen S. Scott evaluated the effectiveness of the program in teaching addition and subtraction skills with various degrees of difficulty. The participants in the study were three fourth grade students with mild intellectual disabilities. Each participant worked to achieve different target skills, as they were performing at different ability levels (Scott, 1993, p. 101). The students were taught the touch points for the numbers as well as the recommended phrases that explain the steps for completing addition and subtraction problems (1993, p. 104). The students completed worksheets, which were used to collect data. Scott concluded that, "Results from all three subjects suggest that the Touch Math Program can be effective in teaching column addition, two-digit addition with regrouping, single-digit subtraction, single-digit subtraction with regrouping, and three-digit subtraction with regrouping" (1993, pp. 107 - 108). The results of this study show that the Touch Math Program can be used to teach basic problems, but also problems of varying difficulty.

The research regarding the Touch Math Program suggests that this program may be considered a reliable intervention that can be used to help students with and without disabilities become successful math students. The research also shows that the program can be used to help students in different grade levels, as well as different ability levels. Students enjoy the program and continue to use the process in everyday settings. The program can be used as an accommodation to help ensure that all students recognize their potential. It gives students the opportunity to be successful and instills an appreciation for mathematics.

After reviewing the research, the Touch Math Program appears to be an appropriate intervention to use with the student. The program addresses the student's main areas of difficulty, including counting and writing numbers and increasing fact fluency. Scott stated, "…because students with mild disabilities also demonstrate problems with basic math fact proficiency, the Touch Math program may be beneficial for these students. This program does not require students to have math facts memorized, but rather it seeks to facilitate the acquisition of these facts" (1993, p. 99). The purpose of the study is to incorporate the Touch Math Program to supplement the current mathematics program. The research hypotheses are as follows: The Touch Math Program will help the student learn basic addition and subtraction facts, and improve speed, accuracy, and math fact fluency.

A really great job on the literature review – you used multiple sources, integrated the findings and provided strong rationale for using this method for your student. I really like how you started with the big picture of NCTM and discuss the importance of math and then funnel down to talk about the research on this specific method

Data Sources

In order to learn more about the community where the study will take place, data was collected by reviewing information on Information Works! The teacher also provided some background information about the school district. Data collected in the 2007-2008 school year describes the school's population as 76% Hispanic, 14% African American, and 10% White. According to the data collected, 27% of students receive ESL/Bilingual educational services. All of the posters in the school are printed in both English and Spanish. Notices sent home are also printed in both languages. According to the data, 84% of students are eligible for free or reduced lunches. The teacher explained that the school also offers a breakfast program and the children are offered a midmorning snack. The teacher explained that some children are missing out on educational opportunities, because the do not come to school every day. The teacher shared that some students miss school so frequently that the school must inform the truancy officer (InformationWorks! Using Information, 2007-2008).

Before implementing the Touch Math intervention, it was important to obtain data and information regarding the student's current level of performance. Data was collected through various informal measures. The student was observed during a typical mathematics lesson. The student's actions and responses were carefully recorded. The student was also assessed on early numeracy skills, such as number identification, number sequencing, and quantity discrimination. The student also completed two computation probes. In order to learn about the student's disposition towards math, the student completed a math attitude survey. Finally, discussions with the classroom teacher provided a rich background of information regarding the student's abilities as well as the resources available in the school.

The student in the study was observed during a math lesson. The teacher began by presenting a whole group lesson on story problems. The teacher asked the students to use the turn and talk strategy to discuss what they thought a story problem was about. The student in the study did not speak at all during the turn and talk time. She simply listened as her partner talked. Then, the teacher wrote a story problem on the board. She read the problem aloud and asked simple comprehension questions, regarding the setting of the problem and the characters in the story. The student raised her hand to answer these questions, which suggests that she had some basic comprehension of the story problem that had been read aloud. However, as the teacher asked for ways to solve the problem, the student did not raise her hand to participate. She often had her head down and needed to be reminded by the teacher to pay attention. The teacher modeled several ways to solve the problem, including drawing pictures, using the count all strategy, the count on strategy, tally marks, and the number line.

Next, the children had the opportunity to practice on their own. The teacher read the story problem aloud, and once again asked some basic comprehension questions. Then, the students were asked to solve the problem independently and show their work. The student was unable to begin the work on her own. She needed teacher guidance in setting up the problem and drawing tally marks. The teacher encouraged her to write the larger number and then draw tally marks for the smaller number. Once prompted on how to solve the problem, the student was able to use the count on strategy to solve the problem.

After observing the student and speaking with the classroom teacher, it was evident that the student was having difficulty with basic computation skills. In order to assess the student's basic mathematical abilities, the student was administered three early math fluency probes. These probes are usually administered to students in kindergarten and first grade. The first early

numeracy probe, number identification consisted of lists of the numbers from zero to nine. During the one--minute session, the student was able to correctly identify 49 numbers with one error. Next, the student was asked to complete the missing numbers probe. The student was asked to look at a series of numbers and fill in the missing number. The student attempted 8 series. She correctly completed 2 series. The student was able to say the sequence correctly, but did not write the correct number in the empty space. She often confused the numbers 2 and 6, and she reversed the number 4. The last early numeracy probe was quantity discrimination. The student was asked to look at pairs of numbers and identify the larger number in the two pairs. The student correctly answered 11 questions with 1 error.

The data suggests that the student is able to identify the numbers zero through nine. She is also able to identify the larger number in a pair of numbers. However, she struggles to identify the missing number in a sequence of numbers

After assessing early numeracy skills, the student was administered two computational probes. The first probe was an addition probe using the numbers 0-10. The student attempted 3 problems and correctly answered 2 problems in the two minute time period. The score was based on the number of correctly written digits per minute. On this probe, the student wrote 3 correct digits, which yields a score of 1.5 correct digits per minute. She tried using her fingers to count, but it was clear that the student struggled to complete the task and felt overwhelmed. The second probe was a subtraction probe using the numbers 0-10. The student attempted all of the problems in the two minute time period. She answered one problem correctly and identified 2 digits in two minutes, which yields a score of 1 correct digit per minute. On this probe, the student tried to add some numbers and randomly guessed.

On the addition and subtraction probes, the student's average score was 1.25 digits per minute. These scores indicate that the student was struggling with the basic computation facts. Spinelli described researched norm computation scores. At the second grade level, students who are working at the instructional level should correctly identify 10-19 digits in one minute. A student who correctly identifies 0-9 digits in one minute is working at the frustrational level (2006, p. 369). As the student is only able to correctly identify an average of 1.25 digits per minute, this suggests that the student is performing below grade level. Great information here and I like that you compared her scores to the norms

Next, the student was asked to count and write the numbers starting at zero. The student was instructed to count out loud and write as many numbers as she could. Upon reviewing the sample, the student struggled to recall numbers in sequence, reversed the number 4, and struggled to count and write numbers above 30.

In order to gather information about the student's disposition towards math, the student was asked to complete an attitude survey. I love that you got her input! The survey consisted of several statements about the math program, manipulatives used in the classroom, and basic computational skills. If the statement expressed something that the student enjoyed about math, she was asked to color in a smiling face. If the statement expressed something that the student did not enjoy about math, she was asked to color in a sad face. The directions were explained and all of the statements were read aloud to the student. The student responded that she liked everything about math. She stated that she liked to use her fingers and manipulatives to count. She expressed interest in working with calculators. She even shared that she feels comfortable asking her teacher for help if she is confused. Although she stated that she liked math, when asked what she liked best about school, she explained that she liked art because she enjoyed

coloring. This suggests that the student may not have been responding truthfully. As Salkind explains, "the interviewee might respond with a bias because he or she may not want to give anything other than the socially acceptable response" (2009, p. 199). Good analysis of her comments about math and using our text as a source to support your thoughts

Important information was also shared through informal conversations with the classroom teacher. The teacher expressed concern that the student's performance was below grade level standards. Upon suggestion of the Touch Math Program, the teacher agreed that this program would be a useful intervention for the student. The teacher also explained that the resources were readily available, as the school has Touch Math Program materials. Therefore, the teacher could introduce the entire class to the program or continue individual instruction with the student after the intervention has ended.

Important factors to consider when implementing the Touch Math intervention include when, where, and how often the intervention will occur, as well as how long the intervention will last. After speaking with the classroom teacher, it was decided that the intervention would occur two days a week. The teacher suggested the time slot from 10:30 am to 11:00 am. During this time, the teacher presents an enrichment vocabulary lesson. The student would not miss any of the basic instruction of the day. There are many students who are pulled out of the classroom for different services during this time, so the student would not be singled out. The intervention would be held at the testing table which is available in the hallway directly outside of the classroom. Well done – you use many varied sources of data and account for many factors

Constituent Input

This research study presents minimal risks to the student. The project aims to benefit the student by introducing an intervention program in an attempt to help the student improve basic

computational skills. The intervention will occur during a vocabulary enrichment block, so the student will not miss any new academic information. The teacher has explained that many students leave the room for different interventions during this time period. This ensures that the participant will not be singled out. Should the participant not want to participant in a session on a given day, the session will be cancelled.

The student has expressed an interest in math and learning a new way to solve problems. The participant has also explained that she enjoys coloring and art. In an effort to keep the student engaged and motivated, these elements will be included in the intervention as much as possible. The student will have the opportunity to create and color her own touch point number models, rather than relying on the materials available in the kit. The program also offers many practice activities that give students the opportunity to color in a picture. These materials will also be used during the intervention.

Learning Expectations

As a result of this study, I hope to learn more about the process of obtaining mathematical fact fluency. Most research studies focus on using Touch Math to teach basic addition and subtraction skills. I am interested in learning how effective the strategy can be when teaching subtraction skills to students.

Research by Simon and Hanrahan included information about how the participants often chose this method over other methods to solve problems, "…once they had mastered the dot-notation system, the subjects consistently chose this system over other available methods such as finger or tally counting," (2004, p. 204). I am interested in learning whether the student will use the strategy during her regular math instruction or if she will share the technique with other students.

Simon and Hanrahan also described difficulties students experienced during the intervention, "Because these subjects did not draw the numbers 6 and 9 in the same way as these numbers were presented during instruction, they had some difficulty applying the Touch Math pattern of dots to their own handwritten numerals" (2004, p. 206). During initial assessments, the student often confused the numbers two and six. She also reversed the number four. I am interested in learning whether or not this will limit the student's ability to use the program effectively.

## Phase II: Develop a Plan of Action

### Action Plan

Research by Carpenter and Moser (1984) described the various strategies and levels of mathematical development displayed by children when acquiring computation facts. The researchers described three different strategy levels that children use to solve addition and subtraction problems (Carpenter & Moser, 1984, p. 180).

At the first level of addition problem solving, direct modeling, children often use concrete objects or pictures. At this stage of problem solving, the student will "use a count-all strategy that consists of counting, with the use of fingers or other objects, each addend in an addition problem starting at 1 until all numbers have been counted" (Simon & Hanrahan, 2004, p. 192).

Once the student has mastered this skill, they begin using the strategies that employ the use of counting sequences. This stage begins with the counting-on-from-first strategy. At this stage, the student will say the first addend and then count on until they reach the sum (Carpenter & Moser, 1984, p. 181). Students will soon recognize that it is more efficient to begin with the

larger addend and count on until they reach the sum. Carpenter and Moser describe this strategy as the "counting-on-from-larger strategy" (1984, p. 181).

The final addition strategy described by Carpenter and Moser is based on fact fluency and recalling number facts, "the final stage of addition learning…involves storing and later retrieving addition facts from long-term memory. With repeated practice and reinforcement, children memorize basic addition facts and retrieve them from memory when needed" (Simon & Hanrahan, 2004, p. 192). Once certain facts are committed to memory, students can use this information to help them solve more difficult problems.

Carpenter and Moser also described the basic strategies students use to solve subtraction problems. These strategies are related to those used to solve addition problems (1984, p. 182). Students begin at the concrete level and use manipulatives to solve subtraction problems. Once this skill has been mastered, the student begins to use counting strategies to solve problems. With time, the student memorizes certain subtraction facts (Carpenter & Moser, 1984, 182).

The researchers described three direct modeling strategies; separating from, adding on, and matching (Carpenter and Moser, 1984, p. 182). With the separating from strategy, the student begins with a number of objects, and then takes away a certain number. The student then counts the number of remaining objects. The adding on strategy involves starting with a certain number and then adding on until a desired number is reached. The number added on represents the solution. This strategy emphasizes the relationship between addition and subtraction. Finally, the matching strategy involves matching objects from one set to the objects in another set. This continues until all matches are made. The objects remaining represent the difference between the two sets (Carpenter & Moser, 1984, p. 182).

With practice, students move from concrete models to abstract strategies. The subtraction counting strategies include, counting down from and counting up from a given number. The counting down from strategy involves starting with the larger number and then counting backwards. With the counting up from a given number strategy, the student starts with the smaller number and then counts up to the larger number (Carpenter & Moser, 1984, p.182).

As with addition, the final subtraction strategy involves memorizing subtraction facts and using these facts to help them solve more difficult problems.

The Touch Math Program provides a sequence for presenting ideas and concepts. This sequence aligns with the research presented by Carpenter and Moser. The program begins by introducing students to the numbers and their touch points. The touch points provide a concrete representation of the numbers. Once students are familiar with the touch points, they begin adding single digit numbers. Simon and Hanrahan explain, "Children are taught to begin with the first number, count all the dots on that number and then continue counting the dots on the second number until all the dots have been counted" (2004, p. 294).

Miller and Mercer stated,

> The Touch Math approach appears to teach addition according to the same strategies that children naturally develop to solve addition problems. The system offers a method for teaching addition that involves count-all and count-on strategies but does not require the retrieval of stored facts from memory, an area of difficulty form many learning-disabled students. (as cited by Simon & Hanrahan, 2004, p. 194)

In order to determine whether or not the Touch Math Program is an effective method that will help this particular student in the targeted area of growth the researcher will implement a single-subject research design. Salkind stated that this experimental method is "…useful in

almost any setting in which the researcher wants to know the effects of manipulating an independent variable on the behavior of one individual" (2009, p. 244). This design includes establishing a baseline and then implementing an intervention, where the independent variable is the Touch Math Program and the dependent variable is the number of digits the student can correctly write during a timed computation probe.

The intervention will be conducted over the course of five weeks. After speaking with the classroom teacher, it was decided that the intervention would occur two days a week for a half an hour each day. Due to time limitations, the intervention will focus on basic addition and subtraction skills. The intervention will be individualized instruction and will be held at the testing table which is available in the hallway directly outside of the classroom.

The intervention plan is modeled after previous research methods by Simon and ~~Hanrahan (~~Hanrahan (2004) and Scott (1993). These studies described a teaching phase in which the students were introduced to the touch points, followed by an intervention phase in which students implemented the technique to solve computation problems (Simon & Hanrahan 2004; Scott 1993). During the first week, the student will be introduced to the touch points for each numeral. Simon and Hanrahan described the procedure,

> First, the subjects were instructed to copy the experimenter while she touched and counted the dots on each of the nine numbers in the correct pattern. Second, the subjects were instructed to draw the dots on a set of numbers provided according to the instructed pattern. Finally, they were asked to write the numbers 1 to 9 by themselves and then to draw the dots correctly on each number. (2004, p. 197)

Once the student has been introduced to the touch points, the second phase of the intervention will be implemented. During this phase, the student will learn how to use the touch

points to solve basic computation problems. Each week, the student will be introduced to a different type of problem. The intervention will begin with the simplest type of addition problem, adding two one--digit numbers using the count all strategy. The student will be instructed to add the two numbers by counting all of the dots on both numbers. During the second week the student will be introduced to the count on strategy, where the touch points are removed from the larger digit. The student must identify the larger digit and then count on using the points on the smaller digit. During the third week of the intervention, the student will learn to use the touch points to solve basic subtraction facts. The student will learn to start with the larger number and then count backwards using the touch points on the smaller number. During the final week of intervention, the student will practice adding double--digit numbers, without regrouping, using the count on strategy.

When the student is introduced to a new skill, the teacher will explain and model how to use the touch points appropriately to complete the computation problem. Then, the student will have the opportunity to practice several different computation problems with teacher assistance. The teacher will provide verbal feedback including praise and corrective feedback. At the end of the session, the student will complete a two--minute curriculum based measurement (CBM) probe. The probe will consist of twenty problems that represent the strategy that was modeled and practiced that day. The probes will be created using a random worksheet generator from the Math Worksheet Site. After the student completes the probe, the correct number of digits will be counted and divided by two to calculate the correct number of digits per minute. Data will be collected twice a week during the four weeks of intervention. A final probe consisting of twenty problems representing all the strategies will be given after the intervention period.

Baseline CBM probes indicate that the student can correctly identify an average of 1.25 digits per minute when presented with basic addition and subtraction problems. At the second grade level, students who are working at an instructional level should correctly identify 10-19 digits in one minute (Spinelli, 2006, p.369). Research by Fuchs & Fuchs (1993) described math computation improvement norms. The research stated that

> A weekly increase of .30 digits seems to represent a realistic CBM weekly rate of improvement for Grades 1, 2, and 3…CBM practitioners may employ the following targets for establishing more ambitious weekly rates of growth for their students: at Grades 1, 2, and 3, .50." (Fuchs & Fuchs, 1993)

In an effort to increase student performance and place the student at an instructional level of basic addition and subtraction computation, an ambitious goal was selected. A final goal of 10 correct digits per minute was established for the student.

Important Factors

The action plan that has been described takes many factors into consideration. The plan was developed with input from the classroom teacher and is based on the needs of the student. The classroom teacher suggested a specific time to complete interventions to ensure that the student would not miss important classroom instruction. The intervention will occur outside of the classroom to minimize classroom distractions. Another important factor is that the program is available in the school. This means that the teacher can continue to use the program if the intervention is successful.

The Touch Math Program was selected for a variety of reasons. The program addresses the student's main areas of difficulty, including counting and writing numbers and increasing fact fluency. It is also a multisensory program that will help maintain student motivation. During

an observation of a math lesson, the student implemented the count up strategy to solve a story problem. This suggests that she has some background knowledge of the process.

The Touch Math Program also aligns with current research regarding the process of learning addition and subtraction. The program follows the strategies and steps that are outlined by Carpenter and Moser in their description of the acquisition of computation skills.

The action plan also aligns with previous research in implementing the Touch Math Program. Previous studies employed a teaching phase to introduce the touch points, and an intervention phase to teach using the touch points to solve problems. Finally, the assessment plan is based on researched norms for math CBM probes.

It is important to consider the limitations of the outlined action plan. First, the action plan is a single subject design with baseline and intervention data. Due to time constraints it will not be possible to assess the student to see if they have maintained the information. This design also limits the generalizabilty of the study.

It is also important to remember that the schedule is based on the classroom teacher's suggestions. The intervention sessions are short, therefore only certain topics may be addressed. The intervention will occur outside of the classroom at a testing table in the hallway. There may be some unexpected factors, such as noise and interruptions. It is also important to consider that there may be changes to the school schedule. In November, there are a number of days when school is closed. A student's schedule may change due to assemblies or a change in resource scheduling.

Finally, it is important to consider possible temporary student factors. The intervention will occur after snack, but before recess. The student may not be hungry, but she may be excited

about recess. Other factors to consider include the student's health and motivational level. These factors may influence the student's disposition towards the intervention.

Demonstrated Understanding

The purpose of the intervention is to incorporate the Touch Math Program to supplement the current mathematics program. As a result of the study, it is expected that the student will learn basic addition and subtraction facts. The intervention should also improve speed and accuracy of computation, as well math fact fluency. The goal for the student is to increase the correct number of digits in computation problems from an average of 1.25 per minute to 10 correct digits per minute. This goal aligns with the expectations of the intervention. As the student learns basic addition and subtraction facts, her speed and accuracy will improve and the student will develop math fact fluency that can be transferred to different settings.

The intervention aligns with the Rhode Island Math Grade-Level Expectations. One of the major content areas addressed in the primary grades is the Number and Operations Content Standard. As stated in the Rhode Island Mathematics K-8 Grade Level Expectations,

> Students cannot appreciate the power of numbers unless they also understand the operations upon those numbers. Students need to recognize which operation to apply to a given problem situation they encounter. They need to know what effect the various operations will have on different types of numbers. They need to know the relationships among the operations and among the operations and their properties. A deep understanding of the operations and their properties will help students make sense of computation algorithms and lead to fluency in computation. (2007, p. 3)

The Rhode Island Math GLEs emphasize the importance of improving computation skills and developing math fact fluency.

During the intervention, the student will practice adding and subtracting skills. The student will use touch points to employ the count all, count on, and count backwards strategies. These strategies align with the second grade math GLEs. According to the content standard M(N&O)–2–3, by the end of second grade, the student "Demonstrates conceptual understanding of mathematical operations involving addition and subtraction of whole numbers by solving problems involving joining actions, separating actions, part-part whole relationships, and comparison situations; and addition of multiple one-digit whole numbers" (2007, p. 4).

The Touch Math Program is a multisensory program. The student can see the points, touch the points, and count the points. According to the Math Communication, Connections, and Representations Standard, "Reading, writing, talking, listening, and modeling provide students with the opportunity to develop deeper mathematical understanding and to integrate the language of mathematics into their world. Actively exploring, investigating, describing, and explaining mathematical ideas promote communication which leads to a greater comprehension of mathematical concepts" (2007, p. 31). The Touch Math Program also provides the student with opportunities to actively solve computation problems. This aligns with the Content Standard M(CCR)–2–1. According to this standard, "Students will communicate their understanding of mathematics and be able to: Draw pictures and use objects to illustrate mathematical concepts" (2007, p. 31).

Valid and Reliable Measures

Data will be collected during each intervention session. At the end of the session, the student will complete a two minute CBM probe without teacher assistance. The probe will consist of twenty problems that represent the strategy that was modeled and practiced that day. The probes will be created using a random worksheet generator from the Math Worksheet Site.

The probes will contain the appropriate touch points for the skill that is being addressed. Data will be collected twice a week during the four weeks of intervention. A final probe of twenty problems that represent all of the strategies will be given after the intervention period to represent post intervention data.

The student will be given the probe and the researcher will read the standard set of directions recommended by Aimsweb Training Workbook (Shinn, 2005). The researcher will say begin and start the timer. The student will work independently for two minutes. At the end of the two minute period, the researcher will say stop and collect the probe.

After the student completes the probe, the correct number of digits will be counted and divided by two to calculate the correct number of digits per minute. The student's accuracy level will also be calculated. The accuracy level will be obtained by dividing the number of correct answers by the number of problems attempted. Finally, the researcher will also complete an error analysis to determine what errors the student made as well as the cause for these errors.

The data will be collected during each session and during a final review session. The baseline data, eight -intervention data points, and post intervention data will be graphed to show student progress. The student's accuracy levels will also be charted and graphed.

The researcher will also collect anecdotal information regarding the activities completed, changes to planned activities, student performance and level of participation during each session of the intervention. Although data will be collected from multiple sources, the researcher will be the only one collecting observational and anecdotal data. This ~~limits~~ lack of interobserver reliability~~, which~~ limits the reliability and generalization of the results.

Constituent Input

Throughout the intervention, the researcher will use professional judgment regarding the procedure and sequence of the plan. According to the plan, the student will be introduced to a new concept each week. However, if the student completes a probe with less than 70% accuracy, then the teacher will review the topic and provide extra opportunities for practice. If needed, different materials, such as flashcards and games, may be introduced to supplement the Touch Math program and help to reinforce a concept.

Specific accommodations will be made to ensure that the student is successful. The student is currently reading below grade level. Therefore, all written directions will be read aloud. As observed during a classroom lesson, the student can become overwhelmed when presented with math problems. When presenting a new topic, the researcher will limit the number of problems on a page and include graphics to limit anxiety. It is also important to ensure that when digits are written, they are large enough to include the touch points. The touch points must be clearly presented in order for the student to use them accurately. Therefore, some materials may be rewritten by the teacher to make sure that the touch points are clearly visible.

~~I~~Throughout the pre-intervention data collection, the student often looked to the teacher for approval. In~~n~~ an effort to keep the student ~~engaged and~~ motivated, the researcher will provide verbal feedback, including praise and corrective feedback, during instructional sessions. It has been observed that the classroom teacher is currently employing the repeated reading method in order to increase fluency. After the students read a passage, they graph the number of words they read correctly. Each reading they try to improve their previous score. This strategy has been successful in the classroom and has proved to be a motivating factor for the student. To increase motivation, tresearcher will keep the student informed of her progress. Each week, the

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researcher will show the student a graph of her progress. -It is hoped that this will help build confidence as well as help the student develop a positive disposition towards mathematics. Thank you for adding this extra constituent content

## Phase III: Implement Plan of Action

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### Action Plan Fidelity

The implemented intervention followed a single-subject research design. This design includes establishing a baseline, implementing an intervention, and then collecting post intervention data. The post intervention data is then compared to the baseline data to see if the intervention had an effect on the student's behavior. In this intervention, the independent variable is the Touch Math Program and the dependent variable is the number of digits the student can correctly write during a timed computation probe. Great job using the research terms

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The implemented action plan followed the intended plan. However some changes were made in order to meet the needs of the learner. As planned, the intervention was implemented two days a week for a half an hour each day. As suggested by the research, the action plan included a one week teaching phase followed by a four week intervention phase.

During the teaching phase, the student was introduced to the touch points. The teacher followed the model suggested by research. The teacher modeled how to touch the points while counting out loud. The student practiced counting using the touch points. Then, she practiced writing the numbers with the appropriate touch points. She had the opportunity to create her own set of touch point number cards. Finally, the student practiced writing the numbers in sequence with the appropriate touch points.

After the one week teaching phase, the student was able to accurately draw and count the touch points on the numbers from zero to nine. At this point, the four week intervention phase began. The action plan outlined the scope and sequence of the content to be taught during the intervention. According to the original plan, the intervention would begin with the simplest type of addition problem, adding two one digit numbers using the count all strategy. During the second week the student would be introduced to the count on strategy, where the touch points are removed from the larger digit. The student would identify the larger digit and then count on using the points on the smaller digit. During the third week of the intervention, the student would learn to use the touch points to solve basic subtraction facts. The student would learn to start with the larger number and then count backwards using the touch points on the smaller number. During the final week of intervention, the student would practice adding double-digit numbers, without regrouping, using the count on strategy.

As planned, the actual intervention began with instruction in addition using the count all method. The student was very successful and showed great improvement in the number of correct digits per minute during the first two intervention probes.

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During the second week of the intervention, the student was introduced to the count on method. The teacher introduced a card game, in which the student had to select two number cards from a pile and then determine which number was bigger. This activity was included to ensure that the student could discriminate between quantities as this skill would be needed to implement the count on strategy. During this activity, the teacher observed that at times, the student struggled to identify the larger number. She had some trouble when the two numbers were close to each other (14 and 15). She often had to start at the number 1 and count up.

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After the quantity discrimination activity, the teacher modeled how to identify the larger number in the problem, circle the number, say the number and count up using the touch points on the smaller number. The student was able to correctly identify the larger number in each problem, but she had trouble counting on from the larger number. She reverted to counting all touch points. She could not start at a specific number and count up in sequence. When the student was given the probe and instructed to use the count on strategy, she began by circling the bigger number in every problem. She was able to correctly identify the larger number in each problem. However, she struggled to count on and she counted out of sequence. At times, the student started counting backwards. She also began counting on her fingers. It was clear that she was overwhelmed by the task, as she was only able to correctly identify 3 digits per minute with 25% accuracy.

At this point, it became evident that it was necessary to change the original scope and sequence of the action plan. In order for the student to progress from the count all to the count on method, it was imperative that she be able to count in sequence when starting at a number other than one. For this reason, the teacher decided to change the original action plan. Excellent – you used the data to make a decision about your plan

Using professional judgment, the teacher stopped touch point instruction, as it was not beneficial in teaching the student sequencing skills. The teacher decided to implement a new technique. During the next two sessions, the teacher provided multiple opportunities for student practice. New materials were incorporated to help the student count in sequence from one to twenty. The student practiced counting on a number line, as well filling in missing numbers on a number line. The student also completed dot-to-dot activities and mazes to reinforce counting in sequence. The student had the opportunity to work with one of her peers. There is another

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student in the class that is also learning Touch Math. They wanted to work together to solve problems. Each student had a sheet of paper. I gave them a problem, they wrote it down, and tried to solve it. The student was able to find the correct answer, but she was still counting all touch points. I asked the other student to explain how he solved the problem. He was using the count on method. He was able to explain how he only drew touch points on the smaller number and then counted on. The student really enjoyed working with her peer, as she was able to see how another student solved problems.

After two sessions of sequencing review, the student completed two timed probes. The first probe was a one--minute Quantity Discrimination probe. The second probe was a one minute Missing Number probe. These probes were administered to confirm student acquisition of sequencing skills before continuing with Touch Math instruction. The data collected from these probes was not included in the data charts, as they are not computation probes. After the student showed progress on the Quantity Discrimination and Missing Number probes, the teacher returned to the sequence outlined in the original action plan. Good explanation here of this extra assessment you did

During the sixth intervention session, we reviewed how to add using the count on strategy. In the first activity, the student was presented with a picture of ten stars, which were grouped in a box. Then, there were single stars outside of the box. The student counted the stars in the box to make sure there were ten. Then the teacher modeled how to count on from ten. The student counted all of the stars to make sure that we got the same answer. After working with pictures the student practiced the count on strategy using numbers. She was given problems where only the smaller digit had touch points. She was reminded to say the bigger number and then count on using the touch points on the smaller number. With some prompting she was able

to successfully complete the task. The student practiced various examples and then completed another computation probe, which focused on the count on method. The student was able to correctly write 13 digits per minute with 94% accuracy.

In order to reinforce the count on strategy, the next session reviewed the technique and allowed the student to practice counting on in sequence. Once again, the student was able to quickly solve the problems using the count on strategy. She completed all twenty problems with 100% accuracy.

As the student had shown success using the count on strategy, the teacher implemented the next step in the action plan. During the final session, the student was introduced to subtraction by counting back using the touch points. The subtraction sign was colored in red to draw the student's attention to the fact that we were solving subtraction problems, so we must count backwards. On the final prompt, the student correctly wrote 5.5 digits per minute with 100% accuracy.

In order to collect post intervention data, the student completed one final computation probe. The probe was a two minute timed probe, which consisted of a combination of addition and subtraction problems. Once again, the subtraction signs were colored in red to prompt the student to count backwards.

Although the researcher attempted to follow the original action plan, some changes were necessary in order to meet the needs of the student. The original procedure outlined a scope and sequence for presenting content. This was modified when it became evident that the student was still struggling to count in sequence. Sequencing instruction and an extra session practicing the count on method meant that we were not able to complete two sessions practicing subtraction

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using touch points. The intervention did not address the area of adding two 2--digit numbers using the count on strategy.

The implemented action plan followed the assessment methods of the original action plan. At the end of each computation instruction session, the student completed a two--minute curriculum based measurement (CBM) probe. Each probe consisted of twenty problems that represented the strategy that was modeled and practiced that day. The probes were created using a random worksheet generator from the Math Worksheet Site. After the student completed the probe, the correct number of digits was counted and divided by two to calculate the correct number of digits per minute. The student's accuracy level was also calculated. The accuracy level was obtained by dividing the number of correct answers by the number of problems attempted. An error analysis was completed after each probe to determine what errors the student made as well as the cause for these errors. The researcher also collected anecdotal information regarding the activities completed, changes to planned activities, student performance and level of participation during each session of the intervention.

With a change in the procedure, came a change in the methods and materials used. The touch point method was used to teach computational techniques. However, as the student was not acquiring the skills to count in sequence using the touch points, the teacher introduced different techniques to reinforce the skill. A terrific decision of what you did, the changes you made and the rational behind them

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Implemented with Respect to Constituent Input

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As previously mentioned, the original action plan was modified in order to meet the needs of the student. The teacher provided additional methods and materials in order to ensure student success. Games and activities were selected to help the student acquire skills and help her

see the importance of learning the concept. These activities also helped to keep the student motivated. She enjoyed the number line activities in which the number line was drawn as a fence and she had to move the cat from one post to the next. She also liked completing the dot-to-dot activities and would try to guess the picture. Although the original plan focused on individualized instruction, the student had the opportunity to work with another student. This gave her the opportunity to explain her thinking process, as well as learn from another student.

In order to meet the needs of the student, the teacher provided various accommodations. The student was given multiple opportunities to practice new skills and review. The teacher also confirmed student understanding of a concept before presenting a new concept. Written directions were read aloud. When introducing a new topic, the teacher limited the number of problems on a page. When the student was introduced to subtraction using touch points, the teacher colored the subtraction sign red. This was done to focus the student's attention on the type of problem and served as a visual reminder that she must count backwards to subtract. The teacher also adapted some materials used for instruction to ensure that when digits were written, they were large enough to include the appropriate touch points. The touch points must be clearly presented in order for the student to use them accurately. For example, although the computation problems for the probes were randomly generated, the teacher rewrote them adding the appropriate touch points.

The student often looked to the teacher for confirmation and approval. In an effort to keep the student motivated, the researcher provided verbal feedback, including praise and corrective feedback, during instructional sessions. The teacher considered sharing the graph of the student's progress as encouragement. However, during one session the student was particularly proud of her work and asked if she could take her papers home. Up to this point, the

researcher had been collecting all of the student's work samples. She selected the piece that she felt was her best work and was excited to share it with her family. The student also wanted to share her work with the classroom teacher. From that point on, we ended the sessions a few minutes early so that the student would have the opportunity to show her teacher all of the work she had done. This provided the student with additional positive reinforcement and encouraged the student to feel proud about her accomplishments. I really like this part about sharing the work at home

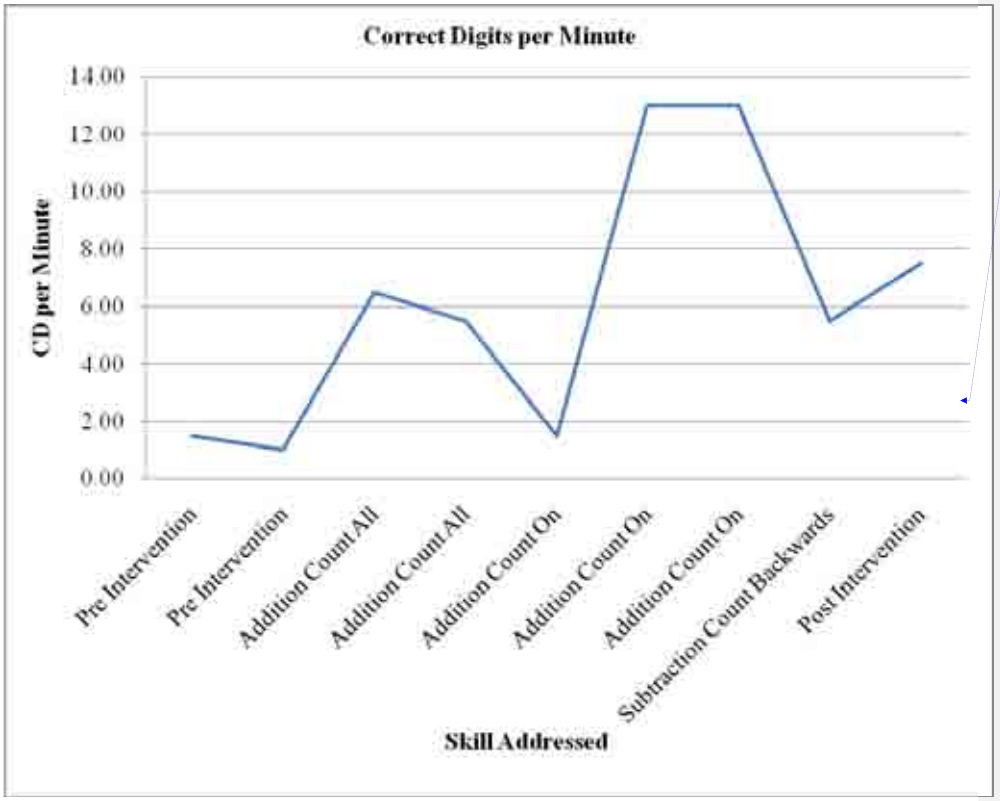
Data Collected

Chart 1: Correct Digits per Minute

| **Intervention Session** | **Skill Addressed** | | **Probe Number** | **Correct Number of Digits in 2 Minutes** | **Correct Number of Digits per Minute** |
|---|---|---|---|---|---|
| 1 | Addition Count All | Given Touch Points | 1 | 13 | 6.5 |
| 2 | Addition Count All | Student Draws Touch Points | 2 | 11 | 5.5 |
| 3 | Addition Count On | Student Draws Touch Points | 3 | 3 | 1.5 |
| 4 | No Probe | Sequencing Review | - | - | - |

| | | | | | |
|---|---|---|---|---|---|
| 5 | No Probe | Sequencing Review | - | - | - |
| 6 | Addition Count On | Touch Points on Smaller Number | 4 | 26 | 13 |
| 7 | Addition Count On | Touch Points on Smaller Number | 5 | 26 | 13 |
| 8 | Subtraction Count Back From Larger Number | Touch Points on Smaller Number<br>Subtraction Sign Colored | 6 | 11 | 5.5 |
| Post Intervention | Addition & Subtraction | Touch Points on Smaller Number<br>Subtraction Sign Colored | - | 15 | 7.5 |

Figure 1: Correct Digits per Minute

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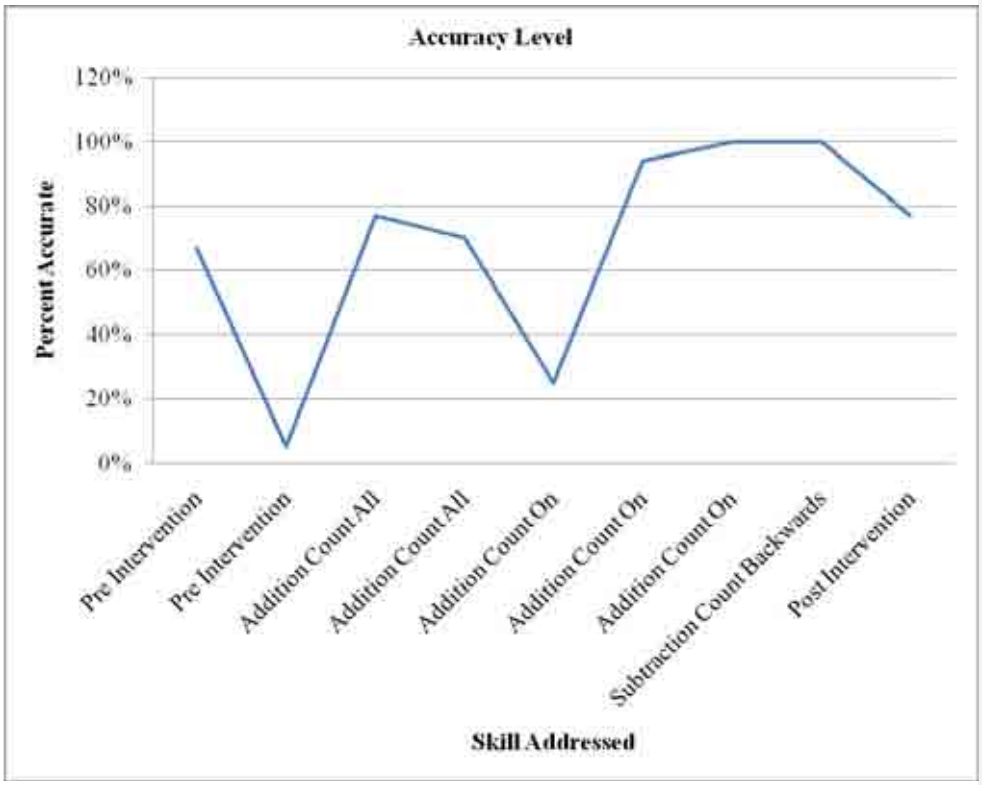
only thing to add in both charts would be a phase line between the baseline and intervention phases

Chart 2: Student Accuracy

| Intervention Session | Skill Addressed | | Probe Number | Number of Problems | Number of Problems Attempted | Percent Accurate |
|---|---|---|---|---|---|---|
| 1 | Addition Count All | Given Touch Points | 1 | 10 | 13 | 77% |
| 2 | Addition Count All | Student Draws Touch Points | 2 | 7 | 10 | 70% |
| 3 | Addition Count On | Given Touch Points | 3 | 3 | 12 | 25% |
| 4 | No Probe | Sequencing Review | - | - | - | - |
| 5 | No Probe | Sequencing Review | - | - | - | - |
| 6 | Addition Count On | Touch Points on Smaller Number | 4 | 16 | 17 | 94% |
| 7 | Addition Count On | Touch Points on Smaller Number | 5 | 20 | 20 | 100% |
| 8 | Subtraction Count Back From Larger | Touch Points on Smaller Number Subtraction | 6 | 11 | 11 | 100% |
| Post Intervention | Addition & Subtraction | Touch Points on Smaller Number Subtraction | - | 10 | 13 | 77% |

Figure 2: Student Accuracy




your tables and charts show the progress that she made – it is clear and accurate – well done – I know how much time you spent on these…

Appropriate & Accurate Data Analysis

The purpose of the intervention was to incorporate the Touch Math Program to supplement the mathematics program currently in place in the second grade classroom. The goal of the intervention was that the student would learn basic addition and subtraction facts. The intervention would also improve speed and accuracy of computation, as well math fact fluency. The goal for the student was to increase the correct number of digits in computation problems from an average of 1.25 per minute to 10 correct digits per minute. It was expected that as the student learned basic addition and subtraction facts, her speed and accuracy would improve and the student would develop math fact fluency.

The data shows a gradual increase in the correct number of digits per minute. At the beginning of the intervention, the student quickly made progress and her correct number of digits rose from an average of 1.25 to 6.5 digits per minute. The student maintained the skills learned during the first session and was able to apply those skills during the second probe, correctly identifying 5.5 digits per minute.

Once a new skill was introduced and some of the touch points removed, the student's progress quickly declined. When the student was introduced to the count on method, which requires the student to say the larger number and then count on using the touch points on the smaller number, she struggled to master the skill. When presented with a number, the student had trouble counting up from that number. She often had to start at one and count up. The student's difficulty with this skill became evident when she completed the third probe. On this probe the student was only able to correctly identify 1.5 digits per minute with 25% accuracy.

After two sessions of review in counting in sequence, the student was reintroduced to using touch points to count on. The practice and review proved to be helpful to the student.

During the fourth probe the student's correct number of digits and accuracy level greatly increased. She was able to correctly identify 13 digits with 94% accuracy. The student maintained these skills and on the fifth probe she correctly identified 13 digits with 100% accuracy. At this point, the student showed that she was beginning to develop math fact fluency, as she was able to solve some computation problems without using the touch points. She was applying the additive identity property (7+0=7) and the adding ten strategy (10+3=13). She was also beginning to recognize and memorize fact doubles (5+5=10).

The student was introduced to subtraction by counting backwards using touch points. The student was instructed to say the larger number and then count backwards using the touch points on the smaller number. The student had multiple opportunities to practice during the session. When the new skill was introduced the student's correct number of digits per minute dropped, however her accuracy level remained at 100%. This suggests that she understood the concept, but was working at a slower pace, which would be expected when learning a new concept.

On the post intervention probe, the student correctly identified 7.5 digits per minute with 77% accuracy. The errors made by the student were due to the student using the wrong operation. The average correct number of digits for the six intervention probes was also 7.5 digits per minute.

The data shows that with modifications, the Touch Math Program was an effective program for the student. Although the student did not reach the intervention goal of identifying 10 correct digits per minute, the student did show growth in her ability to solve computation problems. Observations of the student also show that she is beginning to develop fact fluency skills, as she did not always rely on the touch points to solve problems. The data aligns with the

research hypothesis and shows that The Touch Math Program is effective in helping the student learn basic addition and subtraction facts, and improve speed, accuracy, and math fact fluency. Insightful analysis here and well written – it was easy to understand  your conclusions are solid and based on the collected data

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## Phase IV: Impact of Action Plan

### Impact of Actions

The purpose of the intervention was to help the student make progress in the area of targeted growth. The intervention was implemented to help the student make gains in the areas of counting and computational skills. Through the intervention, it was expected that the student would master counting and writing the numbers from zero to twenty. The student would also learn how to use the touch point process to add and subtract numbers from zero to ten. Once these skills had been mastered, the student would begin practicing more advanced problems, such as adding 2 two-digit numbers without regrouping.

Although the intervention was not able to cover all of the content contained in the original action plan, it was successful in helping the student make progress in the areas of counting and computational skills. With some modifications, the program helped the student write and count numbers in sequence. The student can accurately count from one to twenty with little teacher prompting. She is also able to write the numbers in order, with the occasional reversal.

The student also made progress in the area of computation. The intervention mainly focused on addition instruction using the touch points. Subtraction using the touch points to count backwards was briefly addressed. The student increased the correct number of digits from an average of 1.25 to an average of 7.5 digits. Although this does not meet the instructional goal of 10 digits per minute, it does reflect growth in the area of computation. Observations of the student also show that the student is beginning to understand basic properties of addition, as she began to use the additive identity property, add ten property, and doubles facts. More research would be needed to determine if the Touch Math Program is successful at teaching the student basic subtraction facts, as well as more difficult types of addition problems.

The intervention also impacted teacher skill application. Through the intervention the teacher was able to learn about the Touch Point Program, as well as develop ways to modify and supplement the program to meet the needs of the student. The program encouraged the teacher to think of creative ways to make accommodations for the student.

Relationship between Findings, Literature, and Best Practice

The research regarding the Touch Math Program suggests that the program may be considered a reliable intervention that can be used to help students with and without disabilities become successful math students. This purpose of this study was to determine whether or not the Touch Math Program could help students develop skills in the areas of counting and fact fluency.

According to Duris, "The concept of which number is bigger is also reinforced. In Touch Math, the student needs to identify which number is bigger and then count those dots and then count on from that number to the next number" (2002-2003, p. 10). The data collected from this study aligns with this research information. The Touch Math Program helped the student develop quantity discrimination skills. She was able to correctly identify the larger number in a problem. The student was instructed to circle the larger number, and then count on using the touch points on the smaller number. The Touch Math Program reinforced the concept of counting on from a larger number.

In her article, Duris also stated that the Touch Math Program can be an effective tool in teaching children how to count in sequence, "Touch Math can help reinforce and enhance numeral identification and counting skills…by emphasizing rational counting. Since each dot…counts for one, this enables the student to practice counting numbers in succession" (2002-2003, p.10). Data from this study does not support the information in this article. In this study,

the Touch Math Program did not help the student learn to count in sequence. Additional materials had to be introduced in order to help the student count from one to twenty in sequence.

The results of this study relate to the data described by Scott (1993). In the study, the researcher described several skills that students should have mastered before implementing Touch Math Instruction. Scott described how she assessed students for particular skills before beginning instruction, "In accordance with the Touch Math program, I screened each subject for the following prerequisite skills: knowledge of one-to-one correspondence, number concept, counting forward to 20, and counting backward from 20" (1993, p. 100). Upon implementing the intervention, it became clear that the Touch Math Program was not effective in helping the student count in sequence. Further instruction in using touch points could not continue until the student had practice and review in counting skills.

Other researchers described similar findings in their research. Simon and Hanrahan stated, "Several skills are prerequisites for using the Touch Math system. Children must be able to recognize, count and write numbers from 1 to 50. Furthermore, the program requires that children are able to count-on from the largest number when adding number pairs" (2004, p.193). Research by Wisniewski and Smith (2002) also described counting as a prerequisite skill.

Research also suggested that the Touch Math Program was effective at helping students develop fluency with basic computation facts. Previous research indicates that the program can help students increase speed and accuracy in problem solving. Duris stated, "Touch Math can also be used to teach addition and subtraction skills to reinforce fact mastery" (2002-2003, p. 12). The data and results of this study show that with continued use of the program, the student was beginning to master certain math facts. She was beginning to recognize and remember doubles facts. She was also using the additive identity property and was able to recall addition

facts when adding zero. As described by Scott, "This program does not require students to have math facts memorized, but rather it seeks to facilitate the acquisition of these facts" (1993, p. 99).

The Touch Math Program allowed the researcher to make appropriate accommodations and modifications to meet the specific needs of the learner. This helped ensure that the learner was successful. Research by Scott also described how the program can be easily and successfully modified as necessary (1993, p. 109). Scott stated, "…the Touch Math program, unlike some commercial programs, allows for teacher flexibility and creativity" (1993, p.109). As the program is easily adaptable, it is expected that it can be used to meet the needs of various learners.

Finally, research by Simon and Hanrahan described how the Touch Math Program can help students develop positive dispositions towards mathematics, "…subjects seemed more confident in their ability to solve addition problems" (2004, p. 205). The observations and anecdotal notes collected from this research study report similar findings. In this study, the student was clearly proud of her work. She was excited to take it home and share it with her family. She looked forward to showing her classroom teacher all of the work she had done.

The data and results of this study align with the results and findings discussed by other researchers. The Touch Math Program is an effective program that can help students learn basic computational skills and increase the speed and accuracy of problem solving skills, thereby increasing fact fluency. It is important that students acquire certain skills before implementing the program. The teacher should modify the program and make accommodations to ensure that all students are successful. Wow – this was fantastic!

Unintended Outcomes

At the beginning of the study, the student did not appear to have a lot of confidence in her mathematical abilities and often looked to the teacher for reassurance. During initial teacher interviews, the teacher had expressed that the student often put her head down or closed her eyes during math lessons. This suggested that she was overwhelmed. When the class was sharing examples of how they had solved problems, she would rarely participate.

The intervention had a positive impact on the student's self esteem. Through the intervention, the student has developed confidence in her mathematical abilities. She is very excited about Touch Math and looks forward to learning and counting. She has begun taking samples of her work home to share with her family. She always tells the classroom teacher that she is going to work hard and she enjoys showing her classroom teacher all of the work she has completed. The teacher has shared that this positive attitude has been displayed throughout the day in different areas of instruction.

As a result of the student's progress with the Touch Math Program and the increase in student self esteem, it has been decided that the student will continue to receive instruction using this program. The special educator will provide small group instruction using the touch points to solve different types of computation problems. The student will work in a small group with her peers and the instruction will supplement the current mathematics program. The special educator has also invited the researcher to join the sessions in order to learn more about Touch Math. The teacher has offered to show the researcher how the Touch Math Program can be used to teach more complex skills.

## Phase V: Reflection

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### Impact of PIP on Professional Knowledge, Skills and Dispositions

The Professional Impact Project and the implementation of the intervention plan have provided an opportunity to set goals for a student and then help the student achieve those goals. Through this project, I have had the opportunity to learn about a program that may be an appropriate accommodation for a variety of students.

The intervention has shown the importance of collecting multiple forms of pre-assessment data to learn about a student's present performance level. Through pre-assessment, it was determined that the student was able to count and write numbers up to twenty with some teacher assistance. However, during the intervention, the student struggled to count on when she had to start at a number other than one. It would have been helpful to reinforce counting skills before beginning the intervention. Perhaps if more pre-assessment data had been collected, or a different type of assessment implemented, the student's weakness would have been detected earlier.

The research project focused on using the program to increase fact fluency. The program was easy to learn and there are many free resources available at the TouchMath website. Although the intervention focused on computation skills and completing math facts, it can be used to help students develop problem--solving skills. By helping students see the real world application of mathematics, they will learn to appreciate and value mathematics.

The intervention also encouraged me to think creatively to find ways to modify the program and make accommodations to meet the needs of the learner. Although the program is multisensory and addresses visual, auditory, and motor skills, there are still many ways that one can adapt the program to help a child succeed. Coloring the subtraction signs red provided a

visual reminder that it was a subtraction problem and we needed to count backwards. This modification can be used in the classroom even if the teacher is not using Touch Math. The student can be taught to look at the operation and circle it to help them remember whether to add or subtract. This accommodation can be used in the everyday classroom. It is important to give students tools that will help them generalize the information to different settings.

Professional Goals

Through the implementation of the Touch Math intervention, I have had the opportunity to work with various professionals. They provided a lot of guidance and instruction in implementing the Touch Math Program. The special educator has invited me to join lessons in which she will teach the student more Touch Math skills.

The intervention focused on basic addition and subtraction skills. I am interested in learning how students use touch points to solve more complex addition, subtraction, multiplication, and division problems. Through the website, I have learned that Touch Math has created touch points to help children count coins. I would like to observe lessons taught by the special educator in order to see how students use touch points to compute more complex problems.

Due to the time constraints of the project, I was unable to determine whether or not the student would maintain the skills that she had learned. I would also like to observe the student during regular mathematics instruction to see if she uses the touch points outside of Touch Math instruction. This would help me learn whether or not the student was able to maintain the skills and generalize them to a different setting.

The student in the intervention was in the second grade. I would like to learn more about the effects of the program on older students. The research that I obtained focused on children in

elementary school. I am interested in looking for research that pertains to older children. As this method is a multisensory method that does not draw attention to the student, I would be interested in learning whether or not this program is effective with students in the middle school, high school, or even with adults. Awesome reflection here You really considered all the angles and tied together what you learned and want to learn

Final PIP Rubric Score = 197.25

Final PIP Grade = 98.62 A

Overall this is a superb paper. It is well organized and written in clear unambiguous language. And that is how research should be written up. You did careful planning which lead to good implementation.

Your literature review was outstanding – you used many relevant sources and tied everything together. You linked your goals to standards.

You asked good research questions that you could take data on and followed up with many sources of data. Despite this you still identified that you could have possibly taken more pre-intervention data that could have helped you understand the student's needs even better.

You made vital connections between what has been done and what your findings were and ended the paper with appropriate analysis, solid conclusions, and meaningful reflections. In sum, you expertly implemented the RIC Plan, Act and Reflect model into this PIP process. I'm proud of you.

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As I have edited several Phases before, I really have very little constructive criticism at this point – just a few small edits such as adding hyphens, commas, spacing, etc., – nothing to worry about or change.

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Appendix A: Anecdotal Notes

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Session 1

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| Activity | Observation |
|---|---|
| Review of Touch Points<br><br>Student writes the numbers 0-9 and draws Touch Points | The student is successful in writing the numbers with the correct Touch Points. The numbers are written correctly, but still not in sequence (0,1,2,3,4,6,5,7,8,9). Student has created a new Touch Point sequence for the number 9. |
| Introduce Touch Point addition using the count all method. | Student successfully completes practice activities with little teacher guidance. Due to student success, she was introduced to addition story problems. The story was read aloud and restated for clarification. Then the student wrote the number sentence, drew Touch Points, and found the sum. Introducing the story problems can help student develop reading skills. It also helps the student recognize real world applications of addition. |
| 2 Minute Timed Probe | Student looks for confirmation that she is doing a good job. She didn't need to count Touch Points for all problems. She knew 5+5 and 0+0. The student did not want to stop when time was up. After marking her progress, she was allowed to finish the rest of the problems.<br><br>Correct Digits in 2 minutes: 13<br><br>Correct Digits per minute: 6.5<br><br>Number of Attempted Problems: 13<br><br>Number Correct: 10<br><br>%Accurate: 77% |

Session 2

| Activity | Observation |
|---|---|
| Review of Touch Point addition using the count all method | Once again, the student successfully completed all practice pages with little teacher support. She is very excited about the program and wants to keep practicing. |
| Touch Math Story Problems | The student practiced more addition story problems. The problems were read aloud. We discussed the important words that were signals to add. The student had trouble grasping this concept. She was able to write the number sentence, Touch Points, and solve the problems correctly. |
| 2 Minute Timed Probe | On this probe, the student had to create her own Touch Points. She solved some problems by counting up from the larger number. The student did not want to stop when time was up. After marking her progress, she was allowed to finish the rest of the problems.<br><br>Correct Digits in 2 minutes: 11<br><br>Correct Digits per minute: 5.5<br><br>Number of Attempted Problems: 10<br><br>Number Correct: 7<br><br>%Accurate: 70% |

Session 3

| Activity | Observation |
|---|---|
| Practice identifying the larger of two numbers. | The student picked two cards from a pile. Then, she had to identify the larger number. She was usually able to correctly identify the larger number. She had some trouble when the two numbers were close to each other (14 and15). She often had to start at the number 1 and count up. |
| Introduction to Touch Point addition using the count on method. | The teacher modeled how to identify the larger number in the problem, circle the number, say the number and count up using the touch points on the smaller number. The student was able to correctly identify the larger number in each problem. She had trouble counting on in sequence. She reverted to counting all touch points. She could not start at a specific number and count up in sequence. |
| 2 Minute Timed Probe | On this probe, the student had to count on from the larger number. She began by circling the bigger number in every problem. She was able to correctly identify the larger number in each problem. She struggled to add on and count up, as she counted out of sequence. At times, the student started counting backwards. She also began counting on her fingers. She was overwhelmed by the task.<br><br>Correct Digits in 2 minutes: 3<br><br>Correct Digits per minute: 1.5<br><br>Number of Attempted Problems: 12<br><br>Number Correct: 3<br><br>%Accurate: 25% |

Session 4

| Activity | Observation |
|---|---|
| Review counting in sequence 1-20 | The student showed difficulty with counting in sequence, particularly when she had to start at a number greater than 10. In order to be successful with addition using the count all method, the student must be able to count sequentially. The student completes various counting activities. The student practices filling in the missing number using a number line. She often had to look at the number line for help. At times, she counted backwards. She also completed dot-to-dot pictures to help her practice counting in sequence. She really enjoys the dot-to-dot activities. |
| 2 Minute Timed Probe | The student did not complete a timed probe during the instructional session. |

Session 5

| Activity | Observation |
|---|---|
| Review counting in sequence 1-20 | The student continued to practice counting in sequence. She completed missing number activities and dot-to-dot activities. |
| Small Group Activity<br><br>Touch Math addition | There was another student in the class that was also learning Touch Math. They wanted to work together to solve problems. Each student had a sheet of paper. I gave them a problem, they wrote it down, and tried to solve it. The student was able to find the correct answer, but she was still counting all touch points. I asked the other student to explain how he solved the problem. He was using the count on method. He was able to explain how he only drew touch points on the smaller number and then counted on. The student really enjoyed working with her peer, as she was able to see how another student solved problems. |
| 1 Minute Timed Probes<br><br>Missing Numbers<br><br>Quantity Discrimination | These probes were given to see whether or not the student was able to count sequentially when starting with a number greater than 0. This is important if the student is going to use the count on strategy. The student was able to correctly write 8 out of 8 number sequences. She was able to identify the larger number in a number pair with 85% accuracy. |
| 2 Minute Timed Probe | The student did not complete a timed probe during the instructional session. |

Session 6

| Activity | Observation |
|---|---|
| Review of count on strategy using pictures | After the student showed progress on the Missing Number and Quantity Discrimination probes, we reviewed how to add using the count on strategy. In the first activity, the student was presented with a picture of ten stars which were grouped in a box. Then, there were single stars outside of the box. The student counted the stars in the box to make sure there were ten. Then the teacher modeled how to count on from ten. The student counted all of the stars to make sure that we got the same answer. The student practiced various examples. |
| Review of Touch Math addition using the count on method | After working with pictures the student practiced the count on strategy using numbers. She was given problems where only the smaller digit had touch points. She was reminded to say the bigger number and then count on using the touch points on the smaller number. With some prompting she was able to successfully complete the task. |

| | |
|---|---|
| 2 Minute Timed Probe | On this probe, the student was given 20 addition problems. The touch points were provided on the smaller digit in each problem. There were some facts that she knew without having to count touch points. The student worked quickly to complete each problem. She often looked for reinforcement that she was completing the task correctly. Verbal praise provided encouragement. She was very proud of her work and asked if she could keep it. She selected her best piece of work to take home. She also shared her work with the classroom teacher.<br><br>Correct Digits in 2 minutes: 26<br><br>Correct Digits per minute: 13<br><br>Number of Attempted Problems: 17<br><br>Number Correct: 16<br><br>%Accurate: 94% |

Session 7

| Activity | Observation |
|---|---|
| Review of Touch Math addition using the count on method | Once again, the student practiced adding two digits using the count on strategy. She completed a cross word style activity. She was both pleased and surprised when her answers lined up correctly to complete the puzzle. |

| | |
|---|---|
| 2 Minute Timed Probe | Once again, the student was able to quickly solve the problems using the count on strategy. She completed all twenty problems in less than two minutes. She was very excited. Once again, she shared her work with the classroom teacher.<br><br>Correct Digits in 2 minutes: 26<br><br>Correct Digits per minute: 13<br><br>Number of Attempted Problems: 20<br><br>Number Correct: 20<br><br>%Accurate: 100% |

Session 8

| Activity | Observation |
|---|---|
| Review of Counting Backwards | The student completed an activity page where she was asked to count backward. She had some trouble counting backwards from numbers larger than 10. |
| Introduction to Subtraction using Touch Points | The student was introduced to subtraction by counting backwards. The touch points were provided on the smaller digit. The subtraction sign was colored in red to help the student identify it as a subtraction problem in which she needed to count backwards. |
| 2 Minute Timed Probe | Correct Digits in 2 minutes: 11<br><br>Correct Digits per minute: 5.5<br><br>Number of Attempted Problems: 11<br><br>Number Correct: 11<br><br>%Accurate: 100% |

Thanks for sharing these anecdotal notes and the error charts in Appendix B – I read them but did not look for anything to edit as they are from your notes

Appendix B: Error Analysis Charts

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Probe 1

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Addition Count All Method

| Problem /Student Solution | Random Response | Basic Fact Error | Wrong Operation | Counting Error | Observations |
|---|---|---|---|---|---|
| 4+7=14 | | | | ✓ | Student counts the touch points on the 7 twice |
| 4+4=12 | | | | ✓ | Student counts on from previous answer of 8.<br><br>8+4=12 |
| 9+2=19 | ✓ | | | | |

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Probe 2

Addition Count All Method

| Problem/ Student Solution | Random Response | Basic Fact Error | Wrong Operation | Counting Error | Observations |
|---|---|---|---|---|---|
| 7+6=1 | | | ✓ | | Student subtracts and counts backwards |
| 0+7=11 | ✓ | | | | |
| 4+0=0 | | ✓ | | | Student does not recognize additive identity property. |

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Probe 3

Addition Count On Method

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| Problem/Student Solution | Random Response | Basic Fact Error | Wrong Operation | Counting Error | Observations |
|---|---|---|---|---|---|
| 10+7=10 | | ✓ | | | Student does not recognize plus 10 facts. |
| 9+4=11 | | | | ✓ | |
| 7+3=12 | | | | ✓ | |
| 3+1=5 | | | | ✓ | |
| 9+3=7 | | | ✓ | ✓ | Student subtracts, and counts backwards. |
| 0+9=8 | ✓ | | | | Student does not recognize additive identity property. |
| 7+1=9 | | | | ✓ | Student adds 1 to previous answer. 8+1=9 |
| 2+10=10 | | ✓ | | | Student does not recognize plus 10 facts. |

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Probe 4

Addition Count On Method

| Problem/Student Solution | Random Response | Basic Fact Error | Wrong Operation | Counting Error | Observations |
|---|---|---|---|---|---|
| 5+1=2 | ✓ | | | | |

Post Intervention Probe

Addition & Subtraction

| Problem/Student Solution | Random Response | Basic Fact Error | Wrong Operation | Counting Error | Observations |
|---|---|---|---|---|---|
| 17-9=26 | | | ✓ | | |
| 16-7=23 | | | ✓ | | |
| 5+4=1 | | | ✓ | | |

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Appendix C: Student Work Samples

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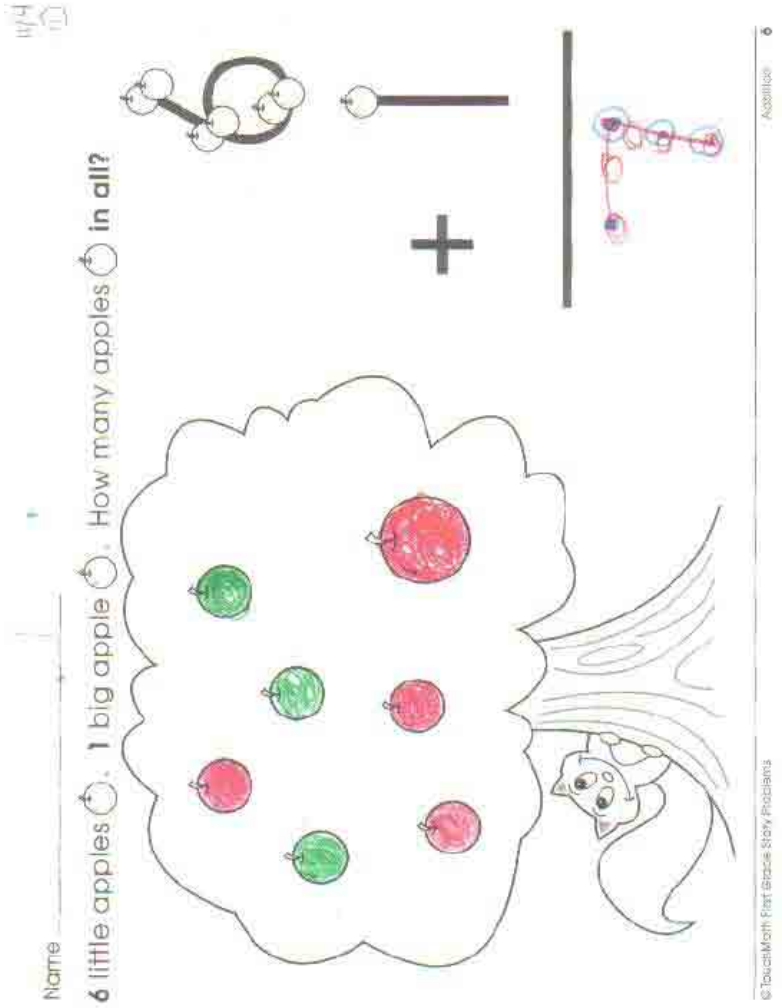
Identifying Touch Points

Your scanned documents below look great – they really add to the PIP and really augment the text

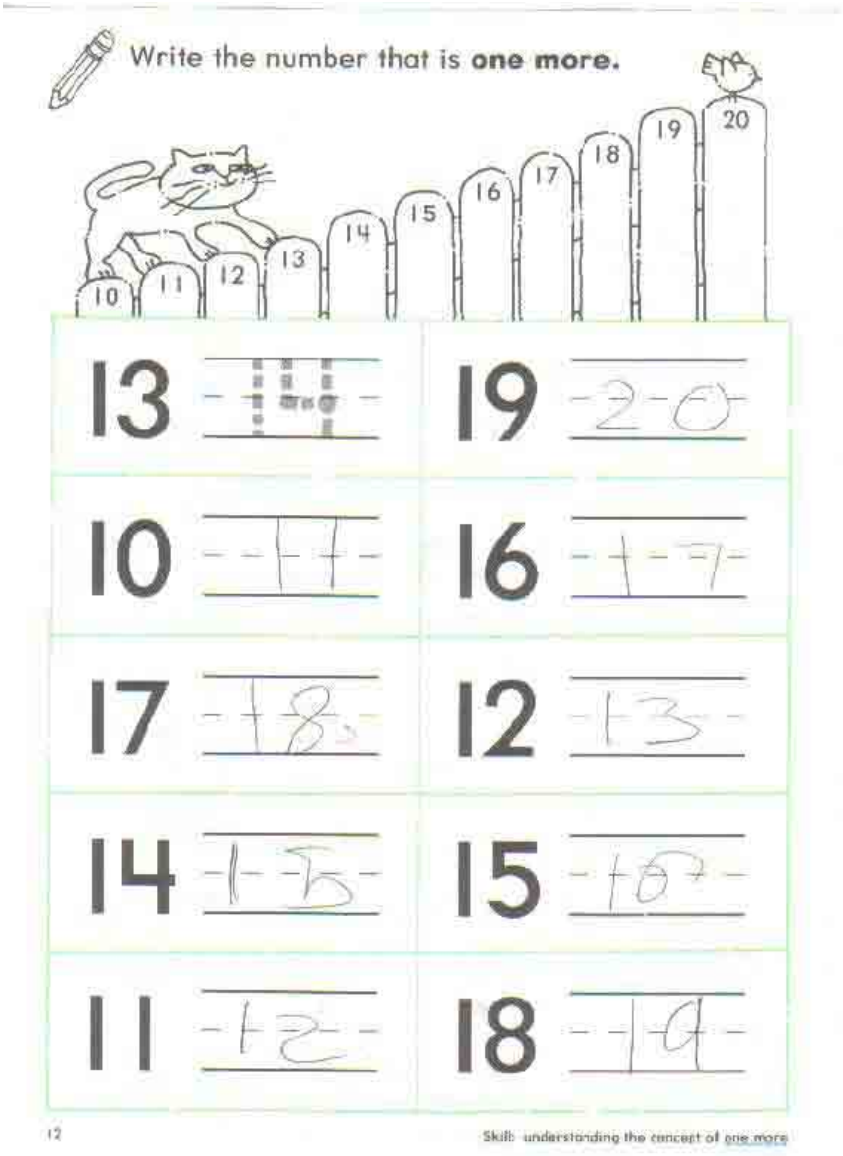
Draw the Touch Points on these numbers


Write the Number 0-5 and draw the Touch Points

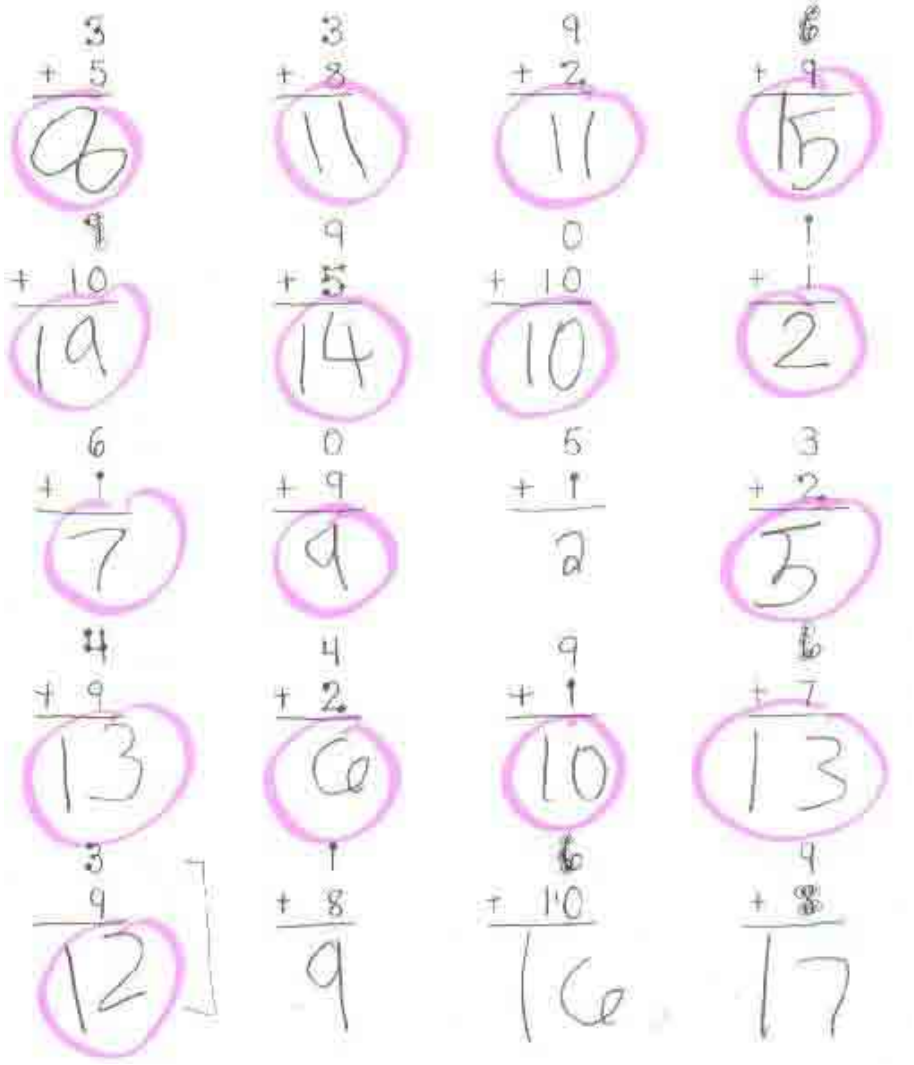
Addition- Count all Method



Sequence Activity



Addition- Count on Method



Subtraction-Counting Backwards using Touch Points

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Name _____

Touch the first number, say its name, and count backward on the TouchPoints of the second numeral. Fill in the bubble beside the correct answer. Then say the problem and answer.