Status of Teaching and Learning Mathematics for Students with Visual Impairment Studying in Inclusive and Special School Settings

VIJAY SHANKAR SHARMA*

Abstract

Mathematics is important for students with visual impairment just like for non-disabled students. Learning of mathematics by visually impaired students is generally considered tough as some of the areas in Mathematics demand vision. Several research studies reveal that visually impaired children can also learn mathematics when they are taught in an appropriate manner. The present paper focuses on a study which was conducted to find out the available provisions of learning mathematics by visually impaired children who are studying mathematics in inclusive as well as special school settings. The paper will put some light on various aspects related to availability of resources, trained human resources, interest and aptitude of visually impaired students towards learning mathematics. The paper also ponders upon the provisions made for making the learning of mathematics accessible for students with visual impairment by various education boards of northern part of India. The paper will also provide a structured format of teaching mathematics to visually impaired students. The paper will sum up by justifying the importance of Mathematics learning for children with vision loss.

* *Associate Professor* and *Head,* Department of Visual Impairment, Faculty of Special Education, D.S.M. National Rehabilitation University, Lucknow

Introduction

Mathematics is important and one of the fundamental learning component in school curriculum and thus considered as an essential component of the curriculum for visually impaired children also. Experts emphasised that learning of mathematics is actually demanding in today's era for learners with vision loss. Mathematics emphasises on logical thinking and the opportunity offered by mathematics helps students to relate theory to practice. Mathematics occupies a very important place in the education of an individual both as a subject of intrinsic value and for its usefulness in daily life.

It would be very difficult that man can lead his life successfully and smoothly without elementary and preliminary knowledge of mathematics. At primary stage of education, especially mathematics as a subject, occupies an even more important place. It is at this stage that foundation is laid for the development of conceptual understanding of mathematics. The importance of mathematics cannot be neglected and overlooked in today's era. It develops mental capabilities such as logical thinking, reasoning power, systematic examination of facts and analytical ability leading to discovery of solution to a problem.

Learning mathematics is considered to be difficult even for the children with vision. It is thought to be a subject involving abstract entities having little resemblances to real objects, which one handles in their daily life. Mathematics has a quality that the applications of simplest mathematical operations have numerous results but if mathematics were merely abstract, it should be easier for visually impaired children to comprehend it because due to the unavailability of unnecessary visual inputs, children with visual impairment are saved from so many unnecessary visual perceptual details. But this is not so by virtue of the development process of concept formation in the child as well as the nature of the concepts and relations involved in learning mathematics. The basic concepts of mathematics are not merely abstract but they are concrete that gives these concepts wide applicability as well as precis meaning. It will never be acceptable to any mathematician if one says that visually impaired children have a different notion or meaning of any concept of mathematics. Learning of mathematical activities should be designed in such an order that the desired learning of the mathematical concepts is not affected for children with visual impairment.

Mastery over mathematical skills by children with visual impairment may be little difficult because of number of reasons related to learner, teacher or transaction of curriculum of mathematics. The visually handicapped are not less competent in this, what is required is not the perception of concrete particular in all its richness but most general (Mani,

1992). Due to primary and secondary implications of visual impairment, students with visual impairment and mathematics teacher teaching them face several problems. (Sharma 2008 and 2009).

Children with vision loss may lack in the incidental experiences, which their sighted counterparts can make use of, therefore, they need successive interactions with basic experiences and suggestions to arrive at the desired intuitive grasp of the concept. One has to put the mathematical learning activities for a visually impaired child in such an order that the desired learning of the concepts is not affected.

The study was conducted in the State of Uttar Pradesh having a total of 5,79,182 persons with visual impairment; out of these, 3,07,821 were males and 2,71,361 were females. The total population of visually impaired persons in Uttar Pradesh comprises of 1,42,921 persons with seeing impairment who belong to the age range of 10 to 19 years, while a total number of 53,560 visually impaired children were of the age range 0 to 4 years and 70,532 were from the age range 5 to 9 years (Census, 2011).

There are total seven schools for the visually impaired students in Uttar Pradesh being run by the Government. In Lucknow and Gorakhpur, two different intermediate colleges are established separately for boys and girls with maximum intake of 200 students in each. In Banda and Meerut, two schools for the visually impaired boys are established with maximum intake of 200 students and in Saharanpur, one school for visually impaired at High School standard is established. All these schools are under direct control of Department of Empowerment of Persons with Disabilities, Government of Uttar Pradesh and have both residential and non-residential facilities for its students (Performance Budget, DoEoPwD, GoUP, 2018).

Rationale of the Study

Mathematics has equal importance for disabled and non-disabled students. As per the exemptions extended by various educational Boards to persons with disabilities, students are permitted to choose four subjects from the list of subjects in addition to one language. Due to various reasons, in most of the schools, students with visual impairment do not choose mathematics as one of their subjects. Considering the importance of mathematics, it is essential to know the status of mathematics teaching and learning for visually impaired students studying in inclusive and special schools. Hence, the present study was carried out.

Objectives of the Study

The study was planned to attain the following objectives:

1. To study the present status of mathematics teaching in special and inclusive schools for visually impaired children.

2. To study the mathematical aptitude of children with vision loss.
3. To study the availability of various resources for teaching and learning of mathematics by visually impaired children.
4. To identify the problems encountered in curriculum transaction of mathematics learning to children with visual impairment.
5. To suggest various measures to provide structured format of teaching and learning of mathematics to visually impaired students.

Delimitations of the Study

The following were the delimitations of the study:

1. There are several subjects available for students with visual impairment but the present study was delimited to teaching-learning of mathematics only.
2. The study was delimited to only those inclusive schools where at least five visually impaired students were enrolled.

Sample and Sampling Procedure

Usefulness of any research work depends on selection of a good sample. Population in the present study is very limited; hence, purposive sampling procedure was adopted for selecting the sample. The study was carried out in 7 special schools for the visually impaired students and 7 inclusive schools.

The preliminary data was collected about the teacher teaching the visually impaired children both in special schools and in integrated schools. The study was carried out on sample size of 100 teachers. Out of these, 50 special education teachers were teaching in special schools for the visually impaired students and 50 teachers were teaching mathematics in inclusive schools, where visually impaired students were enrolled. Another sample of 100 visually impaired students was selected in which 80 students of Class VI to VIII were enrolled in special schools for the visually impaired and rest 20 visually impaired students were from inclusive schools. The sample of visually impaired students was further divided into 50 per cent boys and 50 per cent girls in each setting.

Hypothesis

Since this study was aimed at problem identification during mathematics teaching and learning to visually impaired children, it was hypothesised that the teachers do not face any problems in teaching and learning mathematics to visually impaired children. It was further hypothesised that adequate resources are available in the schools for teaching and learning mathematics for students with visual impairment.

Tools

The following tools were used in this study:

1. Preliminary Data Blank was developed in order to collect the

basic personal information like age, sex, qualification, experience of the teachers, visually impaired students, availability of resources, etc.

2. A questionnaire was constructed by the investigator to identify the problems faced by mathematics teachers of visually impaired children as standardised tools could not be found for this purpose. This questionnaire consisted of 60 items, out of which 10 required descriptive answers and the balance 50 had three options each. These were discussed in detail with experts in the field and on the basis of these discussion 20 items, found not very relevant were dropped. Hence, the final questionnaire consisted of 40 items.
3. Another questionnaire was designed to know the responses of visually impaired students studying in special schools and inclusive schools about their mathematical aptitude, availability of resources, etc. This tool consisted of 20 questions including 6 open-ended type questions. This tool was also sent to subject experts and content validity was established based on the suggestions provided by the experts. Experts found all the 20 items relevant and provided few suggestions on the syntax, which were incorporated before applying the same.

Data Collection Procedure

Personal information about the mathematics teachers working both in special and integrated education programmes was collected with the help of personal data blank in the first phase. After collecting preliminary data, the questionnaire for the study regarding the problems of mathematics teachers, was distributed to teachers selected as sample from special schools for the visually impaired in the second phase. In the third phase, questionnaires were given to the sample consisting of visually impaired students of classes sixth to eighth. The investigator collected the filled-in questionnaires personally and with the help of research scholars. For visually impaired teachers, the questionnaire was transcribed in Braille script.

Statistical Techniques

Quantitative analysis of the data was done using descriptive statistical techniques to draw inferences.

Discussion

Majority of the teachers of visually impaired students (85%, i.e., 68 teachers out of 80) teaching various subjects in special schools expressed that the major problem in teaching mathematics to visually impaired children was lack of resources and other facilities necessary for teaching this subject. The visually impaired children have their mathematics textbook in Braille but all the mathematical concepts were not

properly transcribed in Braille. The concepts related to geometry and other concepts where vision is needed to understand are also not transcribed in tactile form. 65 per cent of the teachers, i.e., 52 teachers of visually impaired students informed that they use only Taylor Frame and Abacus to teach mathematics while only 5 per cent of such teachers informed that they emphasis Braille slate and mathematics Braille notations for practicing mathematical calculations by visually impaired students. Surprisingly, none of the teachers teaching visually impaired students in special schools used new geometry kits to teach geometrical concepts to students with visual impairment. The teachers teaching visually impaired students in inclusive schools were of a different notion about teaching-learning mathematics by students with visual impairment. Nineteen teachers out of 20, i.e., 95 per cent responded that students with visual impairment will not be able to understand mathematics at senior secondary and further levels due to unavailability of adequate aids and appliances to teach mathematical concepts. This results in problematic situation for students with vision loss, as even if they try to make efforts, they get discouraged. Similar findings came out through the research conducted by Frances (2006). The present study is in line with previous studies of Pushpa (1996) and Kalaiselvi (1985) who both reported that mathematics teachers of visually impaired children face problems of shortage of Braille material and special equipment. 70 per cent of the teachers teaching in inclusive schools expressed that time specified for teaching mathematics to visually impaired children for one period is not sufficient as they are more engaged with students with sight in the classroom and unable to manage time during teaching concepts where visually impaired students are also engaged with their sighted counterparts. However, more than half such teachers reported that they use peer support in such situations. Such teachers emphasised on giving extra time in one period for teaching mathematics to visually impaired children. This finding is very important so far as the promotion of teaching this subject is concerned. The provision of additional time will help these teachers pay more attention on teaching this subject. Only 5 teachers, i.e., 6.25 per cent from the special schools had qualifications to teach mathematics at senior secondary level. The teachers' training institutes consider graduation with 50 per cent marks as minimum qualification for admission in B.Ed. Special Education-Visual Impairment degree and very less number of students, who studied mathematics up to Graduation level, are opting for this course.

Surprisingly, the teachers (80%) teaching mathematics in inclusive schools, although not all stated that there are some areas in the mathematics curriculum which

visually impaired children may not be able to learn correctly as it required vision essentially. They also reported that the curriculum needs certain modifications, however, 30 per cent of the respondent teachers expressed opposite views on this regard and said modifications should not be made. This is contrary to all the previously available studies, where it has strongly advocated that the curriculum needs no change. Findings of studies conducted by Stanley (2008), Sharma (2012) and Andrea (2014) also revealed the need of adaptation and development of new and need based material for use among these children for teaching some spatial concepts.

Majority of the teachers reported that the major problem in promoting teaching of this subject in both special schools as well as in integrated programmes is the exemption, which the visually impaired children enjoy and opt for other subjects in place of mathematics in secondary classes. Due to this, on one hand children do not take any interest, the teachers on the other hand, do not want to take pain in teaching this subject even at the secondary level. This is perhaps the reason that few teachers mentioning that some areas in the mathematics curriculum need modification or omission.

Teachers of inclusive and special schools have given another important observation that the parents of the visually impaired children were not supportive enough in making their wards to learn mathematics. This is perhaps because of the fact that parents, in the absence of objective understanding of the restrictions imposed by visual impairment, do not realise the importance of this subject and they are unaware of the capabilities of their child.

Visually impaired students (66) of special schools, i.e., 88 per cent of the sample reported that they are not interested to learn mathematics in their senior secondary classes and the rest, 12 per cent, i.e., 9 students were of the view that if good mathematics teachers, mathematics Braille books and aids and appliances, other than Taylor Frame and Abacus, are provided to them, they want to continue studying mathematics even at senior classes. This is a very positive sign where students want to continue their learning of mathematics at higher level if appropriate teaching methodology is used. Students who were studying in inclusive schools also were of the opinion that they will continue their mathematics learning at higher secondary level as their sighted peers support them.

None of the schools, whether special schools or inclusive schools, had Brailler with them and thus students do not know about the functioning of Brailler in writing mathematical equations or problems. All the seven special schools for the visually impaired and seven inclusive schools were using Braille slates, Taylor frames and abacus for

teaching and learning of mathematics for students with visual impairment.

On the basis of findings of the present study, it is narrated that both the hypotheses are rejected. The findings reveal that the teachers and students with visual impairment face several problems in teaching and learning of mathematics. It is also revealed that adequate resources are not available in the schools for teaching and learning of mathematics to students with visual impairment.

Conclusion

Children who are blind or have low vision can easily understand and learn mathematics like any other child with sight; what they need is a teacher who understands their needs, plans teaching of his/her mathematics lessons accordingly and learning resources should be made available to them. Students with visual impairment may need special assistance in understanding mathematics about what is being taught in the class. Their peers, teachers and senior students can help them in proper understanding of the concepts. Teachers should make such programmes so that sighted peer group can be sensitised. This includes knowledge of difficulties faced due to visual disability and also training in the use of various aids, appliances and Braille. Prior to this, provisions should be made to study mathematics at senior secondary or higher levels among interested students and for those who have mathematical learning aptitude. This can be initiated on trial basis. To sum up, it can be drawn that the child with visual impairment can understand all the mathematical concepts. The only requirement is to make efforts for making it easier for learning mathematics among children with visual impairment.

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