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### Teaching Mathematics to Children with Visual Impairments at Specialized Boarding Schools

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#### Abstract:

The article discusses how to teach mathematics to children with visual impairments at school. When selecting methods of work and the experience of specialized boarding schools for visually impaired children, it is important to take into considerations of creating a safe and barrier-free environment that can contribute to the formation of mathematical knowledge of children with the help of various visual aids such as counting sticks, abacus, three-dimensional figures, arithmetic boxes, subject pictures and relief-graphic aids. With the help of these techniques, children can develop the ability for mental operations, clarify the idea of objective and spatial images in mathematics (size, shape, number of objects, spatial arrangement and drawing and measuring actions), and help form visual and tactile memory.

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#### Introduction

When teaching the blind and visually impaired children at specialized boarding schools, it is important for educators to differentiate between blind and low vision students. The educational definition of visually impaired considers the extent to which a child's vision affects learning and makes special methods and materials necessary (Hergarty 1993). A blind student is totally without sight or has so little vision that he/she learns primarily through other senses. Most use their sense of touch to read Braille. A low vision student on the other hand is able to learn through the visual channel and generally learns print. The learning process of visually impaired schoolchildren is influenced by the lack of sensory experience, which occurs due to difficulties in spatial orientation, and is also associated with reduced perception.

## Materials and Methods

Visually impaired students obtain most of their information through the senses of hearing, touch and smell. As such, children need to develop listening skills systematically. Hergarty (1992) claims that this is an important component of the educational program for the visually impaired children. Herward and Orlansky (1988) note “Blind people are not gifted with an extra ordinary sense of touch; rather they may learn to use their sense of touch to gain information about the environment”. However, Socks (1992: 140) says that blind people who read braille that the reading finger has an exceptionally large representation in the tactile parts of the cerebral cortex. One would suspect that the tactile (and auditory) parts of the cortex are enlarged in the blind and may even extend to what is normally the visual cortex.....It seems likely that such a differentiation of cerebral development would follow the early loss of a sense and the compensatory enhancement of other senses. Jackson (2002) says that the blind mathematician, Morin’s blindness may have enhanced his extraordinary visualization ability. He says Morin noted that “disabilities like blindness reinforce one’s deficits, so there are more dramatic contrasts in disabled people” (Jackson 2002:1248). From the way the blind go about their daily tasks, one would concur with Socks and Jackson that the loss of sight seems to have enhanced other senses like touch, feeling and smell. Jackson (2002) reports that the French believe that it was the mathematician Lebesgue who suggested to the blind mathematician Louis Antoine that he should study two- and three-dimensional topology partly because “in such a study, the eyes of the spirit and the habit of concentration replace the lost vision”.

According to Gearheart and Gearheart (1988), early professionals who realised that the visually impaired children could be educated together with their sighted peers with only minor modifications and adaptation and that the limitations imposed by visual disability did not require a special curriculum. So the visually impaired follow the same curriculum as their sighted colleagues, but do need compensatory skills, what Gearheart et al (1988: 161) call “plus factors”.

Blind students use Braille, which is a system of reading and writing in which letters, words, numbers and other systems are made from arrangements of raised dots, developed by Louis Braille in 1830 who was blind (Herward et al, 1988). Braille is complex; it is like some form of shorthand. Abbreviations called ‘contractions’ help to save space and permit faster reading and writing. They say the regular classroom teacher is not expected to learn braille, but many find it helpful and interesting to do so.

However, in this article, we aim to discuss how to teach mathematics to children with visual impairments at school. Why do the students with visual impairments have to learn mathematics?

According to Paling (1982), the students with visual impairments have to learn mathematics because of the reasons as follows: “We see mathematics as a way of finding answers to problems; a way in which we use information; use our knowledge of numbers, shapes and measures; use our ability to calculate and , most important, think for ourselves in seeing and using relationships”. Thus the visual impaired students need to develop, as far as possible, the ability to think for themselves in acquiring the mathematical knowledge and skills that are passed on to each child in school.

When selecting methods of work and the experience of specialized boarding schools for visually impaired children, it is important to take into considerations of creating a safe and barrier-free environment that can contribute to the formation of mathematical knowledge of children with the help of various visual aids such as counting sticks, abacus, three-dimensional figures, arithmetic boxes, subject pictures and relief-graphic aids. With the help of these techniques, children can develop the ability for mental operations, clarify the idea of objective and spatial images in mathematics (size,

shape, number of objects, spatial arrangement and drawing and measuring actions), and help form visual and tactile memory.

In order for the training to be effective, it is necessary to correct the subject-practical activity through the use of various visual aids. Teaching children with low vision is possible both in specialized boarding schools and in separate classes of general education schools. When teaching in public schools, it is necessary to create special conditions, appropriate for the needs of the children. First of all, it concerns lighting in classrooms. It is necessary to have special textbooks, typhlotechnical teaching aids. The staff of the educational institution should have a typhlopedagogue, a typhlopsychologist.

Tiflopedagogue - a teacher who helps to implement or implements educational process, education, performs polytechnic and labor training of blind and visually impaired children and adolescents based on knowledge of their cognitive activity, also compensates for impaired (underdeveloped) functions. Correction of the educational process in a mass school should be carried out to the same extent as in a specialized boarding school.

In the process of implementation of correctional and pedagogical work, it is necessary to use special methods, forms, means of training and education, which are aimed at correcting the shortcomings of cognitive activity, personal characteristics, and motor development of children. Particular attention should be paid to compensating for underdeveloped functions in children with low vision.

If it is necessary, the training period for visually impaired children can be extended, since the perception of educational material takes more time. In addition, with visual impairment, various corrective exercises are recommended for children. Physical therapy classes are necessary for general physical development. Classes aimed at improving social, domestic and spatial orientation. Classes with a speech therapist for the correction of speech disorders, as well as with a typhlopedagogue for the development of visual perception. The specialized schools for blind and visually impaired children have been created, where correction is carried out in full, taking into account the characteristics of children.

## Results and Discussions

In the process of teaching mathematics, the teacher needs to use methodological techniques, as a result of which the child will form knowledge, corresponding to program requirements and will contribute to the mental development of a child with impaired vision.

The experience of specialized schools for visually impaired children can be useful. The lack of development of sensory experience is one of the main difficulties in the study of mathematics. The formation of the sensory experience of visually impaired children is possible only with corrective and pedagogical influence.

The development of blindness compensation processes is due to the strengthening of the functions of intact analyzers, namely hearing and touch. Therefore, speech plays an important compensatory role. With the help of speech in the mind of the child, connections are created and strengthened between the word and the action. This is necessary for the complex development of children with reduced vision, because of which the broken connections with their environment are restored.

When forming spatial representations, first of all, it is necessary achieve the implementation of the principle of visibility. Ushinsky K.D. distinguishes two stages of visualization in the learning process. The primary stage occurs before the acquisition of knowledge. There is a perception, comparison, comparison of the received representations. As a result, the concept of the subject is drawn up. The second stage is to consolidate knowledge. At this stage, the concretization of knowledge, the refinement of their representation takes place. The result is the formation of the necessary knowledge [5]. This is a teaching from the concrete to the abstract, ideas, sensations to thought.

The development of spatial thinking takes place in mathematics lessons with the help of modeling.

There are various visual aids that aim at the development of mental operations in students, contribute to the development of constructive activity, are necessary to clarify spatial and subject representations in children, and contribute to the development of visual and tactile memory.

For the formation of knowledge in mathematics, it is necessary to form in the child specific ideas about the size, shape, quantity, spatial position of objects, as well as various drawing and measuring actions.

The main types of visual aids used in teaching visually impaired mathematics are as follows:

1. Counting sticks. They are necessary in order to form concepts about number and arithmetic operations.
2. Abacus. It is used as a tool for performing arithmetic calculations.
3. A set of voluminous benefits. It is a set of various models, polygon layouts, three-dimensional objects (cube, ball, parallelepiped). When working with children with low vision, it is recommended to use only large objects.
4. Separate numbers and signs of mathematical operations made of different materials and different in size.
5. Arithmetic box. It is a visual tutorial for arithmetic. It is used in teaching counting, studying the composition of numbers. elementary geometry.
6. Subject pictures. They are the pictures printed in a typographical way. In an enlarged size, in the form of a silhouette, they are depicted in a color contrasting with the background.
7. Relief-graphic aids. They are used to develop spatial representation.
8. Saunderson boards. They are required for calculations with multi-digit numbers. Also used to perform simple geometric drawings.

## Conclusion

All these tools contribute not only to mastering the system of mathematical knowledge and skills necessary in later life, but also necessary for the formation of clarity and accuracy of thought, critical thinking, intuition, logical thinking and personality formation.

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