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Izyna Hudym
Institute of Special Education
The National Academy of Educational Sciences of Ukraine
http://orcid.org/0000-0002-6459-806X

DIDACTIC SUPPORT OF DEVELOPMENT OF MATHEMATICAL COMPETENCE OF SCHOOLCHILDREN WITH VISUAL IMPAIRMENTS

The article deals with the main difficulties of acquiring mathematical knowledge of children with visual impairments and the ways how to overcome them. The main purpose of studying mathematics in primary school is to develop the necessary level of mathematical and cognitive competences in children with visual impairments, which will become a basis for gaining mathematical knowledge, skills and abilities in secondary school. The author offers specific teaching aids, adaptation and modification of teaching and methodological support for the study of mathematics in primary school.

The presented methodological approaches to the adaptation of general educational and teaching material on mathematics for children with visual impairments will be useful not only for the teachers of special schools, but also for teachers and assistants of teachers of educational institutions with inclusive education, as well as for parents of children with special needs.

Keywords: *children with visual impairments, primary education, mathematical competences, didactic support*

Logical thinking, acquired knowledge, skills and abilities are essential in order to prepare children for life. It is important for pupils not only to accumulate knowledge, but to learn non-standard thinking, to justify their point of view, make their own decisions, to solve problems with many variants of solution. Development mathematical competence is a key condition for mental development, because the simplest ways of children's intellectual activity are formed during the assimilation of mathematical ideas.

Violation of a human mind has reduced the possibility of acquiring a child's sensory experience. In addition, it has decreased the children's sensory-perceptual capabilities causing a number of features of mental development, their cognitive activity that negatively affects the assimilation of mathematical concepts.

Previous works (L. Venger, G. Kleyman, A. Matiushkin, V.O. Moliako, 0. Savchenko, etc.). have only focused on means and conditions of the development of normal children' cognitive processes. The current studies have found that children with visual impairment have a low level of assimilation of mathematical concepts, mental actions, operations and forms of thinking that provide the process of solving arithmetic problems (L. Venger, T. Nazarov, 0. Samoilov, L. Solntseva, Ye. Ukrainska). T. Nazarova has concluded that children with visual impairment cannot understand the whole condition of an arithmetic problem, so they do sum, which is not corresponded to its content. However, the characteristics of the didactic support in order to develop mathematical competence of children with visual impairments have not been dealt with in depth.

The ***purpose of the article*** is to determine the didactic support of the development of mathematical competence of children with deep visual impairments.

According to the requirements of the State Standard of Primary Education, the aim of the educational branch "Mathematics" is to develop the mathematical competence and key competence that is necessary for students' self-realization in a rapidly changing world.

0. Onoprienko and N. Lystopad have recently defined the ***mathematical competence*** as the student's ability to structure the situation, to discover mathematical relations, to create a mathematical model of a situation, to analyze and transform it, to interpret the obtained results. Moreover, it is the student's knowledge in a system of basic mathematical concepts and mastering them with basic subject skills.

The objectives of the initial course of mathematics study for children with visual impairments are expanded by reason of the needs to overcome the specific difficulties of gaining mathematical knowledge, in particular children with visual impairments have not enough sensory experience. The main aim is to develop the corresponding level of mathematical and cognitive competencies of children with visual impairments which will become a reliable basis for acquiring mathematical knowledge, skills and abilities in secondary and senior school.

The development of mathematical competence of primary pupils in the educational process will be effective under the following conditions. Firstly, implementation of a systematic approach that involves the unity of conceptual foundations for the formation of key and subject competences of students in primary school of general secondary education. Secondly, the development of socially and personally significant problem situations and practical tasks as means of development of primary pupils' competences and methods how to implement them into the educational process.

The non-standard tasks, puzzles, riddles should be used to develop logical and mathematical competences. Furthermore, in order to develop logical thinking teachers should use tasks such as: to compose the text of a similar task, to map the conditions of the problem in the form of a picture, to find several ways to solve, to divide a task text into separate logical elements. Teacher should develop students' autonomy and cognitive interest.

There are several characteristics of the development of objective mathematical competence:

- a holistic perception of the world;
- recognition of problems that are solved with the usage of mathematical methods;
- ability to solve the problems, logical reasoning, to perform actions by algorithm;
- ability to use mathematical terminology, graphic and sign information;
- ability to navigate on the plane and in space;
- ability to apply computing and measuring skills in practical situations.

The process of the development of mathematical competence of students with visual impairments requires a special organization, the usage of tools, methods, special pedagogical technology work aimed at correcting cognitive processes and enriching the children's sensory experience of.

Slow visual perception of the educational material in children with visual impairment and absence of visual perception in the blind children affects negatively on the development of logical methods of thinking, through which students must find ways to solve problems. In addition, it makes difficulties of the formation and development of spatial representations, precise measurement activities.

Specific features of children with visual impairment occurs when they mastering graphic skills - the writing of numbers, symbols of mathematical symbols, during making and reading charts, drawings, operating the system of symbols.

The visual and general exhaustion of children with visual impairments reduce their mental and physical activities. The pace of work of these children is slower compared to the pace of work of sighted peers.

Furthermore, students with deep visual impairments have difficulties in gaining spatial concepts that have negative effect on task solving. The blind junior children rely on insufficiently perfect sensory abilities when they learn knowledge about the environment At different stages of the development of specific representations and formal operations, the senior blind children compensate for the lack of sensory capabilities based on the integrative processes of cognitive activity and assimilate arithmetic problems lately. The blind students have significant difficulties studying how to solve arithmetic problems, especially in the process of their illustration and with a short recording of the task.

Generally, all difficulties in gaining mathematical competence by primary schoolchildren with visual impairments are associated with a decrease and specific development of cognitive processes (thinking, attention, and memory), a general reduction in their cognitive activity due to the disappearance of the main channel of perception of information about the surrounding world such as sight.

A special methodology for teaching mathematics for pupils with visual impairments as well as general educational methods involves maximizing the

visualization of the teaching material, especially at the initial stages of the study of mathematical concepts and mastering mathematical operations.

Different teaching aids are used at primary school: handbooks, teaching aids for students (mathematical cards, printed books, directories, etc.), special visual aids (objects or their images, cut-off digits, action marks and comparisons, models of geometric shapes etc.), tools and instruments (ruler, compass, corner, and palette), technical means of training. Learning tools are divided into frontal (demonstration) and individual, but for the blind students, especially in the preparatory and first grade, it is more appropriate to have individual ones.

The aims of the usage of visual aids are:

- to activate students' work;
- to save time at the lesson;
- to increase the amount of work in the classroom;
- to enhance the efficiency of the process of acquiring knowledge, skills and abilities.

However, visual teaching should not be decisive. It will be illegitimate, even harmful, for a long time to admire the visibility. Without the timely development of abstract thinking, a complete gaining mathematical knowledge is impossible.

Obviously, students with visual impartments of the preparatory and first class, as well as their peers with normal sight require a variety of didactic support and explanations. It should be taken into account the peculiarities of the children's perception. Therefore, the teachers should teach mathematical concepts not only via verbal explanations, but also the usage of various touch, tactile, vibrational, olfactory stimuli.

The traditional and the most important means of learning is a textbook, in which the contents of the course of mathematics are systematically and fully revealed as well as the level of students' knowledge, skills and abilities is displayed.

Pupils from 1-4 grades use textbooks of general education institutions adapted and modified to print in Braille which allows them to take the learning material tactilely.

Textbooks on mathematics for primary blind schoolchildren are relief-dotted variants of mathematics textbooks for primary schools of general education.

The peculiarity of a system of writing and reading Braille's relief-dot font determines the difficulty of translating the plain text into a further braille font. Flat-printed products require significant adaptation for the correct transmission. In the case of a textbook for primary school where the children start to acquire the Braille font, it is important to adapt the appropriate and to modify the texts in accordance with the possibilities of the child's perception of the educational material.

Adaptation of general textbooks on mathematics for 1-4 grades to Braille print is accomplished by modifying tasks and replacing visual information with a descriptive one that methodically reduce it as a teaching tool. At the same time, in primary school relief images for children with deep visual impairments are not able to replace voluminous objects, small toys, natural materials, various forms and materials, everything that children can take in their hand, everything that will stimulate her tactile sensations. In addition, children should be taught to read and accept the relief images, even the best quality. That is why the main didactic means in order to teach the mathematics of the blind students in primary school will be various objects of the environment that children are well familiar.

The textbook has important didactic functions:

1) The textbook helps to gain knowledge consciously.
2) The textbook teaches methods of thinking,
3) The textbook promotes the formation of certain skills including self-study skills.
4) The textbook helps the teacher in the presentation of the basic educational material.

In addition to the textbook, important elements of teaching and methodological support are visual explanations, the usage of structural schemes and drawings, handouts, didactic materials. Objects of the surrounding reality and their images, toy models, numbers, signs of action and relations, etc. can be used at mathematics lessons.

A variety of counted material is an important additional means to study mathematics for primary schoolchildren. These can be sticks, small items (buttons, beads, chestnuts, nuts, etc.). The counted material is used to illustrate the operations of aggregating sets, extracting from a given set of a subset, dividing a plural into a subset, which is the theoretical basis for the arithmetic operations of adding, subtracting and dividing the natural numbers.

During teaching the blind children, the teacher is usually deprived of the opportunity to use the blackboard as well as the printed didactic and visual aids, workbooks for secondary schools. Therefore, the usage of adapted the illustrative material is almost the only means of presenting the educational material.

However, should be taken into account that the relief drawing is quite difficult for young learners to perceive it. Also, its informative possibilities are rather narrow. Nevertheless, it is actually impossible to reproduce plot images into the relief image, complicated reproduction of the perspective, detail of objects and objects. The relief drawing is not possible to see simultaneously. The lines and points of the picture are gradually inspected by the touch. To develop the concept of the object of perception, a complex transformational long-time thinking activity is required for the blind students. The touched perception and recognition of children of primary school age is characterized by slowness, fragmentary and weak differentiation of characteristics of perceived objects.

The quality of the relief images, which are disappeared by frequent using, loses clarity. The relief and bas-relief pattern on plastic has not become widespread because of the high cost of producing. As a result, at the initial stages of teaching, illustrative material is better to prepare individually for each student and replace with real objects or three-dimensional models.

But at the same time, it is important to develop the skills of tactile perception of relief images in the process of correctional work with students over the whole period of study in primary school.

Teacher should analyze relief images in the textbook and familiarize the children before the lesson with the corresponding real objects or their three-dimensional models at the beginning of the school year. This can be done during walking, lessons of natural science, art and craft lessons.

It is necessary to familiarize students with the main means of the relief image. Teacher should gradually teach that the main contour lines replace the shape and structure of the subject. Moreover, a special relief hatching of different types, separate and unifying additional lines serves as a means of transferring on the picture the material texture of the subject, the separation and the connection between its parts.

A table is also an important means to study mathematics. According to their purpose, tables are divided into:

- tables for the formation of mathematical concepts and regularities (training tables);
- table-instructions;
- tables that serve as a means of finding a way to solve a task;
- tables for oral calculations;
- reference tables.

Tables in relief-dotted font, especially for pupils of 1-2 grades, it is expedient to submit on individual cards, because their perception in the text of the textbook, at the initial stages of mastering touch-reading, is complicated. The mobile frames for tables with pockets, slots for individual cards with data, which table will be filled in according to the training task, should be prepared in advance.

It is difficult for the blind students to perceive and reproduce mathematical schemas, short records of conditions and problem solving. Their submission at the initial stages should also be individual and maximally elaborate. For example, when considering the condition of a task, teacher can use a separate tray for several lines and departments to lay out the number of items specified in the condition of the task.

To facilitate and accelerate the implementation of written assignments, their terms on separate cards should be offered and write only answers on the number of the task in workbooks. Similar cards with mathematical assignments can be used: during self-study studies, written control works; as additional tasks for individual students; to work with students who have gaps in knowledge; during the organization of independent work of a small group of students in the background of the front-end work with the class.

As a means of visualization in primary school, there are widely used sets of different subjects (geometric figures, sticks, cubes, small toys, etc.) and cards depicting geometric figures, figures, signs of arithmetic and mathematical relations. These manuals should be mobile, so a number of homemade gadgets are used in the schools for the blind schoolchildren. The most necessary and convenient manuals are a flannel board and a set of cloths.

The flannel board simplifies the children's orientation in the workplace. If all the handout material is laid directly on the workplace, the student will not have to waste time searching it on the desk and reduces the noise when working with sticks, coins and other small objects.

The simplest design of a flannel board is a board covered with flannel fabric. It can also paste a soft cloth with the bottom of the separate tray which will absorb noise while working with it.

A cloth with slots for insertion of cards or magnetic tape also facilitates orientation and serves as an accessory during using the distribution material and studying most of the topics of the initial mathematics course. The individual cloth is designed for the use of paper-cut handouts (cards with numbers, *">", "<", "+", "-", "-",* etc.).

Learning of numbers and quantities is based on the practical activity of the students related to the skills and abilities of measuring the length of the segment, the area of the figure, mass of the object, capacity, and time. Teacher can measure these values using tools. The calculator serves as the necessary visual guide for studying the numbering of numbers in the range of 1 000 000. It is used in 1 grade, gradually

increasing the number of wires. While studying numbers within 10, on the counters teacher can familiarize students how to get the next and previous numbers, how to compare the numbers (the number of stones on the two wires); demonstrate the composition of the number; hold numbers, add and subtract numbers; to expose the concept of "increase (decrease) by several units"; compile tables of addition and subtraction.

The models and sets of geometric shapes play a great role in studying mathematics. A considerable part of the geometric content can be reproduced on the manual, which is a board (plywood) with the nails screwed in it at a distance of 5 cm from each other (the nails is protruded on 1-2 cm above the surface of the board). The colored rubbers are used in the work with the manual. Teacher can quickly introduce, change geometric shapes, and solve both simple and complex tasks of geometric content using these manuals.

In order to develop children's ideas about the straight line and the segment, firstly, it is necessary to find out the children's experience about these concepts. Then, two segments are compared with each other by the method of overlay. Comparison of segments brings children to the need to measure their lengths. In this case, it is important to use a standard measure of length (1 cm, 1 dm, 1 m). To develop clear representations about them, it is possible to use wooden flat sticks, wire, cubes with a 1 cm edge, strips of paper or cardboard of 10 cm in length (perceptions about the unit of measurement 1 dm), laces, ropes, threads, tapes, rails length 1 m (perceptions about the unit of measurement 1 m).

Teacher should use the weight scales and cups weights, electronic scales weighing as a visual guide in order to develop ideas about the mass and its measurement. The blind children need to be detailed and on various practical examples to explain the importance of the ability to determine the mass in everyday life and give an elementary practical idea about measuring the weight of some subjects. In the process of perceiving the weight of different masses and objects (notebook, book, tools for writing, an apple, a cube, etc.), as well as practical exercises on weighing objects on the scales, children develop their concept about "easier" and "heavier". It can be combined practical work on weighing of objects with the compilation and writing of numerical expressions.

Firstly, children get acquainted with only liter among the standard means of measuring volume. Visual objects for measuring volume are plastic, glass (safe), metal measures, glasses, jars, bottles, etc. It is not enough to find out exactly what is measured in a liter, it is also necessary, that children themselves as a result of their own observations and experiments on measurements, determine how many glasses of water contained in 1 liter, in % liter.

The technical means of teaching the blind schoolchildren include Braille displays and computer software for voice recording information from a computer monitor. They help to replace the writings on individual cards when teachers explain a new material.

This paper has underlined the importance of the development of mathematical competence for primary schoolchildren with visual impairments. To overcome difficulties in gaining all the components of mathematical competence, special didactic support is needed. The main functions of these didactic support are to stimulate their perception, interest in the surrounding world, to help in studying the properties of objects and phenomena, their various qualities and attitudes which ensures the success of the development of cognitive interests; to develop the skills for the differentiation of

certain features, comparison of objects and phenomena, their generalization and classification.

This research has thrown up many questions in need of further investigation. Considerably more work will need to be done to determine pedagogical supporting models for all primary education courses.

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Ірина Гудим. Дидактичний супровід формування математичної компетентності у школярів з порушеннями зору.

Важливість формування математичних уявлень для розумового розвитку дитини та труднощі опанування математичною компетентністю дітьми з порушеннями зору, через своєрідність їхніх пізнавальних процесів та особливості сенсорно-перцептивного розвитку, безперечно актуалізують окреслену у статті проблему. Способи діяльності під час формування математичних уявлень розглядаються як об'єктивна послідовність дій, які має виконати дитина для засвоєння знань. За вимогами Державного стандарту початкової освіти метою освітньої галузі «Математика» є формування предметної математичної і ключових компетентностей, необхідних для самореалізації учнів у швидкозмінному світі.

Актуальність статті зумовлена необхідністю подолання специфічних труднощів опанування математичними знаннями, внаслідок збідненого чуттєвого досвіду дітей з глибокими порушеннями зору. Основним завданням опанування курсу математики є формування у дітей з порушеннями зору необхідного рівня математичної та пізнавальної компетентностей, що стане надійною основою для опанування математичних знань, умінь та навичок в основній та старшій школі.

У статті окреслено основні труднощі опанування математичними знаннями дітьми з глибокими порушеннями зору та шляхи їх подолання, зокрема через застосування специфічних засобів навчання, адаптацію та модифікацію навчально-методичного забезпечення вивчення математикиу початковій школі.

Представлені методичні підходи до адаптації загальноосвітнього навчального та дидактичного матеріалу з математики для дітей з глибокими порушеннями зору, будуть корисними не лише для педагогів спеціальних шкіл, але й більшою мірою, для вчителів та асистентів педагогів навчальних закладів з інклюзивним навчанням, а також для батьків дітей з глибокими порушеннями зору.

Ключові слова: *математична компетентність, діти з порушеннями зору, початкова освіта, дидактичний супровід.*