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The Effectiveness of Touch Math Intervention in Teaching Addition Skills to Preschoolers at-Risk for Future Learning Disabilities

Amaal Ahmed Mostafa *

*Assistant Prof Dr., Beni Suef University, Egypt

Abstract

The purpose of this study was to explore 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. Results. Findings from this study indicated the effectiveness of the program employed in addition ability in the target children . Discussion. On the basis of the findings, the study supports the idea of Touch Math as a powerful intervention for children .

Keywords. Touch Math , preschoolers ,Learning Disabilities ,Addition skills .

Introduction

Touch Math is a multi-sensory, supplemental curriculum that attempts to bridge the gap between manipulation and memorization of math facts (Bullock, 2000; Grattino, 2004). It follows the sequential learning strategies endorsed by Bruner, Piaget, and Vygotsky in their developmental theories. Students point to, touch, and count dots representing the quantity of the number. This satisfies the sensorimotor and concrete stages of understanding, according to the ideas of Piaget and Bruner, respectively (Vinson, 2004). Eventually students learn to associate the number of dots, or touchpoints, on a numeral that corresponds to the quantity of the number. In learning to add, students are taught the number and touchpoints, touch the touchpoints while counting them, verbalize the total quantity, write the answer, and restate the problem with the answer.

Children enter school with a certain knowledge base of numbers and some find it easier to perform numeric operations than others (Kilpatrick, Swafford, & Findell, 2001). However, with intense instruction most students could make noticeable progress. Many students learn to add without supplemental instructional techniques such as Touch Math. However, some students, such as gifted students , may require a program such as Touch Math that incorporates a structured, systematic, and multisensory approach in order to master basic computational skills. Touch Math is a multisensory instructional program. It has been used for over thirty year in a variety of settings. It is commonly used to teach students with mild to moderate disabilities, both in general education and special education classrooms. Most of the literature indicates that Touch Math is used largely with students from first through fifth grades. Touch Math has been used with students from high achieving, high socio-economic communities to students from lower achieving schools in lower socio-economic communities (Bedard, 2002; Dulgarian, n.d.; Simon & Hanrahan, 2004). Furthermore, numerous colleges and universities across the country incorporate Touch Math in teacher training courses.

Many researchers suggest that students learn best through preferential learning styles (Bedard; Moustafa, 1999; Rudolph, 2008; Scott, 1993; Simon & Hanrahan); however, research by Cronbach (1975) indicates that teaching styles and student learning preferences are not determinants of student success. The key factor in learning is employing a highly structured, systematic, and repetitive program that offers students the opportunity for guided practice and for receiving corrective feedback (Shapiro, 2004).

Touch Math, while based in part on the preferential learning style theory, also incorporates these key components of effective instruction. Surveys and small studies have been conducted to determine the effectiveness of Touch Math in various classroom settings (Jarrett & Vinson, 2005; Rains et al., n.d.; Rudolph, 2008; Strand, n.d.) available on this topic, most studies have concluded that Touch Math has been an effective tool in teaching basic addition, subtraction, multiplication, and division with students in various classroom settings. Few comparison studies have been conducted to determine if Touch Math is a more effective tool or approach than traditional methods of instruction (Bedard, 2002; Dev, Doyle, &Valente, 2002; Dulgarian, n.d.; Wisniewski & Smith, 2002).

Presently there is limited research on the effectiveness of Touch Math on kindergarten children who are at-risk for future learning disabilities .There is even less information available from studies that included treatment and comparison groups through an experimental design. The majority of the research available includes information from surveys that were conducted to summarize the use, implementation, and success of Touch Math by teachers and other educators. Although there is a paucity of research, many of the results are positive in nature (Dev et al., 2002; Grattino, 2004; Jarrett & Vinson, 2005; Raines et al., n.d.; Rudolph, 2008; Strand, n.d.).

Considering the limited research, this study aims to further explore the effect of Touch Math in teaching addition to preschool children who are at-risk for future learning disabilities. Specifically, the aim of this study was to examine the effectiveness of Touch Math in teaching addition to preschool children who are at-risk for future learning disabilities .

Method

Participants

The geographical area selected for research was from Zagazig City . The researcher approached 10 kindergarten schools within the geographical area. Both boys and girls were included in this study. Out of the 10 schools to which permission was sought only three schools agreed to participate in the research. Once the schools agreed to participate, the random sampling method was used to select the participants.

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. Out of 138 using the systematic random sampling method 60 subjects were assigned into Control and Experimental group. Thus the final sample consisted of 60 subjects.

There were 30 subjects in the Control group (n= 30 , 21 boys and 9 girls)and 30 subjects in the Experimental group(n= 30 , 23 boys , 7 girls).

The two groups were matched on age, IQ, and addition skills. Table 1.shows means, standard deviations ,t- value, and significance level for experimental and control groups on age (by month) ,IQ , and addition skills (pre-test).

Table 1**.** *means, standard deviations , t- value , and significance level for experiment tal and control groups on age (by month),IQ, and addition skills (pre-test).*

Variable	**Group**	**N**	**M**	**SD**	**T**	**Sig.**
Age	Experimental	30	53.24	1.96	-.121	Not sig.
	Control	30	51.41	2.01		
IQ	Experimental	30	122.34	4.45	-.221	Not sig.
	Control	30	124.89	4.24		
Addition Skills	Experimental	30	10.21	3.00	-.547	Not sig.
	Control	30	10.67	3.52		

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

Instruments

The Addition Test . The probe consisted of a paper and pencil test of 22 simple addition problems with addenda 1-8. Questions for this probe were selected from the complete set of twenty-five possible combinations of the addenda one to five. Selection of problems was conducted in a systematic manner. Included first were the five questions considered as "doubles" (1+1, 2+2, 3+3, 4+4, 5+5, 6+6 , 7+7, 8+8). The remaining problems for the pretest were determined by choosing a problem and not its reciprocal. For example if 1+2 were chosen then 2+1 would be omitted. This method was conducted in such a way as to assure that half of the problems had the larger addend placed first and the other half had the smaller addend placed first. Each number from 1-8 appeared as an addend in the pretest a total of 8 times. The fifteen problems were then placed in a random order for administration.

Procedures

Before beginning the application of Touch Math to the addition process, a period of Touch point training was required. One hundred percent mastery of the touch point configurations for each number 1 to 5 was required. Instruction was provided for the touch points, and then the subject was given supervised practice in touching and counting in the recognized order. criterion for this task was considered to be three consecutive correct trials of touching and counting on three separate days. During training, numbers were presented in different ways to aid the students with generalization of the knowledge. Different sized numbers were used and the numbers were presented both in isolation and together as on a number line.

Once criterion was reached, the application of this knowledge to the process of addition was initiated. Each session commenced with a review of the touchpoint configurations for the numerals 1 to 5, presented in a random order. Correct answers were praised, incorrect answers were corrected, reviewed and readrninistered.

The subject then received directed practice on a set of four simple addition problems following the order set out or the worksheets. subjects were presented with laminated numbers arranged into vertical and horizontal addition problems. Different sized numbers were used in order to aid generalizability. The four problems that had been practiced were then tested at the end of the session or earlier if the subject was consistently correct on practice trials. The subject could progress to the next set of problems if they received a score of 3/4 (75%) correct or better on the test worksheet. A record of these scores was kept. The subject was praised and given stamps for hard work. Corrective feedback was given immediately on problems done inaccurately. If the subject received less than 75% correct, that training set was continued in the next session. When the subject completed both the original series of worksheets with the touchpoints and the reciprocal series without touchpoints, the probe was readministered to all the subjects. The subsequent subject was then introduced to the training phase as described above. When the final subject completed the training phase, a concluding probe was administered to all the subjects.

Scoring

For both the instructional worksheets and the probe tests, problems were assessed as either correct or incorrect based on unassisted and unprompted answers given by the child. Answers could be written, marked with a number stamp, or if either of the two written recordings were unavailable to the student, he/she was allowed to answer verbally.

Results

Table 2. shows data on ANCOVA analysis for the differences in post- test mean scores between experimental and control groups in addition test. The table shows that the (F) value was (128.009) and it was significant value at the level (0.01).

Table 2. *ANCOVA analysis for the differences in post- test mean scores experimental and control groups in addition test*

Source	Type 111 sum of squares	df	Mean square	F	Sig.
Pre	1.725	1	1.725		
Group	217.276	1	217.276	128.009	0.01
Error	317.340	57	5.567		
Total	1067.933	59			

Table 3. shows T. test results for the differences in post- test mean scores between experimental and control groups in Addition test. The table shows that (t) vale was (11.67). This value is significant at the level (0.01) in the favor of experimental group . The table also shows that there are differences in post- test mean scores between experimental and control groups in Addition test in the favor of experimental group .

Table 3. *T- test results for the differences in post- test mean scores experimental and control groups in Addition test*

Group	**N**	**Mean**	**Std. deviation**	**T**	**Sig.**
Experimental	30	13.50	1.10	11.67	0.01
Control	30	6.43	3.12		

Table 4. shows data on repeated measures analysis for Addition test. The table shows that there are statistical differences between measures (pre- post- sequential) at the level (0.01).

Table 4 . *Repeated measures analysis for comprehension test.*

Source	**Type 111 sum of squares**	**df**	**Mean square**	**F**	**Sig.**
Between groups	661.250	1	661.250		0.01
Error 1	105.611	58	1.821	363.148	
Between Measures	794.978	2	794.978	193.121	0.01
Measures x Groups	596.933	2	298.467	145.011	0.01
Error 2	238.756	116	2.058		

Table 5. shows data on Scheffe test for multi-comparisons in Addition test. The table shows that there are statistical differences between pre and post measures in favor of post test , and between pre and sequential measures in favor of sequential test , but no statistical differences between post and sequential test .

Table 5. *Scheffe test for multi- comparisons in Addition test*

Measure	**Pre M= 6.76**	**Post M= 13.20**	**Sequential M= 12.86**
Pre	--	--	--
Post	8.43*	--	--
Sequential	8.10*	.33	--

Discussion

The main objective of the present study was to explore whether there were differences in post – test scores mean between control and experimental groups on Addition skills . The study also examined If the program was effective, if this effect was still evident a month later .

The results of this study as revealed in tables 3 and 5 show that the Touch Math program was effective in teaching the addition skills to children in experimental group, compared to the control group whose individuals were left to be taught traditionally.

Each group received instruction in their respective groups for 18 days. In order to determine the effectiveness of the intervention, pre- post , and follow-up -tests in math were administered to all groups. The math follow-up -test was administered a third time to the Touch Math group approximately two and a half weeks after the post-test. The hypothesis was that students in the Touch Math group would make greater gains on the math post-test than the students in the other group.

Touch Math combines direct instruction, repetition, and hands on sequential learning. It is also a systematic approach to adding, which in turn should lead to effective instruction. There is a paucity of research on the effectiveness of Touch Math or other multisensory approaches to teaching addition. Of the research that is available, none of it consists of studies with experimental designs. Most of the information available is based on single case design or satisfaction surveys (Grattino, 2004; Jarrett &Vinson, 2005; Moustafa, 1999; Rains et al., n.d.; Simon & Hanrahan, 2004; Scott, 1993; Vinson, 2004). The few studies that do exist are either unpublished or the quasi-experimental design did not include comparison and control groups which is required to be considered experimental (Bedard, 2002; Dev et al., 2002; Dulgarian, n.d.; Wisniewski & Smith, 2002).

Experimental group gained better scores in addition test than did control group in post-test though there were no statistical differences between the two groups in pre- test. This is due to the program which met the experimental group's needs and interests. On the contrary, the control group was left to be taught traditionally. This goes in line with our adopted perspective which indicates that traditional methods used in our schools do not direct students as individual toward tasks and materials , and do not challenge their abilities. This may lead students to hate all subjects and the school in general. On the contrary, when teachers adopt an approach (such as Touch Math) that suits students interests and challenges their abilities with its various modalities, they achieve better gains . Worth mentioning is that children in the experimental group retained the learnt information for a long time even after the period of the program finished, and this indicates the training effect.

Limitations

The main limitation of this research is that 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.

Suggestions for Future Research

Results of this study have been very favourable for the Touch Math method; however further investigation of this program is warranted. The effectiveness of different instructional tools may also provide an avenue of research. As a multisensory approach, the Touch Math method may be supplemented with other sensory experiences. For example, instructors may want to augment the touchpoints on the numerals with fabrics or perforations that students can feel when they touch the dots. This can be done on the number lines or wall posters for an additional

sensory pathway for the student. This tactilekinaesthetic experience may be especially effective in meeting the learning styles of some students.

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