(ISSN: 2455-8001)
Online

Vol 1, No:1-2016

INTERNATIONAL eJOURNAL
Disability Studies
Special Education & Rehabilitation

Use of Taylor frame and Abacus vs Braille Mathematics Code in Learning of Elementary Statistical Concepts by Visually Impaired Students at Secondary level

Dr. Sudeep Kumar Dubey

Designation - Asstt. Professor, Durgabai Deshmukh College of Spl.Edu. (V.I.), University of Delhi.

Introduction

Need for Education and its utility in one's life is obvious, universally and widely accepted. It suffices to say that in the absence of education the men would again go back to primitive era. Our constitutional obligations, whether through National Policy on Education, 1986 or Persons with Disability Act, 1995, emphasize "Education for All" including persons with disability. All mathematical ideas originate from human experience. We took our first shaky steps toward abstract mathematics when as toddlers we learned count. Three cars, three bananas, and three dogs are physical realities that we can see and touch, but 'three' is not a concrete thing. The counting numbers are associated with collections of actual physical objects, but the counting numbers themselves give us our first abstract mathematical structure. We soon learn to add numbers, multiply them, factor them, compare them, and otherwise discover and explore patterns, operations, and relationships among numbers. Numbers and their rich properties illustrate strategy of creating and exploring concepts by starting with real world experiences and isolating features that then become mathematical ideas. When we focus on the idea of measuring quantity in the world, we naturally develop mathematical concepts of number. When we focus on our visual or tactile impressions of the world, we develop geometrical ideas that range from Euclidean geometry to topology. When we isolate ideas of connections, we develop ideas of graph theory. When we analyse patterns and transformations, we find structures that lead to group theory. When we focus on change and motion, we are led to ideas of calculus. Once a mathematical concept has begun its life as an abstraction of reality, then it takes on a reality of its own. We find variations and abstraction of ideas. For example, abstract extensions of the counting numbers include negative numbers, real numbers, and complex numbers. And the relationships and ways of combining counting numbers are extended, varied, or abstracted to accommodate these new classes of numbers.

Mathematics is a challenging subject for blind and visually impaired (BVI) students because it requires specialized instruction to meet their unique accessibility needs. Access to specialized instruction is extremely limited due primarily to a shortage of Teachers of the Visually Impaired (TVI) qualified to teach mathematics.

Talking of mathematics learning we can say that it has the utility value in almost every aspect of human life. Whatever a man does, the practical knowledge of mathematics helps this way or the other. If this is true for all, then how a visually impaired student be left out? One of the most basic features of mathematics is that human beings create it or discover it. Exploring mathematical ideas is an active process. You Will not understand mathematical thought unless you personally participate in mathematical investigations. Is it justified to say that a visually impaired student does not

require to develop his reasoning power, intellectual and disciplinary value, social utility, ethical and character-building capacity through the subject, definitely not? Hence the utility of mathematics is for all. At the same time in reality even today visually impaired students can get exemption from studying mathematics as a subject even up to Xth class as per CBSE norms.

Further the importance of studying mathematics by an individual is accepted by most people as these subjects have a great impact on the way one processes information and perceives the world around. While this is acknowledged in case of seeing students, the students with visual impairment have been given an easy option of exemption of studying these subjects after class VIII or in some states after class X by offering alternative options. This exemption has its own effect on studying mathematics even up to class VIII as the students need not clear these subjects at board level.

The reason could be that in earlier times there were dearth of textbooks and other study materials in Braille or in other accessible format, lack of trained teachers, devices and technology. Schools were allowed to offer Sanskrit and Music in place of Mathematics in class IX and X. With the advent of technology resources are now available but the exemption is still there being followed by most schools under CBSE.

As far as teaching of visually impaired students is concerned, the placement of the students is bifurcated, namely residential and integrated set ups. Accordingly, the present issue related to **'learning of elementary statistical concepts by the visually impaired students'** need to be given proper attention. It is a general practice to omit difficult or visual based mathematical concepts to visually impaired students in the school due to various reasons like lack of time etc. If the students are in residential school, then such omission applies for all. But if the visually impaired students are studying in an integrated set up then this type of omission of concepts, applicable only for visually impaired, has its bad effect on their psychology.

Even if it is not for studying mathematics at higher level the need for learning this subject cannot be undermined. Specially knowledge of statistics and mathematics would trigger analytical thinking and would help students appreciate the role of data, apply to it their own real-life problems or interest area of studies. The role of statistics. The field of education and psychology is increasing day by day. It is essential to have a better understanding of evaluation and measurement. Psychological concepts like, intelligence, attitude, aptitude, personality, and interest can be measured like physical quantities only with the introduction of statistics. And hence the educational performances of the students can be measured objectively. Thus, today a teacher has not only to be well versed with the subject knowledge but also with statistical procedures. Further a visually impaired student may opt for

teaching as his or her profession in future. A teacher's need for learning statistical concepts may be summarized as below:

- To make students' achievements more meaningful.
- To develop scientific temperament among teachers.
- To understand new research-based tests in education and psychology

The present study has the following objectives:

- To study the interest of visually impaired students in mathematics.
- To generate interest among visually impaired students in learning mathematics, especially statistics.
- To find out the methods that might be used to learn statistical concepts by visually impaired students.

Rationale

States in India differ over the issue related to mathematics teaching about standard up to which visually impaired students should be taught. Though the utility of mathematics is universally accepted and the subject is inseparably mixed with one's life, yet we see that the visually impaired students are given exemption from learning mathematics 8th standard onwards. Changed scenario of attitudes, values among the society compel that each visually impaired student has to be educated completely in a real sense. In these conditions how one can escape from one's responsibility of teaching important subjects like mathematics and statistics. At the surface level the exemption may look beneficial for the visually impaired students but otherwise it is, definitely not. Even it restricts one from learning very important subject of every day importance.

Normally a visually impaired student does calculation either on Taylor Frame or in Braille using Nemeth Code for mathematical notations. Statistical problems involve long formulae that are sometimes difficult to remember if one does not have it in writing. Arithmetical calculations are easier on a Taylor frame. It may be a better option to use the combination of both. The present effort tries to study the efficacy of use of Braille mathematics code and mathematical devices like, Taylor frame and abacus in learning elementary statistical concepts by visually impaired students.

Methodology

Review of related mathematics textbooks of middle-class course, applicable for visually impaired students, in Delhi state reveals that elementary statistical concepts are taught only to 8th standard students. It includes graphical presentation of data, tabulation and central tendency (mean only).

The concept of inch centimetre graph was given to the visually impaired subjects so that the graphical presentation of data be clear. X and Y coordinates, required to locate any point on paper, was made understood. It was told that class interval for scores and frequency for number of subjects may be plotted on an axis.

For conducting the present study Single group protest- post-tests design was followed. The group was first assessed with their entry behaviour. The group then was treated with the statistical concepts as they were not taught the same in their regular classroom teaching. A post-tests was conducted on the subjects to measure the efficacy of the treatment. Time taken by the subjects in solving problems by Braille code and Taylor frame were noted.

1. Tools Used

Questionnaire made by the investigator

i. based on elementary statistical concepts
ii. to know the attitude of the subjects towards mathematics, pretest iii. to evaluate the performances after the treatment, posttest iv. to measure the desired change in behaviour

2. Sampling

Sampling is a very important process in any study. It is essential because of many reasons. Any researcher is purposive in sampling at least initially. Later he may adopt randomization etc. In the present study the sampling is purposive. A Senior Secondary school for the Blind in New Delhi was selected for the purpose. Ten students of class nine were selected because they had passed 8th standard and were not taught statistical concepts.

Data Collection

Table 1.1 Answers by the teacher on questionnaire

Q no	1	2	3	4	5	6	7	8	9	10	11	12	13	14

Answers	**yes**	**no**	**Time short, more lessons**	**yes**	**For futur e, teaching**	**Take interest in math**	**Geometry, algebr a**	**Use TLM**	**Rote formula**	**As above**	**yes**	**satisfied**	**Timeless s**	**Lack of time**

Table 1.2 Answers by the subjects on pretest questionnaire

Q.No.	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
1	lecturer	lecturer	-	music	teacher	teacher	business man	-	Music teacher	Not fixed
2	shopping	Daily use	In mark	market	meausrement	Daily life	everywhere		All subject	Plus minus
3	Arithmetic algebra	Arithmetic algeb ra	Arith metic algeb ra	Arithmetic	Arithmetic algeb ra	Arithmetic algeb ra	maths	-	Arithmetic	Arithmetic
4	16 km/h	-	16 km/h	16 km/h	-	-	16 km/h		16 km/h	
5	formula	a+b/2	-	-	Do not know		Do not know		Do not know	a+b/2

6	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
7	Yes	Yes	Yes	-	Yes	Yes	Yes		Yes	Yes
8	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
9	No, time	Left difficult	Do not know	-	No	Yes	No		No	
10	Feel good	Bad	Not happy			Yes			Bad	Neither feeling

Table 1.3 Answers by the subjects on post-test questionnaire

Q.NO.	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
1	yes	yes	-	-	-	yes	yes	-	yes	yes
2	numbers	-	record	-	-	measurement	-	-	yes	
3	yes	yes		yes		yes	yes	-	-	yes
4	yes	yes	yes	yes	yes	yes	yes	-	-	-
5	mean	-	-	-	mean	mean	mean	-	-	-
6	yes	Yes		yes	yes	yes	-	yes	yes	-
7	yes	yes			yes	yes				
8	braille	both	both	both	both	braille	both	both	-	both
9	maybe	yes	yes	yes	yes	-	Can't say	yes		

Table 1.4 Time taken by the subjects while solving problems with the help of Braille
Code

Subject	Answer	Process	Time Taken (in mts)

S1	Right	Right	5.54
S2	Right	Right	5.17
S3	Wrong	Right	7.12
S4	Right	Right	6.26
S5	Right	Right	10.46
S6	Wrong	Wrong	8.37
S7	Right	Right	13.7
S8	Right	Wrong	11.9
S9	Incomplete	Right	13.22
S10	Right	Right	16.35

Table 1.5 Time taken by the subjects while solving problems with Taylor Frame

Subject	Answer	Process		Time Taken (in mts)
S1	Right	Right		4.47
S2	Right	Right		5.02
S3	Wrong	Right		5.48
S4	Right	Right		4.58
S5	Right	Right		7.56

S6	Wrong	Wrong		6.22
S7	Right	Right		10.09
S8	Right	Wrong		9.32
S9	Incomplete	Right		12.2
S10	Right	Right		16.05

Analysis of Questionnaires

It is evident from talking to the teachers that 8th standard NCERT mathematics textbook includes statistical concept but they are not taught to visually impaired students because of lack of time and excess of curriculum. According to the teacher it is needed three times time to teach a visually impaired student as compared to a normal sighted student. He is of the view that if the time permits then elementary and Simple concepts of statistics can be taught with the help of special equipment. The teacher says that visually impaired students take interest in learning mathematics. To teach statistics formulae could be rote memorized, calculations would be easier on Taylor frame and a record could be maintained in Braille.

Generally, students were of the view that mathematics has got its utility value. The knowledge of the subject is useful if someone wants to be a teacher or a businessman. The students had studied arithmetic well but algebra and geometry. They had not even heard the name of statistics though they could calculate mathematical average.
At the same time, they were very keen to learn mathematics and statistics at higher level.

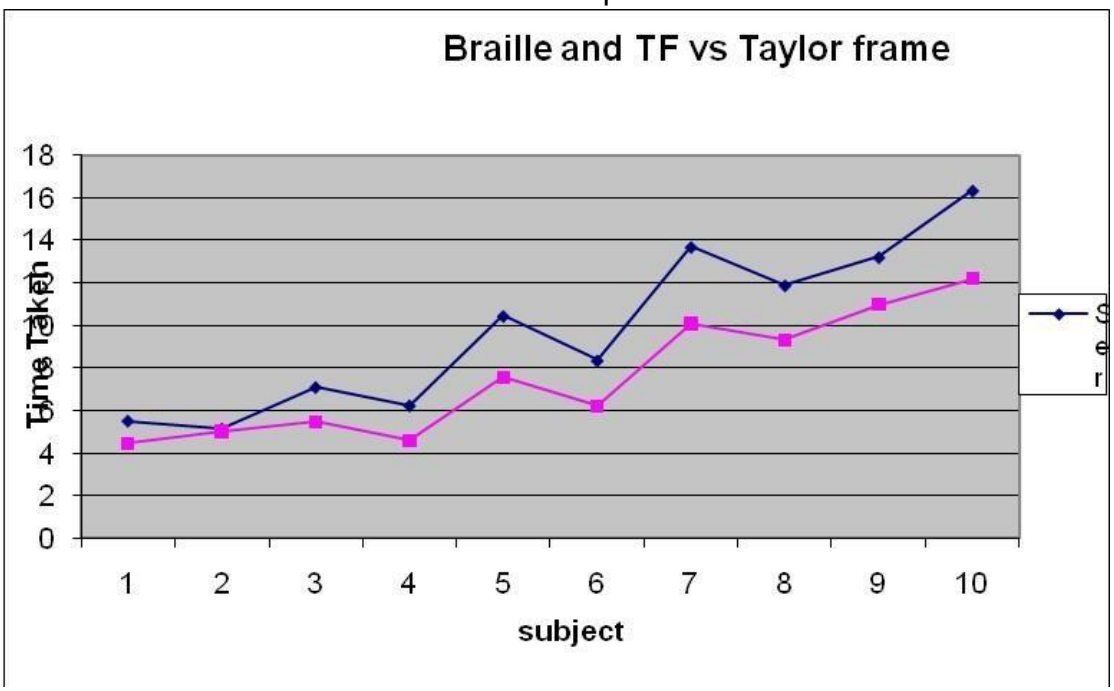
The researcher got motivated to deliver a lecture on why statistics should be learnt, what is its utility in future, due to the interest shown by the students. The students responded very much and became mentally prepared to learn statistics. Thus, the need for statistics learning was established.

Graphical Presentation

Seven out of ten subjects responded correctly the questions related to graphical presentation. The analysis of responses made it clear that the subjects could get the idea of presenting data graphically. One subject was already knowing pictogram etc could reply to most of the questions while one could not even answer the simplest. He was not intending to continue to study mathematics as he was of the view that he would make his future in music or Sanskrit.

Mean

Analysis of post treatment on why statistics should be learnt and its utility eight out of ten student subjects were of the view that a combination of both, Braille slate and Taylor frame would be more beneficial while remaining two favored practicing only on Braille slate. After the preliminary round of lecturing, as above, all the subjects were able to respond to the posttest correctly. Four out of ten subjects were not able to express their understanding of the statistics in words and the main reason for this may be attributed to limited time intervention on the subject. This finding was on the lines with the pretest data gathered through the questionnaire for teachers. The teacher emphasized on the time being limited be one of the reasons for omission of statistical concepts to 8th standard subjects. Finally, we could infer that if the proper time will be made available, using appropriate methods and teaching aids it would be more beneficial to teach such curricular portions.



Findings

The study has been successful since the beliefs that there is no utility of teaching statistics to visually impaired students and there should be no mathematics. The 8th standard onward was not proven true. Shortage of time is a problem to teach the whole curriculum. The understanding of statistical concepts by visually impaired subjects were quite satisfactory. It was found true that

- ★ Every participant was of the view that statistics should be taught to them.
- ★ A combination of Braille code and Taylor frame was more effective in learning statistical concepts by visually impaired students. Nine out of ten subjects were of the same view.

★ Taylor frame could be used as calculating device while formulae etc can be written in Braille.

Annexure 1

Questionnaire for Teachers

1. Does the 8th standard general mathematics curriculum include statistical concepts?
2. Have you taught statistics to 8th std. visually impaired students?
3. If not, why? What difficulties, you think, you will face while teaching the same.
4. Do you think that statistics should be taught to visually impaired students?
5. Do you see any utility of statistics in the future life of the visually impaired?
6. Do visually impaired students take interest in learning mathematics?
7. In which mathematical concepts do you face difficulties in teaching visually impaired students?
8. Do you put some extra effort to tackle these problems of students? 9. What can be done to teach statistics to visually impaired students?
10. Do you believe in omitting some of the mathematical concepts for teaching to visually impaired students?
11. Do students also know that some of the concepts are omitted and not taught to them?
12. Are they satisfied to know this?
13. Do they ask questions regarding this omission?
14. Do you tell them the reason for the omission?

Annexure 2

Questionnaire for Students (Pretest)

1. What would you like to be in the future?
2. What is the utility of learning mathematics?
3. Which branches of mathematics do you study?
4. Mohan goes to place B from A in three hours. In the first hour he travels 15 km, in the second 22 km and in the third 11km. What is his average speed?
5. If the marks awarded to ten students of a class in mathematics are given. How would you calculate the mean?
6. Have you heard the name of statistics?
7. Does your curriculum include statistics?
8. Do you think that statistics should be taught to you?
9. What do you think about why statistics was not taught to you?
10. Are you satisfied with statistics not being taught to you?

Annexure 3

Questionnaire for Students (Posttest)

1. Does statistics have any utility in your future?

2. What do you understand by data?
3. What do you understand by grouped or ungrouped data?
4. Does the member of any group have a tendency to bend towards the central value?
5. What is this tendency called?
6. Can this tendency be measured?
7. Is the mean a measure of central tendency?
8. Which is better, Braille slate or Taylor frame for learning statistics?
9. Is a combination of both more beneficial?

Reference

★ Baroody, Arthur J.; Fostering Early Number Sense. University of Illinois at Urbana-Champaign. A keynote speech presented at the Banff International Conference on Behavioural Science (sponsored by the Centre of Excellence for Early Childhood Development, the Canadian Language & Literacy Research Network, and the Early Childhood Learning Knowledge Centre), Banff, Alberta, March 2008. http://www.excellence earlychildhood.ca/documents/Arthur_BaroodyANG.pdf

★ Clements, D. Sarama, J. Building Blocks. University at Buffalo, State University of NewYorkhttp://www.gse.buffalo.edu/org/buildingblocks/index_2.htm.

★ Fromboluti, C.S. &Rinck, N. (1999). Early Childhood: Where Learning Mathematics Begins. U.S. Department of Education, Office of Educational Research and Improvement, National Institute on Early Childhood Development and Education [On-line] Available: http://www.ed.gov/pubs/EarlyMath/index.html.Liedtke, W.; Aspects of Numeracy in the Primary Years (K-3): Selected Challenges for Teachers; delta-K, Volume 38, Number 1 December 2000

★ Larson, Inez Nemeth. The Use of Nemeth Code in Elementary Mathematics. Alberta.

★ Liedtke, W., Stainton, L.B.; Fostering the Development of Number Sense – Selected Ideas for the Blind (Braille Users); BC Journal of Special Education 1994, Volume 18, No 1

★ Liedtke, W.; Why Should Number Sense be the Focus for Any and All Students? (Let Me Try to Count the Ways); Vector, Fall 2006

★ Liedtke, W., Thom, J.S.; Making Mathematics Meaningful for Young Children: Ages 4 to 7 Nurturing Growth; to be published Fall 2008.

★ Osterhaus, S.A. (2004). Susan's math technology corner: Early Childhood: Where Learning Mathematics Begins. *Division on Visual Impairments Quarterly*, 49(3), 41-47.

★ Texas School for the Blind; Compiled by teachers at Texas School for the

Blind and Visually Impaired. Evaluating Visually Impaired Students Using Alternate Learning Standards Emphasizing the Expanded Core Curriculum Section 3. Basic Math Skills Evaluation table pg. 1031-1035. ★ Agrawal S. (2004) *Teaching Mathematics to Blind Students through Programmed Learning Strategies*.Abhijeet Publications. Delhi.

★ Awad, M and Wise, J (1984) *Mainstreaming Visually Handicapped Students in Mathematics Classes*. Mathematics Teacher, September 1984, 438-441.

★ Cawley, J.F. (1978), *An instructional design in mathematics*. In L. Mann, L.

Goodman, & J.L.