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THE CHARACTERISTICS OF THE MAIN PARAMETERS AND LEVELS OF MASTERING MATHEMATICAL KNOWLEDGE (CONCEPTS) BY CHILDREN WITH MODERATE AND HARD BACKWARDNESS

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Utiosova O. The characteristics of the main parameters and levels of mastering mathematical knowledge (concepts) by children with moderate and hard backwardness. Every child with moderate and hard mental retardation has its speed, dynamics of the development, different abilities of mastering knowledge; therefore, count teaching has to be individually oriented. Strategy and tactics of forming the individual

correctional and pedagogical plan of teaching count are built with a glance to the ,,personal situation" of separately taken child, which includes their level of mastering mathematical knowledge (concepts) and psychological preconditions of mastering count (general level of intellectual development, perception, remembering, ideation, speech). The article contains analyzed criteria, parameters and levels of mastering mathematical knowledge (concepts) by 7-11-aged children with moderate and hard mental retardation. For the objective evaluation of mastering knowledge (concepts) of mathematics, we detached substantive, operational-organizational and stimulating-motivating components of educational activity of intellectually delayed students with moderate and hard mental retardation. The indices of mastering mathematical knowledge and skills are: concepts of color, size, form of subjects, and space and quantity concepts. In accordance to manifestation of each index of mathematical concepts' formedness, we defined its contents and gave the characteristics of levels of its formedness, videlicet sufficient, middle, low and very low. The article contains the main demands to the indices by the levels of mastering mathematical habit patterns by the children with moderate and hard mental retardation: a possibility to accept help, to maintain contact with adults and show interest in interaction. The article considers the direction of further research of the identification of the psychological preconditions of account mastering, selection of pedagogical technologies, tracking the dynamics of knowledge and skills in children with moderate and hard intellectual violation level.

Keywords: moderate and hard mental retardation, mathematical concepts, levels of mastering mathematical knowledge (concepts), indices, criteria.

Утьосова О.І. Характеристика основних показників та рівнів засвоєння математичних уявлень у дітей з помірним та тяжким ступенем інтелектуального порушення. Кожна дитина з помірним та тяжким ступенем інтелектуального порушення має свій темп, динаміку розвитку, різні можливості у засвоєнні знань, тому навчання рахунку повинно бути індивідуально орієнтованим. Стратегія та тактика складання індивідуального корекційно-педагогічного плану навчання рахунку вибудовується з урахуванням ,,особистісної ситуації" окремо взятої дитини, що включає рівень засвоєння математичних уявлень дітей та психологічних передумов засвоєння рахунку (загальний рівень інтелектуального розвитку, сприймання, пам'яті, мислення, мовлення). У статті проаналізовано критерії, показники та рівні засвоєння математичних уявлень дітьми з помірним та тяжким ступенем інтелектуального порушення віком 7 – 11 років. Для об'єктивного оцінювання засвоєння уявлень з математики виділено змістовий, операційно-організаційний та стимулююче-мотиваційний компоненти навчальної діяльності школярів з помірним та тяжким ступенем інтелектуального порушення. Показниками засвоєння математичних уявлень та навичок виступають: уявлення про колір, розмір, форму предметів, просторові, кількісні уявлення; оцінювання якості засвоєння

математичних уявлень та навичок дітьми з помірним та тяжким ступенем інтелектуального порушення, а саме: повна сформованість, недостатня сформованість, часткова сформованість та несформованість засвоєння математичних уявлень та навичок дітьми з помірним та тяжким ступенем інтелектуального порушення.

Відповідно до виявів кожного показника сформованості математичних уявлень було визначено зміст та подано характеристику рівнів її сформованості, а саме: достатній, з можливістю приймати допомогу пояснювального та навчального характеру; середній, з можливістю підтримувати ситуативний контакт з дорослим; низький, з можливістю у ряді випадків проявляти зацікавленість до взаємодії; дуже низький, з проявами пасивного підкорення. У статті представлено основні вимоги до показників за рівнями оволодіння математичними навичками дітьми з помірним та тяжким ступенем інтелектуального порушення, перспективний напрям подальших досліджень виявлення психологічних передумов засвоєння рахунку, добору адекватних педагогічних технологій, відслідковування динаміки та становлення формуючих знань та навичок у дітей з помірним та тяжким ступенем інтелектуального порушення.

Ключові слова: помірна та тяжка ступінь інтелектуального порушення, математичні уявлення, рівні засвоєння математичних уявлень, показники, критерії.

Утёсова Е. И. Характеристика основных показателей и уровня усвоения математических представлений у детей с умеренной и тяжелой степенью интеллектуального нарушения. В статье проанализированы критерии, показатели и уровни усвоения математических представлений, выделено содержательный, операционно-организационный и стимулирующе-мотивационный компоненты учебной деятельности школьников с умеренной и выраженной степенью интеллектуального нарушения в возрасте 7 - 11 лет; определено содержание и дана характеристика уровней сформированности математических представлений (достаточный, средний, низкий, очень низкий); представлены основные требования к показателям по уровням овладения математическими навыками детьми с умеренной и выраженной степенью интеллектуального нарушения.

Ключевые слова: умеренная и тяжелая степень интеллектуального нарушения, математические представления, уровень усвоения математических представлений, показатели, критерии.

1. Introduction.

In the Convention on the Rights of the Child and the Public Standard of the Comprehensive and Special Junior Education, it is said, that the main principle of international standards is the right of persons with psychophysical disorders for the corresponding integration and deserving life as freemen; the basis for integration and the priority of social politics of democracies is the provision of approach to the qualitative education for children with special

educational needs. It touches persons having apparent violations of intellectual development – children with moderate and hard mental retardation. Therefore, there is bigger meaning in heightening of the quality and effectiveness of educational work, it's forecasting and perspective planning by the kindergartners, teachers, correctional and social pedagogues, psychologists, who work in special schools, orphanages for invalids and rehabilitative centers. In particular, it touches math (count) studies of children with apparent intellectual disorders – moderate and hard mental retardation. In the education, it is necessary to foresee the system of such knowledge, skills and habits, which would be, first of all, effective, practically valuable, and would provide their arrangement to the labor activity. In the context of everything, mentioned above, a problem of definition of the main parameters and levels of mathematical knowledge (concepts) of children with moderate and hard mental retardation is obtaining special meaning. It will allow pedagogues to develop individual programs, basing on the analysis of psychical development, choose rational techniques of work and differentiate contents of educational staff.

2. Literature review

Theoretical aspects of the problem of education of children with moderate and hard mental retardation are shown in the researches of O. Gavrilov, L. Zankov, D. Isayev, W. Christen, O. Maller, G. Sukhareva, G. Tsikoto, L. Shypitsyna. The problem of forming mathematical knowledge (concepts) of persons with moderate and hard mental retardation is partially reflected in the papers of K. Ardobatska, L. Baryaeva, N. Volnianska, O. Gavrylov, G. Zasukha, W. Eck, N. Korolko, O. Liashenko, M. Perova, V. Checkurda, U. Urieva. Notwithstanding, most of the scientific researches, directed at the investigation of the process of forming mathematical knowledge and level of its mastering, describe the category of children with mild mental retardation. In particular, O. Gavrylov (2012) mentions: almost till the beginning of the XXI century, scientific researches of correctional pedagogy experts described the children with mild mental retardation only, and only those, who studied in special schools. There were several detached investigations of psychics of children with moderate and hard mental retardation.

Abilities of children with moderate and hard mental retardation to master mathematical knowledge (ideas) are strongly bounded. Yet, the results of work prove (U. Galetska, 2015; A. Maller, 2003) that with the creation of scientifically justified programs of math (count) studies and appropriate methodical provision for the children with moderate and hard mental retardation, there is positive dynamics of their mathematical development. Therefore, there is a necessity of the development of pedagogical provision for forming mathematical concepts of this category of people.

3. Problem statement

The aim of the article is the development of the main parameters, criteria and definition of the common levels of mastering mathematical knowledge (ideas) by the 7-11-aged children with moderate and hard mental

retardation.

4. Results and discussion

First of all, before giving the characteristics of the main indices and levels of mastering mathematical knowledge (ideas) of the children with moderate and hard mental backwardness, we shall describe the contents of the terms „knowledge", „mastering knowledge", „ideas" and „concepts", that will be our basis in this scientific research.

Basing on the definition of I. Malafaik (2005), we consider knowledge as a meaningful and fixed in the memory of subject information about the world, this information is assigned by personality. The scientist mentions that knowledge is demonstrated in the ideas, concepts, minds and theories. Looking forward to the results of scientific researches of O. Sergeeva (2012), we have mastering knowledge to be a process, which is a complicated intellectual activity of a man, connecting in itself all the cognitive processes (general level of intellectual development, perception, remembering, ideation, speech), which provide receipt, meaningful processing, saving and display of information.

Considering that knowledge of a child with mental disability are shown in the ideas and concepts, we should give the definition of terms „idea" and „concept". Idea is a general image of subject or condition, which reflects mostly outer sides, connections and relations, developed on the basis of visual, audial, kinesthetic and other senses and perceptions, and the concept is a product of ideation, it is almost a „unit of associations", based on the complete system of temporary nervous connections of primary- and secondary-sentinel character. Taking into account that ideation of children with moderate mental backwardness is concrete, inconsistent, retarded, forming and operating with abstract concepts is impossible (М. Авраменко, 2009); ideation of children with hard mental retardation is chaotic, non-systemic, concrete, without any meaningful connections, therefore, mathematical concepts forming is impossible, so we look at the mathematical knowledge mastering by the children with moderate and hard mental retardation in the context of their mastering mathematical concepts.

For the objective evaluation of knowledge (concepts) of math (К. Ардобацька, 2002), we need to take into account the main criteria of content, operational-organizational and stimulating-motivating components of educational activity of backwardness students with moderate and hard mental retardation of 8-11 years age. Forming of such educational activity starts at the second stage of correctional and developing work in the institutions for children with moderate and hard mental retardation of the Ministry of Labor and Social Politics of the second section (О. Гаврилов, 2003). Let us look at the details of the criteria of content, operational-organizational and stimulating-motivating components.

1. The content component. The most adequate criteria of the content component at the definition of level of mastering the math concepts by the children with moderate and hard mental retardation are: fullness, righteousness and consciousness.

Fullness means replication of the volume of educational information (both partial and full-size replication), which is defined by the educational program for the children with moderate and hard mental retardation.

Consciousness means understanding, mental process, directed at the finding general, meaningful properties and connections in the mathematical information.

Righteousness means the criteria for evaluation of correspondence of the reflected contents of math information, defined with the program.

In the definition of mastering knowledge (concepts) of math, it is pressing to find out the level of independence in the processing of educational information and their ability to the volitional psychical activity. Independence of tasks execution provides pedagogue's control of children at the execution of diagnostic tasks, helping them on practical (executing it together) and verbal (explaining it) levels. One of the most important characteristics of a child's activity is the way of its acceptance of adult's help.

The important criterion of stimulating-motivating component is forming of the positive motives for the interaction with pedagogue.

Taking into account that children with moderate and hard mental retardation make diverse group by the structure and depth of intellectual defect, and have different abilities to mastering educational information of math (count), we shall state that for the development of indices of the content component of mastering count we used „The programs of education of children with moderate and hard mental retardation" (Institute of Defectology of APS in USSR, 1983) and „Educational program of math for the reception class and 1^{st}-4^{th} forms of special comprehensive educational institutions for the children with moderate mental retardation" (Н. Волянська, В. Засуха, Ю. Юр'єва, 2011). Taking into account different abilities for mastering mathematical knowledge (concepts) of children with moderate and hard mental retardation, procedure includes tasks of different difficulty. Basing on these programs, we defined mathematical concepts and habits for the children to master.

The parameters of mastering mathematical concepts and habits are:

- color concept: to find the necessary color using sample (black, white, yellow, green, red); to define the color by its name (black, white, yellow, green, red); to group subjects by the color;
- size concept: after the instruction, to show and to define the size of the subjects: big – little, bigger – littler, high – low;
- form concept: after the instruction, to show the subjects of the described form (round, square); to group the subjects by the form;
- space concept: after the instruction, to define and show the spatial situation: up, down (up – where the head is, down – where the legs are).
- quantity concept: to recognize the suggested quantity of subjects: many – one, many – little; to count subjects and sum the result within the quantity of seven; to compare the quantity of the subjects with the number within the quantity of seven; to correlate the quantity of real subjects with the conventional symbols (ciphers) within the quantity of five.

The quality of mastering the defined concepts and habits was evaluated in such a way.

1) Complete formedness proved the right answer at some question; independent, consistent execution of the appropriate habit regardless of the conditions, in which it has to be done, a child has positive motives to interact with pedagogue;

2) Lacking formedness was fixed when the answers were not concrete, full, with absence of some important information; habits were reflected partially (non-consistently, in a cut-and-try method, with the help of an adult) and only in the conditions, familiar to a child, a child has positive motives to interact with pedagogue;

3) partial formedness was fixed when a child could not give answers on the questions, there was the lack of understanding sense of a task, it was executed partially, habits were reflected only in the conditions of constant organizing work of an adult, weak motives to interact with pedagogue, a child could keep situational contact with an adult.

4) Absent formedness was fixed when a child did not understand the sense of a task, the answer had no sense or was absent at all, a child did not even try to answer or make some action, it could not reflect appropriate math habit independently, did not react at the organizing help, had no positive motives to interact with pedagogue.

For more accurate orienting in the indices of mastering mathematical knowledge, let us look at the demands accordingly to each index.

The main demands on the index „Color concept" are shown in the Table 1.1.

Table 1.1. The main demands to the „Color concept" index by the levels of mastering mathematical knowledge by the children with moderate and hard mental retardation

Habit pattern	Quantitative-qualitative evaluation of the degree of habit formedness			
	3 points (formedness)	2 points (lacking formedness)	1 point (partial formedness)	0 points (absent formedness)
Finding the necessary color by the example (black, white, yellow, green, red)	Finds and shows the subject of the necessary color independently, finds the subjects of four colors	Executes the task in a cut-and-try method. Is able to find and show the necessary color with the support of an adult	Does the task partially. A child acts prevailingly on the following or on the model	Does not find subjects of necessary color, does not understand demonstrable instruction with mimic and gesture detailing
Detachment of the color by the name (black, white, yellow, green, red)	Identifies all the colors by the name, shows the subjects of the suggested color without	Detaches and shows three colors by the name independently; with the	Detaches colors by the name partially, shows the subjects of 1-2 colors by the name, does	Cannot detach the color by the name, does not understand the instructions

	mistakes	organizing support, detaches all the colors	not want any organizing support	
Subjects grouping by the color	Makes actions of grouping the subjects by the color independently	Groups the subjects by the color partially, executes the task in the cut-and-try method	Groups the subjects situationally, loses task, reflects habits only with the constant organizing support of an adult	Cannot group the subjects by the color, does not understand consistency of actions

The main demands on the index „Size concept" are shown in the Table 1.2.

Table 1.2. The main demands to the „Size concept" index by the levels of mastering mathematical knowledge by the children with moderate and hard mental retardation

Habit pattern	Quantitative-qualitative evaluation of the degree of habit formedness			
	3 points (formedness)	2 points (lacking formedness)	1 point (partial formedness)	0 points (absent formedness)
Demonstration of different-sized subjects by the instruction: big – little; more – less, high – low	Demonstrates sizes of the subjects by the instruction independently (big – little; more – less, high – low)	Executes task in the cut-and-try method, needs repeating the instruction to task. Leaves inaccuracies in demonstration of appropriate size of the subject by the instruction	Shows the subjects of different size by the instruction partially: big – little; more – less, high – low	Does not realize demonstration of subjects of different size by the instruction, does not understand the task
Definition of subjects size: big – little; more – less, high – low	Defines the right size of the subjects and names them independently	Can define two attributes of the subjects size independently (big – little; more – less); definition of the attribute "high – low" is possible in case of giving the organizational support	Defines one attribute of subject size	Does not define attributes of subjects size

The main demands on the index „Form concept" are shown in the Table 1.3.

Table 1.3. The main demands to the „Form concept" index by the levels of mastering mathematical knowledge by the children with moderate and hard mental retardation

Habit pattern	Quantitative-qualitative evaluation of the degree of habit formedness			
	3 points (formedness)	2 points (lacking formedness)	1 point (partial formedness)	0 points (absent formedness)
Demonstration of subjects of described form by the instruction (round, square)	Demonstrates square and round subjects by the instruction independently	Makes mistakes in detaching round and square subjects, but can compare one's actions with a sample in the process of activity	Detaches round and square subjects situationally, reflecting habits only with constant organizing support of an adult	Does not react at the instruction, does not show the subjects of the suggested forms
Grouping the subjects by the form (round, square)	Groups the subjects by the form independently	Groups the subjects by the form partially, executes task in the cut-and-try method	Groups the subjects situa-tionnally, loses task, reflects habits only with constant organi-zing support of an adult	Cannot group the subjects by the form, does not understand the consistency of actions

The main demands on the index „Space concept" are shown in the Table 1.4.

Table 1.4. The main demands to the „Space concept" index by the levels of mastering mathematical knowledge by the children with moderate and hard mental retardation

Habit pattern	Quantitative-qualitative evaluation of the degree of habit formedness			
	3 points (formedness)	2 points (lacking formedness)	1 point (partial formedness)	0 points (absent formedness)
Demonstration of spatial situation of the subjects by the instruction: up, down	Demonstrates spatial situation of subjects by the instruction independently	Makes mistakes in showing the spatial situation of the subjects (up, down), but can compare one's actions with a sample in the process of activity	Demonstrates spatial situation of subjects (up, down) situationally, shows them only with constant organizing support of an adult	Does not react at the instruction, does not show the spatial situation of the subjects
Detachment of the spatial situation of the subjects: up, down (up – where the head is, down – where the legs are)	Finds the right situation of the subjects: up, down	Makes mistakes in definition of the subjects situation; corrects these mistakes with organizing sup-port of an adult	Reflects habits only with constant organizing support of an adult	Cannot define the spatial situation of the subjects, does not understand the task

The main demands on the index „Quantity concept" are shown in the Table 1.5.

Accordingly to the indices of mastering knowledge, we defined such levels of mastering mathematical knowledge (concepts) and habit patterns.

Sufficient level is characterized with reproductive-productive type of activity, indicative with usage of the supraliminal mathematical knowledge (concepts), child's color, size, form concepts are formed; space and quantity concepts are present within the bounds of program demands, a child has positive motives to interact with pedagogue.

Table 1.5. The main demands to the „Quantity concept" index by the levels of mastering mathematical knowledge by the children with moderate and hard mental retardation

Habit pattern	Quantitative-qualitative evaluation of the degree of habit formedness			
	3 points (formedness)	2 points (lacking formedness)	1 point (partial formedness)	0 points (absent formedness)
Identification of the given quantity of the subjects: many – one, many – little	Identifies the right quantity of the subjects independently (many – one, many – little) and names them	Can identify the quantity "many – one" independently; defines the quantity "many – little" only with organizing support	Identifies only the quantity "many – one"	Has no understanding of the quantity of multitude elements (many – one, many – little); does not identify the suggested quantity
Counting subjects, summing the result within 7	Counts subjects within 7 independently, correlates naming of the number with demonstration of the subject, names collective numeral as a result of count	Counts subjects within 7, correlates naming of the number with demonstration of the subject, does not name collective numeral	Counts subjects within 7, but does not correlate naming of the number with demonstration of the subject, does not name collective numeral	Habit pattern of right counting subjects is absent
Correlation of the quantity of the subjects with the number within 7	Makes correlation of the quantity of the subjects with the number within 7	Can correlate the quantity of the subjects with the number within 5	Can correlate the quantity of the subjects with the number within 3	Does not correlate the quantity of the subjects with the number, does not understand the task
Correlation of the quantity of real subjects with conditioned symbols (cyphers) within 5	Correlates the quantity of real subjects with cyphers within 5 independently	Can correlate the quantity of real subjects with cyphers within 3	Correlates the quantity of real subjects with cyphers within 2 with constant organizing support	Does not correlate the quantity of real subjects with the number

Moderate level is reproductive, with the reflection of mastered mathematical knowledge (concepts) and their usage in the works by the sample. A child demonstrates lack of formedness of mathematical concepts of color, size, form of the subjects; space and quantity concepts and appropriate habits are inaccurate and incomplete. Independent activity is possible only if the ways of actions are mastered and with organizing support. Children can support situational contact with an adult.

Low level is characterized with passive activity, for which perception, differentiation and acknowledgement of separate mathematical knowledge (concepts) are enough. A child has partial formedness of mathematical concepts of color, size, form of the subjects; space and quantity concepts and appropriate habits are mastered partially, and habits can be reflected only with constant organizing support of an adult. Independent actions are present only at the level of separate operations. In some cases children demonstrate interestedness in interaction.

Very low level is characterized with presence of isolated mathematical space and quantity concepts; color, size, form concepts as well. While executing tasks, they feel difficulty in understanding the instruction and accepting the help. There are also difficulties in understanding the verbal address, they need vivid instruction with gesture and mimic detailing. Children don’t initiate contact with pedagogue independently, they demonstrate passive submission.

5. Conclusions.

Therefore, the developed criteria, indices and common levels of mastering mathematical knowledge (concepts) and habit patterns allow to investigate the level of its’ formedness in 7-11-aged children with moderate and hard mental retardation. The perspective direction of further researches is open in finding psychological preconditions of count mastering (general level of intellectual development, perception, remembering, ideation, speech). Setting the „starting” level of these psychical processes development will allow regulating and influencing the process of math (count) studies purposefully, choosing adequate pedagogical technologies, controlling dynamics and development of forming knowledge and habit patterns.

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ПСИХОЛОГО-ПЕДАГОГІЧНА ХАРАКТЕРИСТИКА УЧНІВ З ПОМІРНОЮ РОЗУМОВОЮ ВІДСТАЛІСТЮ ЯК ОСНОВА ВИЗНАЧЕННЯ НАПРЯМІВ ПЕДАГОГІЧНОЇ РОБОТИ

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