A STUDY OF UTILITY OF TEACHING LEARNING MATERIAL IN THE INSTRUCTION OF MATHEMATICS FOR PRE-SCHOOL CHILDREN WITH HEARING IMPAIRMENT

Saurabh Kumar Mishra
REGISTRATION NO: 13MSED04

A DISSERTATION SUBMITTED IN PART FULFILMENT OF MASTER'S DEGREE (MASTER OF SPECIAL EDUCATION) UNIVERSITY OF MYSORE MYSORE.

ALL INDIA INSTITUTE OF SPEECH AND HEARING MANASAGANGOTHRI, MYSORE-570006

MAY-2014

DEDICATED TO …

MY LATE PARENTS

MY EVER UNDERSTANDING BROTHERS AND MY FRIENDS

CERTIFICATE

This is to certify that this Dissertation entitled “A Study of Utility of Teaching Learning Material in the Instruction of Mathematics for Pre-School Children with Hearing Impairment” is a bonafide work in part fulfillment for the degree of Master of (Special Education) of the (Registration No. 13MSED04). This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

DR.S.R.SAVITHRI
Director
All India Institute of Speech and Hearing,
Manasagangothri,
Mysore-570006

Mysore
May, 2014

CERTIFICATE

This is certify that this Dissertation entitled "A Study of Utility of Teaching Learning Material in the Instruction of Mathematics for Pre-school Children with Hearing Impairment" is a bonafide work in part fulfillment for the degree of Master of (Special Education) of the student (Registration No. 13MSED04). This has been carried out under my Guidance and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Guide

MS.PRITHI VENKATESH
Lecturer in Special Education
Department of Special Education
All India Institute of Speech and Hearing
Manasagangothri,
Mysore-570006

Mysore
May, 2014

DECLARATION

This is certify that this Dissertation entitled “A Study of Utility of Teaching Learning Material in the Instruction of Mathematics for Pre-School Children with Hearing Impairment” is the result of my own study under the guidance of Lecturer Ms.PrithiVenkatesh, Lecturer in Special Education Department, All India Institute of Speech and Hearing, Mysore and has not been submitted earlier in any other University for the award of any Diploma or Degree.

Register No: 13MSED04

Mysore

May, 2014

Acknowledgement

I thank Dr.S.R.Savithri, Director, All India Institute of Speech and Hearing for allowing me to do this research work. My sincere and heartfelt gratitude to Ms.PrithiVenkatesh for all her guidance and patience without which I wouldn't have completed this dissertation. Ma'am I have learnt a lot from you and I am very much impressed by your polite and good behavior. I am very grateful to you for your support and I can't forget you. You have given me good guidance on every step. I will try my best to apply it in my future. I will be very happy if I get an opportunity to be your student again. Thank you for everything.

I thank Prof. Prema K.S, former HOD-Special Education and Dr. Swapna N, present HOD-Special Education for granting me permission to carry out the study in AIISH pre-school

I thank Vasanthalakshmi Ma'am, for all your advices, patience and moral support that had helped me to learn a lot as a person and for helping me with statistical analysis.

I thank all my classmates, Saurabh Kumar Mishra, K. Kanga Subramanayam, Rachala Rajshekar Gaud, D. Dhivya for their support. I enjoyed a lot with you people. I cannot forget these memorable movements of my life. AIISH was a dream for me, and you people have completed this dream of mine. I can never forget these days.

I sincerely thank AIISH pre-school and its staff for permitting me for conducting the study and collecting data in the pre-school and providing the support, guidance and technical facilities and also permitting me to use Education technology lab to teach the children through computer. I thank all

the children of per-school AIISH and their parents who have participated in the study for their cooperation.

I thank Dr.Malar, Ms.Vijetha Ma’am, Professor Dr.Venkatesan Sir, Clinical Psychology for all the help and guidance.

My sincere thanks to Shobha Ma’am, Hema Ma’am, Mamtha Ma’am for their support and guidance.

I would like to thank to my elder brothers Rameshwer Singh, Rammeher Singh, Nathpal Singh and Shirash Ram which helped to me to do this course and give me financial support.

I would like to thank to my all staff members from Babu Jagjivan Ram Institute for Social Rehabilitation Una, Himachal for encouraging me to do this course and I thank to all my special education friends for helping me in different ways.

Finally, I thank the Librarian, other staff in the library.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

1.0. A school going child is expected to learn different subjects. Each subject has got its significance. English is learnt to develop language and an important subject as it becomes the base for learning and understanding other subjects like science. Similarly other subjects like science, history; geography has got its own significance in the educational development of the child. The main goal of mathematics education in schools is the mathematisation of the child's thinking. Mathematics enables a child to handle abstractions and an approach to problem-solving

Mathematics like any other school subject is a compulsory subject of study, access to quality mathematics is every child’s right. Mathematics education should be made affordable to every child and at the same time enjoyable. The National Policy on Education (1986), which states that mathematics, should be visualized as the vehicle to train the child to think, reason, analyze and articulate logically. It should not be treated as a specific subject, but as a concomitant to any subject involving analysis and reasoning.

George Polya states that there are two kinds of aims for school education: a good and a narrow aim that of turning out employable adults who eventually contribute to social and economic development; and a higher aim, that of developing the inner resources of the growing child. With regard to school mathematics, the former aim of social and economic development specifically relates to numeracy.

Ideally, school mathematics should take place in a situation where children can:

1. Enjoy mathematics
2. Children learn important mathematics

3. Gain life experience which they talk about,
4. Pose and solve meaningful problems
5. Use abstraction to perceive the relationships and structure
6. Understand the basic structure of mathematics
7. Expect to engage every child in class.

According to Harniss et al. (2002:123) the goals of instruction in mathematics, as stated by National Council of Teachers of Mathematics which indicates that students should:

- Learn to value mathematics
- Become confident in their ability to do mathematics
- Become mathematical problem solvers
- Learn to communicate mathematically
- Learn to reason mathematically

However, achieving the above goals becomes difficult because of the following core areas of concern. These concerns over solving mathematics are common among all children. The concerns include:

a. A sense of fear and failure regarding mathematics among majority of children,

b. A curriculum that disappoints both a talented minority as well as the non-participating majority at the same time,

c. Crude methods of assessment that encourage perception of mathematics as mechanical computation, and lack of teacher preparation and support in the mathematics.

1.1. The Significance of Mathematics in Daily Life

Mathematics is a subject which is required to be used by all of us almost everywhere in our day to day activities. Even children with special needs need to know and use

mathematics for their daily activities. Children need to use mathematics while buying things at a shop, calculating the number of sweets they ate or the amount of time they have to spare for doing school home work. Even when they grow up they would have to use mathematics for various things like planning their expenditure, the amount they should save every month etc. Children with special needs should be able to carry out mathematical calculations for their day-to day activities. Learning mathematics is important especially in today's technologically oriented and information rich society. Hence children need to develop mathematical skills in order to have the confidence and competence to be effective participants in our technological society. Mathematics is important for the following activities of our life.

1.1.1. Importance of mathematics is as follows:

- **Important to communication**

Its language expresses the nature and order of things; we cannot live without descriptions of quantities, space and time.

- **Important in our practical lives**

Its concepts are the basis of many of our practical skills.

- **Important in helping us understand relationships**

We use it to describe and compare things, all its parts are interrelated, e.g. addition and subtraction; its concepts help us understand the world around us.

- **Important because it helps us be systematic**

With its structures and tools we can record, bring order and remember our observations. Its patterns and rules help us recognise what we know, and predict what might happen.

- **Important because it is a tool for our imagination**

We express ourselves and are emotionally affected by its patterns, they affect us in music, movement, visual and the tactile arts. A waltz feels different to rock and roll.

- **Important because it fascinates us**

Even though many people fear abstract mathematical language and processes, they are fascinated by patterns, comparisons, changes to quantifies, etc. and are interested in anticipating and predicting outcomes.

However for children with hearing impairment, learning mathematics becomes difficult because of the inadequate language competency. The key issue arising revealed that deaf/hearing-impaired children's limited language base may prevent them from understanding and developing mathematical language.

1.2. Problems faced by children with hearing impairment in mathematics

Mathematics is a subject which requires good logical and analytical thinking. It is suggested that approximately 6 percent of students have significant difficulties in learning basic mathematical concepts and skills (Fleischner and Manheimer,1997). A much higher percentage of students are observed to be low achievers in mathematics displaying a poor attitude towards the subject and having no confidence in their own ability to improve. However, most have simply encountered difficulties with mathematics learning for a variety reasons which are discussed as below:

1. Insufficient or inappropriate instruction (Elliot and Garnett 1994)
2. No coordination between the pacing of curriculum and the students' ability to assimilate new concepts and skills. (Harniss et al. 2002)

3. Usage of difficult language by the teacher which might be above the students' level of comprehension. (Cawley et al. 2001; Lever 1999)
4. Introducing abstract concepts too early in the absence of concrete materials or real life examples (Gucker 1999)
5. Less effective teaching of mathematics is characterized by not frequently reviewing and revising, brief or unclear demonstrations, insufficient guided practice and too little corrective feedback.

It is quite evident from the above discussions that children with hearing impairment face difficulty in mathematics because of the lack of language proficiency. There are many things that need to be considered when teaching mathematics to deaf students. However, given the large number of mathematical concepts that are taught throughout the school years, it would be impractical to make suggestions to tackle each of these concepts with the students. Teachers of the deaf should utilize different strategies to teach mathematics though coursework, workshops, usage of different teaching-learning material and exploring new avenues. (Stewart and Kluwin , 2001) opines that the reasons mathematics is challenging for deaf students are varied and complex ranging from the ability to learn from experiences outside the classrooms to cognitive considerations in the classrooms such as the ability to assign meaning and language to mathematical problems. Another reason for failure as per the researchers is not spending sufficient time working with and talking about the sequences and patterns.

Thus the solution to the problems in mathematics in children with hearing impairment is usage of appropriate and meaningful teaching learning materials.

1.3. Importance of Teaching-Learning Material

Every individual learns differently and thus has a unique learning style. According to Marie Carbo and Rita Dunn (1986), approximately 20 to 30 percent of the school-aged population remembers what is heard, 40 percent recalls well the things that are seen or read, and many must write or use their fingers in some manipulative way to help them remember basic facts. Along with understanding the learning styles of the children, providing the children with effective teaching learning material compliments the learning of children. As teachers, we all know that a teaching-learning material enhances the learning process. Teachers can conduct the learning process effectively with the help of appropriate teaching learning materials. Learning through aid or pictures creates a better understanding in the minds of children and facilitates comprehension. Therefore, teaching learning materials are used in schools or whenever learning interactions are carried out.

1.3.1. Teaching Learning Material

In the field of Education, TLM is a commonly used acronym that stands for "teaching-learning materials." Broadly, the term refers to a spectrum of educational materials that teachers use in the classroom to support specific learning objectives, as set out in lesson plans. It is a misunderstanding that a teaching aid is used only at the time of hard core instruction activity. However, it is not the case; teaching-learning material must be used at all the steps of the teaching-learning process: introduction, imparting knowledge, recapitulization, assessment, homework and follow-up. Hence, teaching-learning materials serve the following purpose:

1. It draws the attention of the learner.
2. It holds the attention of the learner for a longer time
3. It provides stimulating variations while learning
4. It sustains interest

5. Comprehension of key concepts in terms of clarity, co-relation and coordination
6. For making abstract concepts concrete
7. For making complex concepts simple
8. For better retention
9. For better conservation of ideas (verbal discussion is useful but that is wiped out after it is over. TLM on the other hand will help in retaining the information for a long time).

A TLM is also beneficial as it reduces the boredom of ‘chalk and talk’ method, motivates the students, provides direct experiences through see, hear, touch, taste and smell, encourages learning through senses naturally, provides opportunities to handle and manipulate based on learning by doing concepts, in retaining the concepts, helps in fixing up new learning, saves energy and time of teachers, provides reinforcement to learners and meets the individual differences among the children. Thus selection of appropriate teaching-learning materials is important for better understanding of the subject and to sustain interest among the learners.

Mathematics is a subject which if not made interesting will lead to boredom. It is important to create a learning environment that supports and encourages children to build understandings, make connections, reason and solve problems. Children are generally curious by nature. They construct for themselves the mathematics they know. Therefore, the approach to mathematics learning should be an active one where children are engaged in problem-solving activities that are discovery oriented and open-ended. The best way to teach and learn mathematics is with concrete representation of a mathematical concept. In fact, it is best to provide children with multiple embodiments, the use of manipulative materials in all mathematics classrooms.

According to (Behr, Lesh, Post & Silver, 1983), mathematic concepts may be represents in many different ways called modes of representation. These five modes include real-world situations, manipulative models, pictures, oral language and written symbols.

The above mentioned modes were aptly used for the present study to teach the mathematical concepts at pre-school level.

1.4. Need for the Study

Teaching Learning Material should help the child to learn the sub skills or sub concepts. The available TLM helps the children to learn concepts but not the sub concepts. The material may not meet the individual needs of the child. They may be manipulative but does not give scope for practice or drill. The cost of the material may not be affordable by all. A beneficial learning material will encourage and enable children to construct their own meaning out of the mathematical problems. Developing effective teaching learning materials could help in overcoming the barriers of learning. There is a dearth for instructional material for children with hearing impairment for learning mathematics. Keeping all these things in mind, a need was felt to undertake the study with the following objectives.

1.5. Objective of the Study

1. To diagnose the errors made by children with hearing impairment in mathematics at pre-school level.
2. To develop appropriate teaching- learning material to :
    - To reinforce the already learnt concepts in mathematics.
    - To teach new mathematical concepts which is not mastered by the children
3. To study the efficacy of the developed/utilized teaching-learning material.

CHAPTER II
REVIEW OF LITERATURE

2.0. Review of related literature has an important role to play in the research study. This chapter enables the researcher to get an in-depth insight into any selected topic and the different studies conducted. It provides a brief summary of previous researches and writing of recognized experts which provides information to the researcher with what is known and what is still left unexplored. It also gives a large amount of in-depth knowledge of the study and provides a baseline for conducting the study. Therefore an attempt has been made by the researcher to organize the literature and studies related to the present study.

2.1. Problems Faced By Children with Hearing Impairment in Language and Mathematics

It is a known fact that children with hearing impairment have difficulty in almost all aspects of life because of their language deficiency. Even though their cognitive development is similar or sometimes even better than their hearing counterparts, they lag behind because of their language deficiency. Research studies have indicated the problems faced by children with hearing impairment.

A hearing child learns language incidentally, and they pick up incidental information throughout their school lives, which will be more difficult for many deaf children to access. Much of the information that hearing children learn about language is picked up incidentally from their environment. In comparison with their hearing peers, deaf /hearing impaired children miss out of various concepts and vocabulary that hearing children pick up incidentally (Ray, 2001).

Conrad (1979), states that deaf pupils lagged behind their hearing peers. Their lagging in performance was seen in mathematics age but they were not as far behind in their literacy levels. This lag in the performance in mathematics may be termed to the deficiency in language and literacy as these are the areas of most apparent concern.

The way, in which language is used in mathematical problems, where it often has very specific meaning could also create problems. The other problem faced by children with hearing impairment in mathematics is the relationship between reading competence and the ability to solve mathematical problems (Pau, 1995).

A number of studies of mathematical attainment in deaf people have demonstrated that they lag behind their hearing contemporaries. The obvious explanation for this is that language is involved in the mental processes underlying mathematical thinking. As internal speech or sub vocalization is a necessary basis for some aspects of mathematical thinking, we would expect that deaf children with poor linguistic abilities should show low levels of mathematical competence and specific difficulties in learning how to do mathematics (Hitch,1978).

Myklebust (1964) conducted a number of empirical studies. He looked at several different aspects of deaf and hearing children's performance including linguistic abilities and literacy, motor activity and problem solving. He argues that lack of access to sound, the intelligence and personality of the deaf develop in qualitatively different ways from that of hearing people. Though they may display similar levels of intellectual competence, the nature and deployment of that intelligence is different.

According to Wood et.al (1992), in reading tests, we found that deaf children tended to try more items than hearing children, and that they made more errors. This poor performance is because deaf children are generally less aware of the state of their own knowledge and abilities. In contemporary jargon, they would have poor 'meta-cognitive skills'.

According to a study conducted by Wood, Wood and Howarth, 1983a;1983b;Wood et al., 1984 , which revealed that hearing children did significantly better than deaf children.

Children with hearing impairment were on an average about three years behind their hearing peers.

The key issues in teaching mathematics reveals that deaf /hearing impaired children's limited language base may prevent them from understanding and developing mathematical language. Other related issues that influenced mathematical development were parental involvement and comprehensive support in the home environment, together with a greater emphasis on the use of mathematical resources and specific strategies for teaching mathematics to deaf/hearing impaired children.

The solution to all the problems faced by children with hearing impairment in mathematics is to create learning environments that are meaningful for children, meet their individual needs and encourage learning in a holistic, equitable and culturally sensitive way.

2.2. Effectiveness of using different teaching strategies and techniques for teaching mathematics

In countries where the highest achievement levels in mathematics occur (Japan, Singapore and Hong Kong) teachers have note moved whole- heartedly into student-centred activity methods. Typically the mathematics lessons in such countries reveal that teachers maintain fairly close control over the learning process, but ensure that all students participate collaboratively in interactive whole-class lessons to solve problems and apply new skills (Sawada 1999).

Effective teachers of mathematics are good at constructing series of lessons that engage their students actively in the curriculum content (Chen, Lee and Stevenson 1993; Stigler, Fernandez and Yosihda 1996). Their lessons are typically clear, accurate and rich in examples and demonstrations of a particular concept, process or strategy. The teacher takes an active role in stimulating students' interest, imparting relevant information and teaching

specific skills, while still providing abundant opportunities for active participation by students.

Rays et al. (1998: 45) indicates that lessons using manipulative materials have a higher probability of producing greater mathematical achievement than do lessons without such materials. Handling the materials appears to help children construct mathematical ideas and retain them.

In a review of interventions reported by Xin and Jetendra (1999) the following approaches proved to be effective in improving students' ability to solve problems:

- Computer-aided instruction (CIA);
- Training in visualisation;
- Metacognitive training;
- Use of manipulatives;
- Use of diagramming;
- Estimating;
- Attending to key words.

Pau (1995: 290) suggests that "It is vital that any teaching programme designed to improve the child's problem-solving level should include general text-comprehension and, in particular, mathematics text-comprehension activities".

A beneficial learning environment encourages and enables children to construct their own meaning out of mathematical problems, because as Haynes (1999: 143) notes "Infants and toddlers learn predominantly through their senses and motor skills, therefore their physical environment is of utmost importance". When children are given responsibility for their own learning, individual styles of learning are catered for and a variety of resources are made available to meet children's individual needs.

Ward and Center (1999) conducted a study to learn the benefits of teaching children with disabilities with structured and direct teaching approach. They found out that a carefully structured and direct teaching approach has been found to facilitate the inclusion of children with disabilities into the mainstream curriculum.

Naray Can Calik (2010) & TevhideKargin (2010) conducted a study on three students with mild intellectual disabilities studying in 2nd Grade and their ages were 7-8 years. They investigated the effectives of touch math technique based on direct instruction approach the results of the study show that the technique-based on direct instruction approach is effective in teaching the basic summation skills to the students with mild intellectual disabilities

Xiao and liu (1996) Effectiveness of individualized instructional material Individualized instructional material Individualized Instruction has better educational outcomes than traditional group instruction.

Hence it could be concluded that, in order for deaf/hearing-impaired children to develop cognitively, particularly in a mathematical sense, the learning environment must have a wide range of meaningful mathematical experiences that are visually engaging and hands-on. Activities should be purposeful and have relevance to everyday life so that they can be experienced in a context other than a purely mathematical one.

Chapter III

Method

3.0. A study of Utility of Teaching Learning Material in the Instruction of Mathematics for Pre-school with Hearing Impairment' was an experimental study. The study was undertaken with the purpose of studying the effectiveness of utilization of teaching learning material in the instruction of mathematics. The method adopted to achieve the objectives is discussed in this chapter. The study was conducted in three phases:

1) To diagnose the errors made by children with hearing impairment in mathematics at pre-school level.
2) To develop appropriate teaching learning material according to the requirement of the children and utilize the already developed teaching learning material.
3) To study the efficacy of the developed and utilized teaching learning material in the performance of the child.

3.1. Participants

Eight children with hearing impairment in the age group of 4.5 to 5.5 years were selected for the present study. The medium of instruction was Hindi. They had

severe to profound hearing loss. All the subjects have undergone one to two years of pre-school training. Random sampling technique was employed .The following was the criteria for selection of subjects.

3.1.1. Inclusion Criteria

- Severe to profound hearing loss.
- Average intelligence
- Hindi as the medium of instruction
- Comprehends Hindi language
- Has been attending pre-school for at least six months and above.
-

3.1.2. Exclusion Criteria

No addition impairment

Furthermore, assessing the utility of TLM for the selected groups of children, they were further divided into two groups; namely the experimental group consisting of four children and the control group consisting of four children. The children in the experimental group was taught using appropriate relevant teaching learning materials whereas children in the control group were taught using minimal teaching material. This grouping of children into experimental group and control group was done to see benefits of using the TLM. The children were grouped on the basis of their score in the diagnostic test.

3.2. Steps in data collection

The study was carried out in three steps.

- To diagnose the errors made by children with hearing impairment in mathematics.

- Developing / utilizing the teaching-learning material to study its utility in the instruction of mathematics.
- Assessing the efficacy of the TLM in the improvement in the performance of the children.

3.2.1. To diagnose the errors made by children with hearing impairment in mathematics, following steps were included.

Selection/ development of a Diagnostic Test: A diagnostics test in mathematics was essential to ascertain the difficulties faced by children in mathematics. For this purpose an already developed and standardized test namely The School Readiness Test (Yathiraj et.al, 2008) was used. This test in mathematics assessed the performance of children in mathematics who are entering into Grade I. This test includes concept like count and write, draw the number of objects against the number, matching the number to the words, more and less, arrange the numbers in sequence (1-9), circle the correct number, colors the shapes, long and short object, light and heavy, tall and small, addition and subtraction.

Baseline Evaluation

The children in the experimental group and the control group were administered with School Readiness Test (Yatiraj, et al 2008). This test served as the diagnostic test for identifying the errors made by the children with hearing impairment in mathematics. This test was considered as the pre-test. This test showed the errors made by both the

groups in mathematics. The results of the pretest showed that children faced difficulty in concepts like short and large, longer and shorter, heavy and light, size and shapes, missing number, big and small, addition and subtraction etc.

3.2.2. Development and utility of the available material (Appendix -1)

The diagnostic test (SRT) revealed the problems faced by both the groups of children in mathematics. Based on the results of the diagnostic test, the errors made by the children were identified and appropriate TLM was shortlisted. Concepts like count and read, draw the number of objects against the number given, match the numbers to the word, more and less, arrange the numbers in sequence, missing numbers, bigger number, circle the correct number, color the shapes, long and short objects, light and heavy objects, addition and subtraction were taught using materials like flash cards, picture charts, pen, pencils, chocolates, beads, pebbles, toys and another real objects which was developed by the researcher. However, few concepts like more and less, missing numbers, addition and subtraction were taught using materials which was available easily and locally. It was ensured by the researcher that there was enough materials for each child to learn and manipulate and learn. Suydam (1984) opines that 'lessons using manipulative materials have a higher probability of producing greater mathematics achievement than do lessons in which such materials are not used. Hence for those concepts where manipulative materials was used was learnt better as compared to those concepts where manipulative materials were used to a limit.

3.2.3. Assessing the efficacy of the TLM in the improvement in the performance of the children.

The developed as well as the selected teaching learning materials was given to the children in the experimental group to learn new concepts and reinforce the already learnt concepts. However, the children in the control group were taught using relatively few materials and the traditional teaching learning material. After learning through the concrete materials and the traditional materials, the children in both the groups were subjected to School Readiness Test (post-test) to see the improvement in their performance after learning through the teaching-learning material.

3.3. Procedure for data collection

Eight children with hearing impairment with severe to profound hearing loss in the age group of 4.5 to 5.5 were selected for the study. These selected children were divided into two groups i.e. the experimental group and control group. Both these groups were subjected to School Readiness Test (Diagnostic Test) to identify the errors made by these children in mathematics. These errors were analyzed and appropriate TLM according to the requirement of each child was developed and utilized. Each of the selected children in both the groups was taught individually. Children in the experimental group were taught every day for duration of 45 minutes for 20 numbers of days. Similarly, the children in the control group were also taught for duration of 45 minutes for 20 numbers of days. At the end of the session, both the groups were again subjected to School Readiness Test (Post-test) to see the improvement in their performance in the diagnostic test

3.4. Data analysis

The data was analyzed using appropriate statistical analysis.

CHAPTER IV

RESULT AND DISCUSSION

4.0. The present study on “A Study of utility of Teaching Learning Material in the Instruction of Mathematics for Pre-schoolchildren with Hearing Impairment” was taken up with the objectives of identifying the errors made by children with hearing impairment in mathematics through School Readiness Test and to study the effectiveness/utilization of the teaching learning material to learn the difficult concepts identified in the School Readiness Test.

4.1. The study was carried out in two parts:

1) Diagnosing the errors made by children with hearing impairment (Diagnostic Test) in the School Readiness Test.

2) Utilizing or developing effective teaching learning material to teach the difficult concepts identified in the diagnostic test.
3) Studying the efficacy of the developed and utilized teaching-learning material in the performance of the child.

For the purpose of diagnosing the errors; a diagnostic test (School Readiness Test) was administered on the selected children with hearing impairment. This diagnostic test served as the Pre-Test. The score obtained by the selected eight children in SRT is given in table no. 4.1.

Table 4.1 Performance of Children with Hearing Impairment on the School Readiness Test.

SI. No.	Details of the children	Marks obtained in SRT (out of 36)
1.	C1	20
2.	C2	24
3.	C3	22
4.	C4	19
5.	C5	15
6.	C6	20
7.	C7	19
8.	C8	21

The above table shows the performance of the children in the SRT. The results revealed that most of the children had problem with concepts in mathematics and require individual teaching. The children were grouped on the basis of their performance in SRT. Those children who scored less and required more individual attention and practice were grouped together and were included in the experimental group and the remaining four children included in the control group.

These eight children were subjected to individual teaching for duration of 45 minutes for 20 sessions. The children in the experimental group were taught using interesting and attractive teaching learning. After teaching the children for 20 sessions of 45 minutes, both the groups were again subjected to SRT to assess the improvement in the children after learning through different materials (either made by

the researcher or modified by the researcher). Table 4.2 shows the performance of the children in School Readiness Test (SRT)

Table 4.2 (4.2a & 4.2b) Performance of Children with Hearing Impairment (Experimental Group and Control Group) on the School Readiness Test (Post-Test)

Table 4.2a Experimental Group

SI. No.	**Details of the children**	**Marks obtained (out of 36)**
1.	C1	29
2.	C2	28
3.	C3	32
4.	C4	33

Table 4.2b Control Group

SI. No.	Details of the children	Mark obtained (out of 36)
1.	C5	24
2.	C6	25
3.	C7	26
4.	C8	23

Both the above tables show that there is an overall improvement in the performance of both the groups after learning through the materials. However, the experimental group showed better performance than the control group because the experimental group was taught with more variety and relevant TLM as compared to the control group. Haynes (1999: 143) states

"Concept-learning should be taught in such a way that children develop the ability to think mathematically and new experiences should allow them to refine their existing knowledge and ideas in constructing new knowledge". The above improvement in the results could be supported by the study of Nathan & McMurchy-Pilkington (1997) which states that the preferred learning styles of the students were visual and hands-on. Many of them preferred activities that involved manipulating equipment and the use of games, describing them as interesting and fun. Students who perceive mathematics in this way will be more engaged in their learning and have a positive attitude towards it. This is seen as a key to improving mathematics achievement for all students (Ministry of Education, 1992). The same could be observed in the present study where in the children were taught using different materials and their concepts were concretized and hence the improvement in the performance of the children.

Descriptive Statistics

The data as further analyzed by doing descriptive statistics. Table4.3.shows mean and standard deviation scores of each concept obtained by the children in the both group groups

Table 4.3 Mean and Standard Deviation of School Readiness Test for Control Group and Experimental Group [Concept wise]

	Groups							
	Control				Experimental			
	N	Mean	Std. Deviation	Median	N	Mean	Std. Deviation	Median
Counting pre	4	2.7500	.50000	3.0000	4	3.0000	.00000	3.0000
Counting post	4	3.0000	.00000	3.0000	4	3.0000	.00000	3.0000
draw pre	4	2.2500	1.50000	3.0000	4	2.5000	1.00000	3.0000

draw post	4	1.5000	1.73205	1.5000	4	1.5000	1.73205	1.5000
match pre	4	.0000	.00000	.0000	4	.0000	.00000	.0000
match post	4	1.0000	2.00000	.0000	4	4.0000	.00000	4.0000
more pre	4	2.0000	.00000	2.0000	4	2.0000	.00000	2.0000
more post	4	1.7500	.50000	2.0000	4	2.0000	.00000	2.0000
sequence pre	4	1.0000	.00000	1.0000	4	.7500	.50000	1.0000
sequence post	4	.7500	.50000	1.0000	4	1.0000	.00000	1.0000
bigger pre	4	2.0000	1.15470	2.0000	4	1.7500	1.50000	2.0000
bigger post	4	3.0000	.00000	3.0000	4	3.0000	.00000	3.0000
missing pre	4	1.7500	.95743	1.5000	4	2.2500	.95743	2.5000
missing post	4	3.0000	.00000	3.0000	4	2.7500	.50000	3.0000
correct pre	4	2.7500	.50000	3.0000	4	3.0000	.00000	3.0000
correct post	4	2.7500	.50000	3.0000	4	3.0000	.00000	3.0000
colour pre	4	1.2500	.95743	1.5000	4	.7500	1.50000	.0000
colour post	4	2.2500	1.70783	2.5000	4	3.7500	.50000	4.0000
long pre	4	5.5000	1.00000	6.0000	4	2.7500	1.89297	3.5000
long post	4	5.5000	1.00000	6.0000	4	5.5000	1.00000	6.0000

solve pre	4	.0000	.00000	.0000	4	.0000	.00000	.0000
solve post	4	.0000	.00000	.0000	4	1.0000	2.00000	.0000
total pre	4	21.2500	2.21736	21.0000	4	18.7500	2.62996	19.5000
total post	4	24.5000	1.29099	24.5000	4	30.5000	2.38048	30.5000

The above table shows the concept wise performance of the children for both the groups. It could be explained that concepts like counting, drawing, matching, more or less and sequencing were already taught and mastered by the children in both the groups. Hence, not much difference in their performance. However concepts like bigger and smaller identifying the colors and the shapes and long, short are difficult cognitive concept and require concrete teaching. The researcher has used lots of concrete items like flash cards, picture charts, toys, pen, pencils and chocolates, beads, pebbles to teach concepts like bigger and smaller, colors and longer and short, missing numbers, addition and subtraction and hence the improvement in the performance of the children in the experimental group. However, slight improvement is also seen in the control group. The present result could be supported by opinion of Clements & McMillen, (1996) which stated that children seem to learn best when learning begins with a concrete representation of a mathematical concept. In fact, it is best to provide children with multiple embodiments of the concept. To provide multiple embodiments, the use of manipulative is essential in all mathematics classrooms. On the similar lines, it could also be reported here that emphasizes on the importance of providing opportunities for practice. Practice contributes significantly to making routine procedures automatic. This results in more efficient execution of a procedure and thus to the

expenditure of less mental effort, (Hiebert, 1990). The same technique of giving more practice to the children was also employed for the present study.

The data was also analyzed for the performance of the children after learning through the materials. Table 4.4 shows the mean and standard deviation for overall performance of the children (Experimental and Control group) in Pre-test and Post-test.

Table 4.4 (4.4-a and 4.4-b) Mean and Standard Deviation for overall performance of the experimental and control group [Pre and Post].

4.4-a Control Group

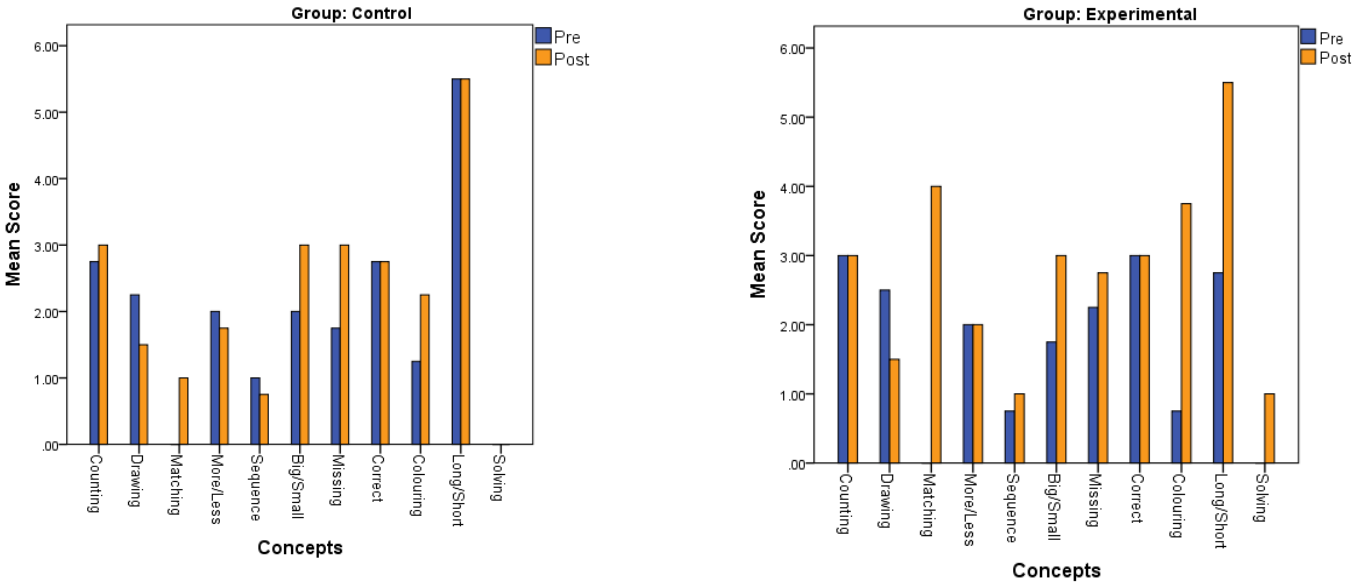
	Mean	**Standard Deviation**
Pre Test	21.25	2.217
Post Test	24.50	1.29

4.4-b Experimental Group

	Mean	**Standard Deviation**
Pre Test	18.75	2.62
Post Test	30.50	2.38

The results in the above table shows (4.4-a and 4.4-b) an overall improvement in the performance of the children in Pre-Test and Post-Test of both control group and experimental group. However, it is quite evident that experimental group has performed much better than the control group the School Readiness Test.

Figure 4.1 Bar Graph showing the performance of children in the control group and experimental group before and after learning through the teaching-learning materials



The above bar diagram for control group clearly shows the performance of the children in the School readiness test (pre and post). It clearly indicates that there is an improvement in the performance in concepts like counting, big/small, missing the numbers and colouring.

Whereas, the performance of the children in the experimental group also showed improvement. Performance in concepts like matching, sequencing and missing improved. However, drastic improvement was seen in concepts like big/small, colouring, long/short and solving. The improvement in the performance in these concepts could be attributed to the usage of concrete and manipulative teaching materials, and the different strategies used by the researcher while teaching these concepts. Marzano et al (2001) summarizes that learning is helped by visual representations giving examples of graph, diagrams and equipments. Similarly, Paivio (1990) describes two ways that the brain receives information, through language and through visual imagery. In mathematics, most teaching situations demand that

pupils engage in both forms of processing information in two ways that learning is most effective.

The present study also utilized the above technique of learning through language and through visual imagery and hence the improvement in the performance of the children

CHAPTER V

SUMMARY AND CONCLUSION

5.0. Mathematics is used on a daily basis throughout our lives. The ability to compute, solve problems and apply concepts and skills in mathematics influences multiple decisions. Keeping the above importance of mathematics in mind, the present study on 'A Study of Utility of Teaching-Learning Material in the Instruction of Mathematics for Pre-school children with Hearing Impairment' was taken up with the objectives of diagnosing the errors made by the children with hearing impairment in mathematics and studying the utility of the developed material in learning mathematics.

5.1. Selection of Participants and Method followed for the study

For the present study, eight children with hearing impairment in the age group of 4.5 to 5.5 years were selected for the present study. The medium of instruction was Hindi. They had severe to profound hearing loss. All the subjects have undergone one to two years of pre-school training. Random sampling technique was employed. These eight children were further divided into two groups namely the experimental group and the control group. Both these groups were administered with a School Readiness test (Yathiraj et. al., 2008) for diagnosing the errors made by these children in mathematics. The results revealed that both the groups of children had problems with mathematical concepts like bigger and smaller, identifying the colours and shapes, long/ short. However, difficulty was also observed in concepts like drawing, sequencing, writing the missing numbers etc.

To overcome these problems, the researcher used different teaching learning materials which were concrete and manipulative to teach the difficult concepts. Both the groups were subjected to individual session for 45 minutes duration for 20 days.

However the only difference was that the control group was taught using more of the traditional method with limited teaching-learning materials and the experimental group was taught using more attractive and interesting teaching-learning materials. The major findings for both the groups after learning through the materials are discussed below:

5.2. Major findings of the study:

a. The mean score of the control group in the pre-test (SRT) is 21.25 and in the post-test is 24.50
b. The mean score of the experimental group in the pre-test (SRT) is 18.75 and the post-test is 30.50.
c. The children in the experimental group performed better in concepts like big/small, write the missing number, counting and coloring

These results show that the developed and the utilized teaching-learning materials were beneficial in bringing about a difference in the learning of the children in the control group and the experimental group.

Hence it could be concluded that students with disabilities and or who struggle to learn mathematics should be actively engaged through the use of the revised mathematics standards, effective instruction, metacognitive strategies, accommodations and technology which serve to improve students achievement in mathematics understandings, concepts and skills.

However the study had few limitations:

1. The study was limited to pre-school children only.
2. The number of participants was restricted to eight only.

3. Due to paucity of time, repetitive teaching was not possible for those concepts which was not mastered by the children
4. The diagnostic test could have been administered on typically developing children to analyze the kind of errors made by them.

Recommendations

1. Instead of utilizing the already available teaching-learning material, new and interesting materials could be made.
2. It could be conducted as a single group design research
3. Children from other pre-school could also be included in the study.

REFERENCES

Conard, R. (1979) the Deaf School Child. London: HMSO.

Cawley et al., J.F., A.M., Leopore, A. ,Sedlak, R. and Althus, V. (1976).Project Math. Tulsa: Educational programs Corp.,

OnitaNakara (1996).Children and Learning Difficulties.Allied Publishers Pvt Ltd. ,

Carbo, Marie. &Dunn, Rita.(1986).Teaching Students to read through their Individual Learning Styles. Silver Arch Books: U.S.A

Durkin, k., Shire.,Reim, R., Crowther, D.R. (1986) 'The social and linguistics context of early number use', British Journal of developmental Psychology 4 (3), 268-288.

Elliot, P. and Garnett, C. (1994) 'Mathematics for all'. In C. Thorton and N.S. Bley (eds) Windows of opportunity: Mathematics for Students with Special needs, Reston, VA: National Council for Mathematics.

Edwards, S. (1998) Managing Effective Teaching of Mathematics. 3-8. London: Paul Champman

Fleischner, J.E.an and Manheimer, M.A. (1997) 'Math intervention for students with learning disabilities: myths and realities', School Psychology review 26, 3: 397- 413.

Gucker, G. (1999) 'Teaching mathematics to students with different learning style', Mathematics Teachers' Journal 49, 1: 39-41.

Harniss, M.K., Carnine, D.W., Silbert, J. and Dixon, R.C. (2002) 'Effective strategies for teaching mathematics'. In E.J. Kameenui and D.C. Simmons (eds) Effectives Teaching Strategies hat accommodate Diverse Lerner (2nd edn), Upper Saddle River, NJ: Merrill-Prentice Hall.

Haynes, M. (1999).The Mathematical world of infant and toddler. In proceedings of the seventh Early Childhood Convocation, Vol 2 (pp. 140-148).

Issues in deaf education , Edited by Susan Gregory, Pamela Knight, Wendy Mckracken, Stephen powers and Linda Watson. , Copyright, David Fulton Publishers Ltd 1998.

Kluwin, T. N. and Moores, D. F. (1989) 'Mathematics achievement of hearing impaired adolescents in different placement', Exceptional children 55 (44), 327-335.

Learning Mathematics in Elementary and Middle Schools, George Cathchart..[et al.] 2nd edition. , Copy right 2001, 2000 by Prentice- Hall, Inc., Upper Saddle River, New Jersey 07458.

Les Staves, 'Mathematics for Children with Severe and Profound Learning Difficulties. , David Fulton Publishers Ltd Ormond House, 26-27 Boswell Street, London, 2001.

Ministry of education.(1992). Mathematics in the New Zealand curriculum. Willington: Learning Media.

Marzeno, R.J., Pickering, D.J. and Pollock, J.E. (2001) Classroom instruction that Works. Alexandria, VA: Association for Curriculum Development.

Myklebust, H. (1964). The Psychology of deafness, Grune and Stratton, New York. Nunes, T. and Moreno, C. (1997a) 'Is hearing impairment cause of difficulty in learning mathematics?' Report to Nuffield Foundation.

Nathan, G. &Murchry-Pilkington, C. (1997, December). Maori developing mathematical power: Empowering through action and reflection. Paper presented at the annual conference of the New Zealand Association for Research in Education, Auckland.

Neyland, J. (1994) Designing the rich mathematical activities. In J. Neyland (Ed.), Mathematics education: A handbook for teachers, Vo 1. (pp. 106-122). Wellington College of Education.(NCERT, 2006), Sri AurobindoMarg, New Delhi 110016 and printed aiSarraswati Printing Press, A-95, Sector -5, NOIDA 201301.

National Curriculum Framework 2005 Position Paper National Focus Group on, 'TeachingOf Mathematics',

Pau, C. S. (1995) 'The deaf child and solving the problems of arithmetic', American Annals of the deaf 140 (3), 287-290.

Peter Westwood. 'Commonsense Methods for Children with Special Educational needs – 4thEdition. , 'Strategies for the Regular Classroom. 'Published by Routledge Falmer New Fetter Lane, London EC4P 4EE. , 2003, 2004.

Paul Chambers., 'Teaching Mathematics Developing as a Reflective Secondary Teacher'. SAGE Publications India Pvt. Ltd B1/I1 Mohan cooperative Industrial Area Mathura Road New Delhi 110044 (2008).

Ray, E. (2001). The Challenges that Deaf /Hearing Impaired Children Encounter.

Secada, W. G. (1984) counting in sign: The Number String, Accuracy and use. Unpublished doctoral dissertation, Enanston, Chicago: North-western university, quoted in Nunes and Moreno (1997a).

Stewart, D.A. and Kluwin. T.N. (2001) Teaching deaf and Hard of Hearing Students: Content, Strategies and curriculum, Boston, MA: Allyn and Bacon.
Wood, D. Wood, H. Griffiths, A. Howarth, I. (1986) Teaching and Talking with Deaf Children. Chichester: Wiley.

Wood, M.H. Modern and the LD child. Academic Therapy, 15, 3, 1980, 279-290.
Wood, D., Wood, H., Howarth, P. (1983) 'Mathematical abilities of deaf school leavers', British journal of Developmental Psychology 1, 67-73.

Wood, D.J., Wood, H.A., and Howarth, S.P. (1993a). Mathematical abilities in deaf school leavers. British Journal of Developmental Psychology, 1 (1), 64-67.

Wood, D.J., Wood, H.A., and Howarth, S.P. (1983a). Language, deafness and mathematical reasoning. In the Acquisition of Symbolic Skills Eds. D.R. Rogers and J.A., Sloboda), Plenum press, New York and London.

Wood, H.A., and Wood, D.J. (1984). An experimental evaluation of the effects of five styles of teacher conversation on the language of hearing impaired children. Journal of child psychology and psychiatry, 25(1), 45-62.

Zweibel, A. and Allen,T. (1988) 'Mathematics achievement of hearing impaired in different educational setting: a cross cultural Perspective', Volta Review 90 (6), 287-