The Effectiveness of Touch Math on Improving Academic Achievement on Math Addition in Children with Autism

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Abstract

The purpose of this study was to explore effect of Touch Math program on improving academic achievement on math addition in children with autism. Children participants diagnosed using Autism Spectrum Disorder Evaluation Inventory (Mohammed, 2006), were invited to participate. The sample was randomly divided into two groups; experimental (n=5) and control (n=5). Findings from this study indicated the effectiveness of the program employed in math skills in the target children. On the basis of the findings, the study supports the idea of Touch Math as a powerful intervention for children.

Keywords: *Touch Math program, children with autism, academic achievement, math addition*

Introduction

The Touch Math program was developed in 1975 by elementary school teacher Janet Bullock. She found that many students were struggling with math concepts and were in need of an intervention that would increase their math skills as well as their confidence in the subject (Bullock, 2005). Bullock (2005) began experimenting with a few struggling students by placing counting points on numbers. She began to see immediate results with her students; they were beginning to make the transition from concrete to symbolic learning. Much of the program is based on a report released by Kramer and Krug (1973) where dots were placed on numerals in a pattern modeled off of dice and dominoes. Kramer and Krug (1973) contend that many different children, both handicapped and non-handicapped, have developed the technique on their own; Kramer and Krug (1973) have observed the creation of this technique among various types of students.

The Touch Math program is also based on the research of both Jean Piaget and Jerome Bruner (Bullock, 2005). Bruner and Piaget both suggest that learning concepts should follow a predicted set of stages: Concrete, pictorial, and symbolic. This idea was the basis of the Touch Math program.

Bruner theorized that education is a process of personal discovery where students should learn to build their knowledge through teacher direction; not by being taught through rote memorization. He studied what he believed to be the three stages of understanding: enactive, iconic, and symbolic. The enactive stage is when children begin to develop understandings of concepts through active manipulation. During the iconic stage children begin to make mental images of the material without the need to manipulate it directly. Finally, the symbolic stage is when students are able to use abstract ideas to connect and understand concepts (Arndts & Cabelus, 2009).

Piaget, very similar to Bruner, felt that education is best when the child learns through discovery. He identified four stages of cognitive development: sensorimotor, preoperational intelligence, concrete

operational intelligence, and formal operational intelligence. During the sensorimotor stage, occurring during infancy, intelligence is demonstrated through motor activity with out the use of symbols. When children grow into early childhood they enter the preoperational stage. It is here that children begin to develop intelligence through the use of symbols. When children mature into the elementary years and early adolescence they enter the formal operational stage of intelligence. Children begin to manipulate symbols that are related to concrete objects. The final stage in Piaget's theory is formal operational when children develop into adolescents and young adults. It is here that the learners begin to demonstrate intelligence through the logical use of symbols related to abstract objects (Huitt & Hummel, 2003).

Various studies have been conducted to evaluate the effectiveness of the program when taught to children with special needs. Wisniewski and Smith (2002) explored a touch point system implementation into a math curriculum to increase student achievement scores for students with intellectual and learning disabilities. Four participants in 3rd and 4th grade were categorized as other health impaired, mild intellectual disabilities, or learning disabilities. A decrease in time to complete the worksheets was the desire result of the TouchMath application. Participants were only tested once and then determined that the students had mastered the TouchMath procedure without visual notation system displayed. The multisensory method was applied to boost percent correct and decrease the number of minutes required to complete the assessment. Mad Minute addition tests were employed as the pre and posttest measures consisting of addition facts and 30-40 double digit addition problem with and without regrouping. Instruction took place in the special education resource room during 20-minute sessions. Student four significantly increased percent correct and decreased completion rate by half. Student one was the only participant that did not decrease completion rate but increase percent correct. Student two scored lower on posttest but required less time to complete the measure.

Cihak and Foust (2008) used an alternating treatments design with students classified with autism to investigate the use of TouchMath to teach single digit addition problem-solving skills versus a number line approach. Three seven and eight year old elementary students with IQ ranging from 40-50 and diagnosed to have severe (2) and average (1) levels of autism participated during the regularly scheduled resource class time. The dependent variable was if there was a functional difference between the two methods to solve addition problems. The percentage of single-digit addition math problems was assessed. Two different probe worksheets with ten single digit addition problems were used to assess math skills. Instruction was based on a least to most prompt hierarchy to guide students to the correct answer as well as an adapted model-lead-test procedure to teach both methods across seventy-four sessions. Testing sessions last from 5-20 minutes. Touch points were found to be more effective and preferred by the participants. There was enough evidence to support a functional difference between the two methods. For two participants the touch point system demonstrate much higher gains but onestudent showed similar increases in percent problems correct for both methods employed.

Amaal Ahmed Mostafa(2013) explored the effectiveness of Touch Math in teaching addition skills to preschoolers at-risk for future learning disabilities The selection of the participants (KG1 children) was based on the marks obtained by all the 138 subjects in a mathematics test. The mean and Standard Deviation (SD) of these scores was calculated.

Only those subjects who scored 1 SD below the mean in their math test were selected for the study . 60 subjects were assigned into Control (n= 30 , 21 boys and 9 girls) and Experimental(n= 30 , 23 boys , 7 girls) group. ANCOVA and Repeated Measures Analyses were employed for data analysis. Findings from this study indicated the effectiveness of the program employed in addition ability in the target children .On the basis of the findings, the study supports the idea of Touch Math as a powerful intervention for children.

Mourad Ali Eissa & Hesham Habib (2013) explored effect of multisensory approach on increasing math skills of children with mild intellectual disabilities. A total of 38 children with mental disabilities from three Fekrya schools in Kafr EL Sheikh Governorate; namely Kafr EL Sheikh Fekrya School ,Baltim Fekrya School, and Disouq Fekrya School(Schools for those who have intellectual disabilities)participated. T-test Analysis was employed for data analysis. Findings from this study indicated the effectiveness of the program employed in math skills in the target children .On the basis of the findings, the study supports the idea of Touch Math as a powerful intervention for children.

Considering the limited research with children with autism disorder, this study aims to further explore the effect of Touch Math in teaching addition to children with autism disorder

Method

Participants

Children participants diagnosed using Autism Spectrum Disorder Evaluation Inventory (Mohammed, 2006), were invited to participate. The sample was randomly divided into two groups; experimental (n= 5) and control (n= 5). The two groups were matched on age, IQ ,and addition skills. Table 1. shows means, Mann-Whitney ,z value , and significance level for experimental and control groups on age (by month) , IQ , and addition skills test scores (pre-test).

Table 1. *Means, Mann-Whitney ,z value , and significance level for experimental and control groups on age (by month) , IQ , and addition skills test scores (pre-test).*

Variables	group	N	Mean Rank	Sum Of Ranks	Mann Whitney	Z	Sig.
Age	Ex	5	5.60	28.00	12.00	-0.113	**0.910**
	con	5	5.40	27.00			**Not Sig.**
IQ	Ex	5	5.70	28.50	11.50	-0.216	**0.829**
	con	5	5.30	26.50			**Not Sig.**
Addition	**Ex**	**5**	**5.20**	**26.00**	**11.00**	**-0.332**	**0.740**
Skills	**con**	**5**	**5.80**	**29.00**			**Not Sig**

Table 1. shows that all z values did not reach significance level . This indicated that the two groups did not differ in age , IQ , and addition skills test scores (pre-test) .

Instrument

The Math Skills Test (Mourad Ali & Hisham Habib, 2013). The researchers developed a 20-items test . It has five subtests; *Tracing The Numbers* (5 items) , where children are asked to trace the number and draw a ring around the number of objects to math the number (the right answer is given 1 mark) , *Missing Number* (5 items),where children are asked to write down the missing number(the right answer is given 1 mark),*Single–Skills Computation*(5 items),where children are asked to do simple addition problems (the right answer is given 1 mark), and *Quantity Discrimination*(5 items), where the children should

identify the number or quantity in the set with the highest value(the right answer is given 1 mark).

Procedures

Following Mourad & Hisham's study procedures (2013),all instruction, training, observations and probes occurred during the regular school day. The data was collected in three phases.

Phase I: Pre- Test

The pre-test was administered on the total of 10 subjects .The subjects were allowed sufficient time to complete the test. No time limit was set for completion of the test. On an average the subjects took 40 minutes to complete pre- test.

Phase II: Treatment

The Experimental Group learnt math skills using the Touch Math program. The intervention lasted for 12 sessions , 15- 20 minutes each. Those children in the experimental group were given following instructions: “Today I am going to teach you a new method to do additions. This method is called Touch Math. First we will learn to use it on numbers 1 to 9. The color dots on each number tell us the “Touch points” and you can count the Touch Points by using your finger or a pencil. “Like this is number one, number one has one touch point now touch and count the number of points on this number :one” The subjects counted numbers 1 to 5 aloud as they touched the single touch Points. For numbers up to 5 the subjects had to touch at the points only once where as for numbers 6 to 9 each point had to be touched while counting the points for each number. To ensure that subjects arrive at the right twice; subjects had to follow a pattern answer, that the subjects were constantly reminded to follow the sequence of pattern for each number. The researcher each group and immediate feedback was given to the subjects. The subjects practiced touching the Points of the numbers in the correct sequence till they attained mastery in counting each number. After the subjects attained mastery in counting the touch Points, the subjects learnt addition .The content included one digit to one digit with and without carry-over, two digits with two digits with and without carry-over, and three digits to three digits with and without carry-over.

Phase III Post test

The Post test was administered on all the students of Control Group and Experimental Group at the end of 12 sessions. Responses were carefully recorded and scored.

Results

Table 2 displays Mann-Whitney test results, rank mean values for both groups (experimental and control), Z test statistical values, and observed significance. Analysis finding showed that there is significant differences at the 0.05 level between the performances mean rank of both group students in addition skills - Z value reached - 2. 643. Accordingly, it can be noted that research data confirmed the accuracy of the hypothesis that children with autism disorder in the Touch Math group will demonstrate larger gains on the math-post test than children in the control group. . So, it can be said that using Touch Math improves addition skills of the experimental group.

Table 2 Mann-Whitney test results, rank mean values for both groups (experimental and control), Z test statistical values, and observed significance

Variables	group	N	Mean Rank	Sum Of Ranks	Mann Whitney	Z	Sig.
Addition	Ex	5	8	40	zero	- 2. 643	0.05
Skills	con	5	3	15			

Discussion

The main objective of the present study was to explore whether there were differences in post–test mean rank between control and experimental groups on Math Skills .The results of this study as revealed in table 2 showed that the Touch Math program as a multisensory approach was effective in increasing math skills of children in experimental group .

This study supports and extends the literature regarding children with special needs and math skills (Scott,1993; Bedard,2002;Wisniewski and Smith ,2002; Cihak and Foust, 2008; Calik,2010; Amaal ,2013; Mourad & Hesham , 2013).

Limitations

Some limitations of this research that are thought to have an effect on the results of the research are as follows: a) The number of participants makes it difficult to support arguments for generalization to other populations. So, larger samples must be investigated before broad conclusions can be made, b) Second, prior knowledge of the TOUCHMATH program was unknown at the time of this study and with the carry over effects, the potential of this prior knowledge can alter the outcome of the study.

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