



Struggles of Children with Visual Impairment in Learning Mathematics in Varanasi

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Abstract

Mathematics is an essential component of the curriculum for both visually impaired and sighted children. Learning mathematics is considered a difficult subject for visually impaired children because of the abstract nature of mathematics. The present paper explores visually impaired children's struggles in learning mathematics at the upper primary level in Varanasi city. Qualitative research was used to explore the challenges of learning mathematics for visually impaired children. Semi-structured interviews were conducted with 13 visually impaired children. A case study of 13 visually impaired children was done. In the present study, 13 visually impaired children of class VIII studying in the blind school of Varanasi city constituted the sample of the study. The interview was audio-recorded. After this, data analysis was done. First, data were transcribed, after transcribing, coding was done, and then themes were created. The study, revealed that visually impaired children struggled in learning mathematics, such as a lack of interest and motivation, lack of skilled professional mathematics teacher, lack of equipment and resources for studying, the curricula are not according to the behaviours of teachers, lack of human resources are outlined as the findings. Visually impaired children studying mathematics are to be encouraged by teachers with appropriate facilities and employment of skillful professional mathematics teachers can ensure quality education for these children.

Keywords: Learning of mathematics, struggles, varanasi city, visually impaired children

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Introduction

The Kothari Commission (1964-1966) has recommended "Science and Mathematics should be taught as a compulsory subject to all students during the first ten years of schooling". Thus, knowledge of mathematics should be an important part of any curriculum. Vision is an important sense organ for knowing the beauty of the world. Challenges of teaching mathematics and science for the visually impaired children are also experienced elsewhere (Design Science 2011; Texas School for the blind, 2007). Blind learners depend on other sense organs such as touch and hearing. Science and mathematics education are easily accessible for normal children but less accessible for visually impaired children because many mathematical concepts cannot be explored by touch, and many mathematical concepts are presented graphically (Design Science 2011; Kalra et al, 2009; Maguvhe 2005, Sahin & Yorek 2009). The data from the International Agency for the Prevention of Blindness (IAPB) indicate that around 1.1 billion people are visually

impaired from moderate to total blindness in 2020. Out of these, 88 million people belong to the school-age range. The global prevalence is estimated to increase to 1.7 billion in 2050. Visually impaired children face various struggles in learning mathematics (Sahasrabudhe & Palvia, 2013; Smith and Smothers, 2012). Thus, visually impaired children face various struggles in solving mathematics problems. Mathematics plays an equal importance for disabled and non-disabled children. (Xaueyar Resource Centre for the visually challenged, 2013).

In the present time, the percentage of visually impaired children studying math and science until class 10th is negligible. Various types of problems are experienced elsewhere while teaching mathematics and science to the visually impaired children. (Design Science 2011; Texas School for the Blind and Visually Impaired 2007).

Science and mathematics education are easily accessible for normal children but not for visually impaired children because many concepts of mathematics and science cannot



be explored by touch (Design Science 2011; Kalra et al 2009, Maguvhe 2005, Sahin & Yorek 2009).

Visually impaired children face different types of problems while solving mathematical problems, such as understanding the solution of a mathematical problem (Dheesha, 2022) Bayram, et al. (2015) conducted a study to know the barriers faced by visually impaired students learning mathematics in inclusive classrooms in Turkey. During this study, the investigator revealed that mathematics teachers' negative attitude towards inclusive education.

Hayes, C. & Proulx, M. (2023) conducted a study to remove the difficulties to science and mathematics education for children with visual impairments. The investigator revealed that hands-on experience and increased lesson time facilitate is usually impairments learning of mathematics and science Vandana and Anshu Singla (2022) reviewed the present status and challenges for visually impaired children in the fields of mathematics. During this study, the investigator revealed that less amount of study has been performed on mathematics education for the visually impaired children.

Mathematics is a subject of specific patterns and structure. It is about logical analysis, deduction, calculation within these patterns and structures. It provides a solid foundation to many aspects of daily life and to give a comprehension of the complexities inherent in apparently quite simple situations. Mathematics could also develop clarity and staying power. It plays a crucial role in everyday life. Mathematical knowledge and skills are essential for everyone in today's computer era.

Mathematics applies directly to abstractions. Every concept in mathematics is abstract in nature. In addition, it is a well-known fact that many students have negative attitude towards mathematics. They feel that the subject is difficult to understand and learn. Singaravelu (2008) found in his study that invariably around 25% of the students are getting low marks in every class in mathematics. It becomes even more challenging for children with visual impairment. The possibility of learning mathematics by visually challenged children is often questioned by highlighting some of the areas in mathematics, which demand vision. Vision loss affects the whole process of information gathering. The visually impaired learners rely on sequential observations, i.e., only part of an object can be seen or felt at a time, and the entire image is built up out of the components. The level of cognition needed for integration of sequential information is higher than that needed for concept formation through immediate visual perception. Even sighted students need to use special tools and techniques to help them translate information on a page into an internal visualization. For visually impaired students, these tools and techniques are just a little different. To ensure effective teaching, adaptations in accordance with students' needs are required in education. Adaptations planning, differentiation of teaching methods, arrangement of content and arrangement of evaluation (Spencer, 1998; Wood, 1999 as quoted by Calik & Kargin, 2010). In ideal situation, teaching-learning process must be based upon the principles of individual differences, utility of creativity and constructive power, relevancy with life, knowledge of culture and civilization, inter-relationship of play and work activities and real-life experiences.

The study of mathematics can satisfy a wide range of interests and abilities. It develops the imagination. It trains in clear and logical thought. It is a challenge, with varieties of difficult ideas and unsolved problems, because it deals with the questions arising from complicated structures. The role of teacher can never be neglected in teaching learning process. Even teacher is the medium of transaction of knowledge and no one is deprived to gain it and never should be. In mathematics learning process, teacher is not only a guide to handle the mathematical problems; it is also a stress-shooter who inculcates the quality of patience, keenness to systematically proceed in the child.

Need of the Study

Vision loss affects the mathematical learning of visually challenged children. However, it does not affect their will to learn Mathematics. As Tripathi (2007) found that, "The lack of vision does not affect the aspiration level of visually impaired students. They have a positive attitude towards mathematics learning. 80% (48 students) accepted that mathematics must be taught as a compulsory subject and 100% students agreed that mathematics is necessary for overall development. The problem in learning mathematics is partly due to a lack of sight. Most of the problems are related to inappropriate teaching methods, unavailability of teaching learning materials and equipment. Although there have been relatively few studies of Math learning by students who are blind, there is general recognition that these students face significant challenges in learning mathematics. Sharma (2009) quoted that "the teacher expressed that the time specified for teaching mathematics to visually impaired children for one period is not sufficient. There are some areas in the mathematics curriculum, which the visually impaired children may not be able to learn correctly". The visually impaired students face problem in mathematics learning due to a lack of pre requisite skill of handling mathematics devices and the unavailability of trained teachers. Kumari (1996) found in her study that Teachers are not acquainted with the proper methods and adapted materials of teaching mathematics to visually handicapped children. If the properly adapted materials are used in teaching visually handicapped children, then they can also perform at par with the sighted children. A teacher is the medium of transaction of knowledge. Role of a mathematics teacher of students with visual impairment is essential as well as challenging. Thus, the significance of knowing their views can never be neglected.

Research Question

Based on the above study, the following question is framed-
What are the challenges faced by visually impaired children in learning mathematics?

Objective

Based on research question, the following objective was framed:

To assess the challenges faced by visually impaired children in learning of mathematics.

Methods

In the present study, qualitative research with a case study

design was used to determine the challenges faced by visually impaired children in learning mathematics. A case study is a detailed and in-depth analysis of an activity, event, or process (Creswell 2008; 476, David & Sutton 2011; 165). A semi-structured interview was constructed to collect qualitative data to know the challenges faced by visually impaired children studying in class VIII of a special school. Semi-structured interview question were constructed by the investigator in lens of literature review and this tool was validated through experts opinion of the faculty of education, Kamchha, BHU, Varanasi. Data were collected from 13 visually impaired children studying in class VIIIth of the Blind School of Varanasi city.

Sample and Sampling Techniques

In the present study, 13 visually impaired children of class VIII of the blind school in Varanasi city were constituted as the sample of the study. Purposive sampling techniques was used to select the sample.

Tools and Procedure

In this case, study, a semi-structured interview was used to collect data. Semi-structured interviews were adopted alternately for each visually impaired child. The time period of interviews was 20 to 30 minutes via face-to-face audio recording. The important question has been assessed by two experts.

Data Analysis

After collecting the data, a written format was prepared for the collected data. The investigator read it to develop the understanding of data. The written format has been divided into different parts. The coding process of Creswell was followed. Summarize the different parts of the written format, and codes were developed.

After this, the number of coding was decreased.

After this, based on coding, themes were developed.

Delimitation of the Study

This study was delimited to the teaching and learning of mathematics of visually impaired children of class VIII studying in a blind school of Varanasi city, India.

Result

In the present study, the results were described in different categories. Such as personal barrier from the VI students' perspective, barriers related to the curriculum; barriers related to environmental and learning media, and barriers related to Human resources education and supporting staff.

Table 1: Personal Barrier from the Grade VI Children's Perspective

VI Children's Perspective (minor codes)	Percentage
Lack of confidence in their mathematical abilities	65.2
Lack of self-efficacy in their mathematical abilities	56.5
Lack of attention in their mathematical abilities	45.4
Illness	52.1

Based on the table, it is clear that most of the visually

impaired children have lack of confidence in their mathematical abilities, majority of the visually impaired children have lack of self-efficacy and illness in learning of mathematics. In the same way, it was also found that visually impaired children have lack of attention in learning of mathematics.

Table 2: Barriers related to curriculum form VI children's perspective

VI Children Perspective (Minor codes)	Percentage
Availability of curricula is not according to their needs	88.9
Curricula is not interesting	78.9

Based on table 2, it is clear that majority of visually impaired children said that availability of curricula is not according to their needs and curricula is not interesting.

Table 3: Barriers related to Environmental and Learning media

VI Children Perspective (minor codes)	Percentage
Lack of learning media and resources	89.9
Learning materials is not easy to use	73.4
Lack of communication skills	76.8
Lack of accessible environment	63.8

Based on Table 3, it is clear that most of the visually impaired children have lack of learning media and resources, lack of communication skills and learning material is not easy to use. Majority of the visually impaired children have lack of accessible environment.

Table 4: Barriers related to Human Resources

VI Children Perspective (minor codes)	Percentage
Ignored by teacher in class while studying	68.3
Lack of the skillful staff to assist visually impaired children	79.8

Based on table 4, it is clear that teachers in class while studying, and lack of skilled staff to assist visually impaired children ignore the majority of visually impaired children.

Discussion

In the present study, a case study was used to examine the struggles of visually impaired children in learning mathematics. From the findings of the study, visually impaired children have lack of self-efficacy in their mathematical abilities, self-efficacy is most important for understanding mathematics learning because self efficacy affects students involvement, effort and academic achievement (Klassen & Usher, 2021). Visually impaired children are ignored by the teachers in class while studying and also lack of the skillful staff to assist visually impaired children. Special education needs to establish a good relationship between learners during learning activities, thus students feel relaxed and enjoy the learning process (Brooker & Lim, 2018; Cheung et al., 2017). Availability of curricula is not according to their needs, and curricula are not interesting. It means curricula are not prepared according to their abilities, other barriers such as a lack of learning media and resources, and learning materials

are is not easy to use. Lack of communication skills, lack of accessible environment, visually impaired children's hands-on activity because the brain's ability can process information optimally when many senses are involved (Shams & Seitz, 2008). Multi-sensory media in mathematics learning, such as tactile media can be useful for visually impaired children (Hayer & Proulx, 2023). Finally, this research not only helps researchers understand the barrier of visually impaired children in learning mathematics but also points out unmet needs as an opportunity for future research and design.

Discussions in the foregoing section have shown that teachers have a positive viewpoint regarding the possibility of mathematics learning among visually challenged students. Mathematics has been considered as a compulsory subject, which enables visually challenged children to face all odds of life. No doubt, the positive attitude of teachers would be beneficial, but along with this positivity, some more efforts will be required to fulfill the aims of mathematics education. There is an urgent need to arrange more training programs for the teachers to enhance skills in using mathematical devices, mathematical Braille codes, etc. Individualized Mathematics teaching is required to make mathematics an easy and interesting subject for visually challenged children.

Conclusion

In this study, the investigator identified visually impaired children's barriers in learning of mathematics such as lack of confidence in their mathematical abilities, lack of self-efficacy in their mathematical abilities, illness, lack of attention in their mathematical abilities, availability of curricula is not according to their needs, curricula is not interesting, lack of learning media and resources, learning material is not easy to use, lack of communication skills, lack of accessible environment, ignored by teacher or special education in class while studying, lack of skillful staff to assist visually impaired children.

The schools for the blind may provide appropriate learning materials to such visually impaired children, and curricula may be developed with special focus on these children's capabilities.

The possibility of learning mathematics by visually challenged children (VCC) is often questioned by highlighting some of the areas in mathematics that demand vision. However, the fact is that many such visual ideas can be converted into non-visual ideas. The efficient teachers can make mathematics easily accessible to visually challenged children.

Implications

Continuous motivation and patience of teachers, which will be reflected in prospective students, are essential ingredients in the teaching-learning process of any subject, including mathematics. 90% of teachers suggested that there must be proper arrangements for seminars, workshops, mentor visits, group discussions, quiz competitions, and practices.

Lack of trained teachers and equipment is the main reason for the dismal status of mathematics teaching. Teachers must be well acquainted with mathematical concepts, modern technology, knowledge of the abacus, Taylor frame, geokits, Braille codes, etc. All (100%) teachers demanded in-

service training to equip them with essential knowledge and skills.

Need to make teaching as per students' needs, interests, and level, to move from simple to complex, to improve tactile and audio, and a practical approach of teaching. 80% teachers agreed that teachers must be sufficiently skilled to develop interest at the pre-primary level towards math, efficient in curriculum adaptation, development of teaching learning materials at the primary level, improve tactile power of students, oral numbers, clear concept of unit, tens, and tactile power development, and increase logical power by using stories, practical facts, and directions. There is an urgent need to make available books in Braille and in large print, knowledge of Braille symbols, and preparation of TIM by teachers. Training must be arranged to teach the proper use of mathematical aids and appliances.

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Conflict of Interest

The author declares that there is no conflict of interest.

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