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“PRACTICAL MATHEMATICS” — A COMPLEX TEACHING AID FOR ADULTS WITH SPECIAL EDUCATIONAL NEEDS

Abstract. Creation of the system of continuing education is one of the modern tendencies of development of society urgent for each citizen. The article is devoted to the study of the problem of creation of educational conditions in neuropsychiatric boarding houses in the Republic of Belarus, which may be considered as an important way for realizing the problems of continuing education. The article describes the content of the complex teaching aid “Practical Mathematics”, which is designed for adults with intellectual disabilities who live at neuropsychiatric boarding houses of the Republic of Belarus. The teaching content of this subject improves viability, everyday life independence of students, and formation of elementary concepts about economic phenomena. The authors of the article describe the characteristics of the structural elements of the complex teaching aid which includes an education program, a tutorial and guidelines for organizing and conducting classes in practical mathematics.

The education program contains the education goals and the content, organization and evaluation components. It describes the general and specific purposes and tasks, the content of education in the subject “Practical Mathematics”, the number of lessons allocated for the study of each topic, the approximate calendar-thematic planning and requirements to the knowledge, skills and habits and methods of pupils’ actions, which are presented by three levels of acquisition of the educational content.

The complex teaching aid "Practical Mathematics" includes mathematics tasks and arithmetic problems, which are divided into six segments, important for the human existence: health, food, everyday life, clothes and shoes, labor, recreation and leisure activities. It provides examples of problems with life-important content, which have practice-oriented character.

The authors have developed methods support materials for specialists, who may conduct classes in practical mathematics with people who live in neuropsychiatric boarding houses. They contain methods commentaries for each page the teaching aid.

Keywords: adults with special educational needs, system of continuing education, complex teaching aid “Practical Mathematics”.

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Introduction

The Code of the Republic of Belarus about Education provides the necessary legislation for the realization of the constitutional right of citizens with special educational needs [2]. The attitude of the society and the state to the people who were earlier considered as “socially unpromising” or “unteachable” has changed [15]. Creation of conditions for making *every* citizen’s life full and worthy has become an urgent task.

On September 28, 2015 the Republic of Belarus joined the UN Convention on the Rights of Persons with Disabilities (the Decree of the President of Belarus of September 24, 2015).

The words italicized by us in the text of paragraph 5 of Article 24 of the Convention attract especial attention: “States Parties shall ensure that persons with disabilities are able to access general tertiary education, vocational training, *adult education and lifelong learning* without discrimination and on an equal basis with others” [3]. The given article of the Convention obliges States Parties to work out a system of *continuing education* thus urging them to search for new forms, new content of education and socio-psycho-pedagogical support of people with psycho-physical disabilities. One of our articles focused on continuing education of people of this category [8].

Research

All over the world people with

disabilities demonstrate lower results in terms of health, education and economic activity and higher degree of poverty than people without disabilities. It is partially connected with the fact that people with disabilities are faced with barriers preventing them from getting services which are customary for other people: health care, education, employment and transport, as well as information. These difficulties are aggravated in less well-to-do communities and micro-societies [13].

An example of such community is presented by a neuropsychiatric boarding house for elderly people and people with disabilities – the leading type of institution delivering support whose main task, according to the Provisions for neuropsychiatric boarding houses for elderly people and people with disabilities adopted by the Ministry of Labor and Social Protection of the Republic of Belarus # 5 of January 10, 2013, is to organize care, help in everyday life and medical assistance of citizens qualified disabled [9].

In the framework of the international project “Creation of educational conditions in neuropsychiatric boarding houses of the Republic of Belarus” realized by the public organization “The Voice from the Heart” we started creating complex teaching aids including curricula, teaching aids for grown-up people with intellectual disability and guidelines for teaching methods for specialists (teachers-psychologists, social workers, labor instructors, etc.) working in neuropsychiatric boarding

houses of the Republic.

Young and adult people not living in the family but in neuropsychiatric boarding houses of the Republic are in the conditions of a closed social group. As a result of inadequacy of diagnostic instruments and due to other reasons the residents of neuropsychiatric boarding houses may be psychically normal people, people with retardation of psychological development and deviant behavior which is the consequence of the social situation in institutions of a closed type [4].

Many of the residents of boarding houses have not received any education due to various reasons (it was only in 2011 that Provision # 48/55 about the adoption of Instruction on the organization and access to special education in institutions of social protection was enacted), in the result of which they were devoid of legal capacity and possibility of employment as the diagnosis approach to the assessment of their employability is still practiced [10]. Some of those living in neuro-

psychiatric boarding houses cannot read, write or count as they have never learnt to do so or were taught unsystematically from time to time [7]. The results of investigation of data about the education of people with disabilities of different degree are shown in Figure 1 (based on 2014 data).

We shall consider only people with Class 1 Disability living in neuropsychiatric boarding houses. As many as 68.3% of residents have no education at all, 28.7% have primary education, 2.8% - general secondary and only 0.2% have vocational education.

It is to Class 1 Disability that people with the diagnosis “mild intellectual disability (mental retardation)” refer to. We selected people for experimental groups from this category of residents of neuropsychiatric boarding houses.

In each neuropsychiatric boarding house (there are 47 such houses in the Republic) we selected up to 20 people for the group of experimental teaching [7].

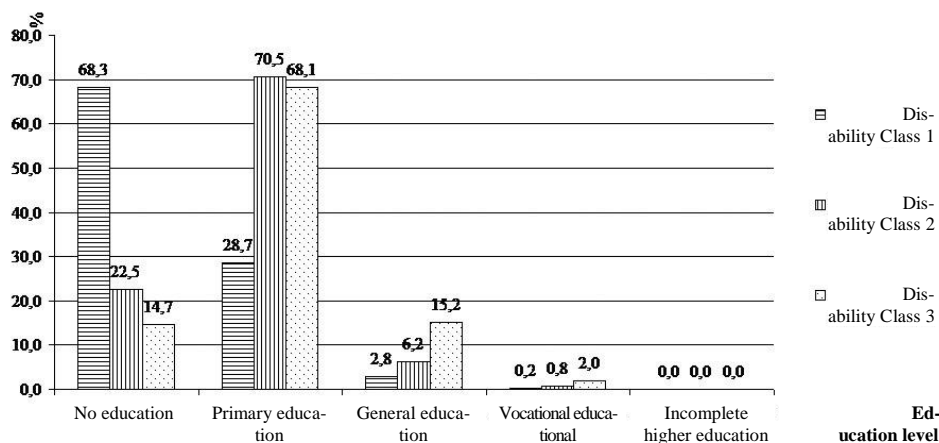


Figure 1. Results of investigation of data about education of people with disabilities

During conduct of questionnaires and interviews with the participants of the experiment even before the beginning of learning it was seen that in the majority of cases the diagnosis had been more serious in terms of degree of intellectual disability than it really was. In the majority of cases it was mild intellectual disability or mental retardation.

While designing the content of education we did not proceed from the diagnosis but from the fact that this content should facilitate the viability of the student and be correlated with the further life of the people of this category. Wherever the person might be, they should be aware of the *sense of their life*, which makes one's being conscious. The sense of one's life helps to see the prospects of life, to plan one's life and gives tempo to one's being [6].

While defining the content of education we took it for granted that formation of adaptive functional skills, use of alternative education means, consolidation of effort of specialists and concentration of attention on social adaptability of students are very important problems for a person with intellectual disability living in a neuropsychiatric boarding house.

The results of questionnaires of adult people allowed us to start writing complex teaching aids. We defined the following 6 complex teaching aids: “*ABC-book for Adults*”, “*Practical Mathematics*”, “*Emotions and Situational Behavior*”, “*Man and the World*”, “*Independence in Everyday Life*” and “*Labor*” [5].

We would like to dwell in more

detail on the characteristics of the complex teaching aid “*Practical Mathematics*” created by the authors of the given article for adults with intellectual disability living in a neuropsychiatric boarding house.

While writing the complex teaching aid “*Practical Mathematics*” for adults we used the existing experience of creation of the complex teaching aid “*Practical Mathematics*” for children with severe multiple developmental disorders [1].

The structure of the given complex teaching aid includes the following elements: *the Syllabus*, *the Teaching Aid* and *the Guidelines for Methods of Teaching Practical Mathematics*.

The syllabus consists of the introduction, the content component, the organization component and the control-assessment component.

The introduction lays out the general and particular goals of teaching the subject “*Practical Mathematics*”. *The general goal* consists in preparation of an adult with intellectual disability living in a neuropsychiatric boarding house for possible independent living and everyday and labor activity. *The particular goal* of teaching the given subject is development and formation of ability and preparation to make various measurements and calculations [11], solve simple and composite arithmetic problems using the four arithmetic operations – addition, subtraction, multiplication and division. The given goals are revealed in more detail in the tasks of education:

1) to form generalized measurement activity aimed at solution of practical problems with everyday life

content including the ones with the help of various meters (scales), measuring instruments (ruler, tape measure), household measures (tea or table spoon, measuring cup), thermometer for measuring the temperature of water or air, etc. [12];

2) to form generalized calculation activity (addition, subtraction, multiplication and division) in the result of solving arithmetic problems with everyday life content using calculator;

3) to form various kinds of activity in defining the geometrical form of things and objects (ways of observation and calling the corresponding form);

4) to form various kinds of activity in defining the time, orientation in time in case of solving a concrete life problem.

The content component of the syllabus defines the content, the approximate number of hours allotted to the study of the topics and their sequence.

Now let us give model content for the topic "Labor".

Due to the fact that labor is the leading kind of activity of an adult and in view of realization of the general goal of education of adults with intellectual disability living in neuropsychiatric boarding houses (preparation for possible independent living and labor) we defined such block of content as labor. The tasks connected with human labor make up the foundation of psychological preparation for labor [14]. The tasks help the students realize that all prizes of life are created by labor and through labor. It is by solving such problems

that the students get acquainted with many professions: painter, salesman, tailor, fitter, cook, milker, combiner, etc. The students do the following kinds of tasks:

– *tasks-calculations*, for example: it is necessary to calculate the amount of time in the morning in order not to be late for work by 8; to calculate how much money will every porter get from the definite total sum of the payment; to define the date of the labor agreement expiration;

– *tasks-facts*, for example: it is necessary to find out the working hours, number of breaks, number of hours for work and rest, find out the difference of the retirement age between men and women in our country, find out the length of leave from work;

– *tasks-correlations*, for example: to compare the length of the shortest and the longest leaves from work, to correlate the length of study (in years) with the length of work;

– *tasks-measurements*, for example: to measure the amount of milk (in liters) the worker may get for work in harmful labor conditions during a certain period of time.

The basic notions of the block the students get acquainted with are the following: *work day, labor productivity, record of service, leave from work, contract of employment, contract, retirement age, harmful labor conditions, family income, wage, pay rate, salary, bonus, trade union dues, pension tax, income tax, material incentive*, etc.

The organization component is represented by model timetable planning. We would like to present a

planning fragment of the topical block “Labor”.

Number of Topic	Topic
1	Work day morning
2	Work day hours
3	Work week hours
4	Leave from work
5	Retirement age
6	Record of service
7	Contract of employment
8	Harmful labor conditions
9	Wages and their parts
10	Material incentives
11	Wages in a team
12	Total family income

The *control-assessment component* includes three levels of acquisition of material: above average, average and below average, which can be reached by the end of the period of study.

The *above average* level is active and demonstrates the maturity of the students’ skills to solve arithmetic tasks provided in the aid and on computer with the help of the computer assisted training program “We solve problems by ourselves”. The level includes the formation of the students’ knowledge about the four arithmetic operations, ability to do addition, subtraction, multiplication and division of prime and concrete numbers using calculator, to convert measures (of length, mass, time) using tables, to do simple measurements with the help of various meters (scales), measuring instruments (ruler, tape measure), household measures (tea or table spoon, measuring cup), thermometer for measuring the temperature of water or air following oral instruction of

the teacher. The degree of formation of knowledge, skills and operations of this level makes it possible for adults to help each other in the process of performing calculations and measurements.

The *average* level is reproductive and manifests stable formation of the students’ ability to solve arithmetic tasks given in the section “Solve on your own” requiring actions on the analogy. The level includes the formation of certain ideas of the students about the four arithmetic operations, ability to do addition, subtraction, multiplication and division of prime and concrete numbers on calculator with the teacher’s help, to convert measures (of length, mass, time) using tables, to do simple measurements with the help of various meters (scales), measuring instruments (ruler, tape measure), household measures (tea or table spoon, measuring cup), thermometer for measuring the temperature of water or air on the model given by the teacher. The degree of

formation of knowledge, skills and operations of this level needs constant help of the teacher in the form of demonstrating visual supports, demonstration of actions and providing commentary.

The level *below average* is passive and indicates the students' ability to solve arithmetic problems which are supplemented with illustrations, needs a brief formulation of the task, and has a detailed description of the course of solution in the aid.

The level includes the formation of elementary ideas of the students about the four arithmetic operations, ability to do addition, subtraction, multiplication and division of prime and concrete numbers on calculator with the teacher's practical help, to convert measures (of length, mass, time) by imitating the teacher, to do simplest measurements with the help of various meters (scales), measuring instruments (ruler, tape measure), household measures (tea or table spoon, measuring cup), thermometer for measuring the temperature of water or air in the process of practical activity together with the teacher. The degree of formation of knowledge, skills and operations of this level needs constant help of the teacher in the form of common activity with the teacher, use of imitation on each stage of solving the problem, demonstration and explanation of the content of the actions and their sequence.

The aid "Practical Mathematics" contains the content of all three levels of acquisition of material described above. "*Practical Mathematics*" is a *complex teaching aid* for adults with

intellectual disability meant to teach them to solve simple and composite (but not more than two operations) arithmetic problems with everyday life content using four arithmetic operations – addition, subtraction, multiplication and division – using calculator.

Parallel acquaintance with geometrical material and formation of spatial and temporal cognitions take place on the basis of arithmetic problems with *everyday life content*. The general content of the aid covers six areas meaningful for the life of a person: health, food, everyday life, clothes and shoes, labor and leisure.

The aid contains ten kinds of arithmetic problems with everyday life content in each of the above mentioned areas with the total number of 180 problems: 60 problems are supplemented with solutions as models, in another 60 analogous problems without solutions we changed the numerical data, and the remaining 60 problems are to be solved on computer with the help of the computer assisted training program "We solve problems by ourselves".

Let us now give examples of the problems included in the work sheets of the aid in each life area.

Health

The average weight of a newly born baby is 3kg 300g. If the baby's father smokes, the weight of the baby is expected to be smaller than the average by 125g. If the baby's mother smokes, the weight of the baby is expected to be smaller than the average by 300g. Define the weight of the baby if: a) its father smokes; b) its mother smokes.

Food

For housekeeping and economy of family budget it is important to know the cost of food and to be able to calculate expenses. Give food product prices per 1kg. Calculate the total cost of the food products. Fill in the table.

Everyday life

To wash 1kg of linen it is necessary to take 50g of washing powder. How many kilos of linen can be washed with 100g, 200g, or 300g of washing powder? Take the necessary amount of washing powder using the measuring cup.

Clothes and Shoes

Put your foot on a sheet of carton. Outline it and cut out. Measure the length of the foot with a ruler. Find out your shoes size in the table.

Labor

The work day starts at 9. It lasts for 8 hours. Lunch break takes 30 minutes. Calculate the time at which the work day ends.

Recreation and Leisure

On a weekend, 4 adults and 8 times more children went on a tour of Belarus cities. How many people went on a tour? Name the cities of Belarus which could be visited during a tour.

The main way of solving the cited problems consists in overall consolidation of relationship of education with practical life. This relationship is realized both through the content of the problems presented in the teaching aid and the ones created by the teacher or student on the analogy with the given ones. Through problem solution, adults with intellectual disability living in neuropsychiatric boarding

houses whose social experience is rather poor get to know important facts of life, meaningful in the cognitive and educational sense. The topics and problem plots have clearly expressed practice-oriented character. Their content facilitates the formation of initiative, responsibility, careful attitude to one's own and other people's health and everyday life independence of adults. The mathematical material employed in the aid has a strong potential for the formation of elementary ability to orient in phenomena, ties and relations of economic character, for the consolidation of skills and actions vital for everyday life and ensuring the viability of man in the modern society.

The content of the problems is brought as close to the interests of adults as possible; it is aimed at enhanced motivation to solving the problems and doing the tasks of the aid as the problems are connected with the students and look upon the adult as a participant of the events that are linked to their family and themselves.

The Guidelines for Methods of Teaching Practical Mathematics are designed for specialists who plan to teach adults with intellectual disability practical mathematics; the guidelines contain methods commentary for every page of the teaching aid and disclose the methods and techniques of work on each topic and provide a list of didactic means, such as calculator, tape measure, tapeline, measuring cup for food products or washing powder, scales (floor and household scales), thermometer for measuring air and water temperature, dial clock, calen-

dar and conversion tables of measure units of length, mass, volume and time. Here is an example of the initial stage of teaching on the basis of the textbook "Practical Mathematics".

Prior to starting work with the textbook "Practical Mathematics" the teacher is advised to carry out an introductory talk with the learners. It would be useful to illustrate the connection of mathematics with real life on concrete examples. For example, the teacher could show any transport ticket and ask the students to calculate how much it would be necessary to pay for transportation a day (a week, a month) if travel to work presupposes one change (or two changes) of means of transport. One more example: The teacher could bring a thermometer for measuring temperature in the classroom, leave it for a time on the table and then ask the students to measure the temperature in the classroom they are in. Such examples are offered in order to enhance motivation to learning and to demonstrate close relationship between the given subject and reality; they give a cue to understanding the essence of the course title – "Practical Mathematics".

Conclusion

The following steps are urgent and vitally important in the paradigm of continuing education and improvement of the process of preparation for independent life of adult people with intellectual disability living in neuropsychiatric boarding houses:

– creation of conditions for providing education at neuropsychiatric boarding houses: gathering learning

groups and working out complex teaching aids (syllabi, teaching aids for adults, guidelines for methods of teaching for specialists);

– motivation to education in people living in neuropsychiatric boarding houses;

– training specialists, qualified and able to realize the tasks of education and support of young and adult people with intellectual disability living in neuropsychiatric boarding houses.

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