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Algorithmic methodological and mathematical literacy of the future primary education teacher: Perspective of learning technology

Zhupat Astambayeva[*1], Abai Kazakh National Pedagogical University, Institute of Pedagogy and Psychology, Pedagogy and method of primary education, mkrn Nurkent 45, Almaty, Kazakhstan https://orcid.org/0000-0002-4911-9614

Aziya Zhumabayeva[2], Department of Pedagogy and Methods of primary education, KazNPU named after Abai, Dostyk ave., Almaty, Kazakhstan

Marina Romanova[3], Department of methodology, State Autonomous educational institution of higher education of the city of Moscow "Moscow city pedagogical University, Moscow city, Russia https://orcid.org/0000-0001-6958-6693

Nurbanu Nygymanova[4], Candidate's degree in pedagogical sciences, Professor, Eurasian Humanities Institute, 18/2, Aleksandr Barayev Street, 010000, Nur-Sultan city, Kazakhstan, https://orcid.org/0000-0001-7104-2548

Rabiga Bazarbekova[5], , Autonomous educational organization "Nazarbayev intellectual schools", Center for Educational Programs, 7G, Sauran Street, 010000, Nur-Sultan sity, Kazakhstan https://orcid.org/0000-0003-4002-064X

Makhinur Nizamova[6], University of International Business, Language Centre, Abai ave. 8A, Almaty, Kazakhstan https://orcid.org/0000-0001-8354-1360

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Abstract

The relevance of the study is based on the development of algorithmic methodological and mathematical literacy of future primary school teachers, the use of knowledge, practical skills and abilities acquired at universities in real professional activities, in everyday life. In this regard, this article is aimed at determining the dynamics of the development of algorithmic methodological and mathematical literacy of the future teacher through exercises of various content and directions. The main bases of research on the development of algorithmic, methodological and mathematical literacy of the future teacher of primary education were taken as systematic, operational, anthropological, axiological and competence. Systematic platform for the development of literacy on the basis of a systematic position in teaching methodological and mathematical materials were considered. The research included algorithmic literacy of 68 new students, a survey of 3rd year students 38 3rd year students and 38 primary school teachers. The essence and methods of teaching exercises aimed at developing literacy were revealed. The materials of the article are practical assistance to young teachers of pedagogical higher educational institutions of specialties 6B013 – Pedagogy and methods of primary education, pedagogical colleges and schools.

Keywords: algorithmic methodological and mathematical literacy; functional literacy; algorithmic literacy; mathematical literacy; methodological literacy; exercises aimed at developing literacy.

* ***** ADDRESS FOR CORRESPONDENCE: **Zhupat Astambayeva**[*1], Abai Kazakh National Pedagogical University, Institute of Pedagogy and Psychology, Pedagogy and method of primary education, mkrn Nurkent 45, Almaty, Kazakhstan
E-mail address: zhupat66@mail.ru

1. Introduction

The development of algorithmic methodological and mathematical literacy of the future primary education teacher is one of the most pressing problems of our time. The issue of developing functional literacy of Kazakhstani schoolchildren identified in the National action plan for the development of functional literacy of schoolchildren for 2012-2016 (National action plan for 2012-2016. Astana, 2012). In general, the development of functional literacy not only of students, but also of students directly depends on the quality of training of future teachers in pedagogical science, especially in universities. Ukkonen-Mikkola & Varpanen, based on socio-cultural and post-structural theory, raised the issue of using trainings that combine initial and continuous training of preschool and primary school teachers and said, «We argue that the practices of reflection and collective enquiry inherent in the model offer a fruitful starting point for further efforts to understand how to support the development of the professional agency of teachers and student teachers simultaneously» (Ukkonen-Mikkola & varpanen, 2020; Bagila et al., 2019). At the same time, future teachers receive significant fundamental and practical knowledge within the framework of the short-term, fast-developing program of primary pedagogical education (ITE) (DeLuca et al., 2021), issues of pre-graduate training of future teachers in technological pedagogical knowledge, skills and abilities (Tugelbayeva et al, 2019), initial training of future teachers using ICT tools and their capabilities in the classroom (Mlambo, Rambe, & Schlebusch, 2020).

There are studies such as psychological and pedagogical training of engineering students and their impact on the communicative competence of future specialists (Maria-Monica Popescu-Mitroi, etc., 2015), the introduction of multilingualism in the process of training future primary school teachers (Zhumabayeva, 2020). In addition, the literacy of the future teacher directly related to pedagogical, psychological and methodological training. Therefore, the future teacher of primary education should also be algorithmically, mathematically-theoretically and methodically competent. In our article, we studied the level of algorithmic literacy of students enrolled in the specialty pedagogy and methodology of primary education of a higher educational institution, the level of development of algorithmic literacy in the disciplines «theoretical foundations of Mathematics with updated content», «methods of teaching mathematics» and the development of algorithmic methodological and mathematical literacy of a future specialist with the help of various exercises related to the acquisition of knowledge obtained from a special course «methods of teaching algorithms».

In general, mathematics has its own kind of exercises: they are examples, problems, and equations. The future teacher should be able to distinguish these types of exercises in his professional activity, first master the sequence of their execution that is, the algorithm, and then apply the algorithm of execution to primary school students, the methodology of the algorithm in practice. We considered the algorithm of all these types of exercises for future teachers to select tasks according to bloom's taxonomy and perform them, compile and analyze various exercises, prepare a flowchart, compile an analysis algorithm and types of exercises for themselves, and prepare the development of an analysis algorithm.

2. Methodology

Theoretical methods:

Analysis (analysis of pedagogical, scientific-theoretical and scientific-methodological literature to reveal the essence of the concepts «pedestal», «exercise», regularity, activity, competence bases); classification (classification of mathematical exercises and exercises aimed at developing algorithmic methodological and mathematical literacy); modeling (modeling the algorithm for performing mathematical exercises, modeling the results of research);

- empirical methods: analysis of the experience of colleagues in conducting mathematical disciplines, generalization and systematization of their own experience in conducting special courses

in the disciplines «fundamentals of updated mathematical knowledge of primary school students», «methods of teaching mathematics» and «methods of teaching algorithms».

- practical diagnostic methods (interviews with students and teachers, analysis of written diagnostic work of Students, survey of students),

- mathematical methods (statistical processing of the results of a pedagogical experiment, t-Criterion student).

Experimental and experimental base at Abai KazNPU, Institute of Pedagogy and psychology.

The research work consists of three stages (determinative, forming, verification experiments): at the first stage, theoretical analysis of the philosophical, pedagogical and methodological-literary, systematic, anthropological, competence bases related to the problems of teaching algorithms, literacy development, dissertation work related to the problem of research, as well as theoretical and methodological research of teaching mathematics was carried out; the problem, goals and objectives of the research were determined, and a plan of experimental research was prepared.

The second stage – the purpose of the training stage – is to develop a methodology for the development of algorithmic methodological and mathematical literacy of future teachers, test its content and results of training. During this period, lectures, practical exercises and independent work were conducted from the special course «methods of teaching algorithms» in order to avoid post-secondary shortcomings and develop algorithmic methodological and mathematical literacy of future teachers. Exercises aimed at developing the level of knowledge of future teachers selected, new exercises compiled, a descriptor of each exercise was developed, and the evaluation mechanism was determined.

At the third stage, in order to check the results after completing a special course, future primary education teachers received an author's questionnaire «algorithm and methods of teaching them», a written diagnostic control paper consisting of 6 tasks according to bloom's taxonomy. Because of experimental and experimental work, the results of the implementation of the tasks «Theoretical foundations of mathematics (TFM) », (Methods of teaching mathematics (MTM) related to the development of the future teacher of primary education were tested. Teaching a special course «Methods of teaching algorithms» (MTA), a «special» type of mathematical training is used to master the algorithm of the method of solving a problem, finding the essence of an example, finding the root of an equation, and the future teacher of primary education can use the following special exercises:

1) competence-oriented exercises;

2) exercises aimed at developing research activities;

3) exercises aimed at developing curiosity;

4) practice-oriented exercises;

5) the results of experiment work related to the ability to perform exercises of logical content were studied, the conclusions were analyzed, the dynamics of the development of algorithmic mathematical and methodological literacy of the future teacher of primary education were checked and clarified, theoretical and practical conclusions were drawn and the identified results were generalized and systematized.

3. Results

Actual data and results:

Research conducted: in the course of analysis of theoretical, mathematical and methodological literature and dissertations on the problem of developing algorithmic and mathematical literacy of future teachers, we found that the concepts of «functional literacy», «algorithmic literacy», «mathematical literacy», and «methodological literacy» mainly considered separately. Development

of algorithmic literacy of students and students through an online program (Humrickhouse, 2021), development of information literacy of students through information and communication technologies (Csernoch & Biró, 2015), mathematical literacy in the process of teaching statistical materials (Büscher, 2018), the impact of a computer training program on adult literacy and numeracy (Deshpande, Desrochers, Ksoll & S.Shonchoy, 2017). When students are asked to write about their algorithmic awareness, there is the possibility for improved algorithmic literacy practices, the author concludes with the help of algorithmic platforms (Facebook, Google, Amazon) that are now actively involved in everyday life (Koenig, 2020). "Functional literacy is an indicator of a person's ability to communicate with the external environment and the ability to adapt and interact as quickly as possible" (formation of functional literacy of students primary classes, Astana, 2013).

There are practically no special research papers devoted to the development of algorithmic literacy of a particular future specialist. Formation of algorithmic competencies of future ICT specialists (Popova, 2019), formation of elements of logical and algorithmic literacy of primary school students (Soroka, 2006), algorithmic training of students of primary school faculties (Hamer, 1999), algorithms in methodological and mathematical training of primary school teachers (Efimov, 1982), strengthening of algorithmic orientation of training of primary school teachers (Ibodov, 1983), etc. issues are considered. In addition, on the problem of the formation of methodological literacy of future specialists, we can name the work of N. A. Yegorova, but it itself is devoted to the problem of the formation of methodological literacy of the future teacher of a foreign language through authentic film text (Yegorova, 2012). In general, the problem of «functional mathematical literacy» also raised in the works of several scientists. Yevtykhova in her article notes that the functional mathematical literacy of middle school graduates «directly depends on the level of mathematical literacy of a primary school teacher» (Yevtykhova, 2015). In addition, G. S. Kovaleva describes functional mathematical literacy as «the ability of a person to understand and determine the role of mathematics in the world in which he lives, to convey well-founded mathematical judgments» (Kovaleva, 2009).

Having studied the works of scientists discussed above, the definition of the concept of «algorithmic methodological and mathematical literacy» is given: «algorithmic methodological and mathematical literacy of the future teacher of primary education is the literacy of their application of methodological, psychological and pedagogical knowledge, the theoretical foundations of mathematics and the knowledge gained in methodological disciplines in the educational process, during daily classes, in research and final (diploma) work, during pedagogical practice and in real life.»

Results of the survey (determining experiment): 43 students of the 3rd year of Abai Kaznpu in Almaty, 18 students of Almaty university, 8 students of this specialty of East Kazakhstan State University in Ust-Kamenogorsk and 44 students of Almaty Kazakh State humanitarian and pedagogical college No. 1, 38 primary school teachers with work experience of 1 to 27 years in various schools of Almaty (№67, 154, «Algorithm», 33), the vast majority of teachers, we noticed that they have no idea what algorithms of materials are considered in primary school mathematics. The algorithm performed according to the types of exercises (problem, example, equation) could not write the content at all. Primary school students had no idea that the curriculum has its own algorithm not only for Section materials, but also for performing various exercises.

If we analyze the results of the above survey on Bloom's taxonomy, we can draw the following conclusions:

Table 1-percentage result of the survey

Stages of Bloom taxonomy	Survey result: achievements and percentage	Survey result: disadvantages and percentage

To know	• knows about the "algorithm" • can tell the types of algorithms. **Result: 67%**	• does not know the exact definition of the concept; • confuses algorithm types; • does not know the need for an algorithm; • does not know the types of exercises, cannot distinguish them. **Result: 33%**
To understand	• understands the tasks assigned to the algorithm types; • understands the content of tasks; **Result: 38%**	• does not understand algorithms in elementary mathematics; • does not understand the order of actions to be performed; • can not explain what the main features of the types of training are. **Result: 62%**
To apply	a linear algorithm can be used in the execution of strings; **Result: 26%**	• does not use the sequence of performing exercises; • cannot accurately maintain the sequence of the algorithm; • does not have its own algorithm; • cannot use the appropriate algorithm type. **Result: 74%**
To analysis	can analyze the linear type of algorithm. **Result: 24%**	• When performing various types of exercises, it is not possible to perform analytical work sequentially; • Has not mastered the report analysis algorithm; • Does not analyze ways to develop algorithmic literacy of students; **Result: 76%**
To summarize	Can define a new concept. **Result:17%**	• Does not know the types of training, can not make a flowchart according to it; • Confuses concepts related to the algorithm. **Result: 83%**
Rating	Can evaluate the need for an algorithm. **Result: 15%**	• Cannot determine the order of the algorithm in students ' tasks; • Although it determines the order of its actions, it is difficult to give an accurate assessment of it; • Cannot identify and accurately evaluate errors in the order of execution of the operation algorithm. **Result: 85%**

Table 2-types of mathematical exercises:

Report	**Example**	**Equation**
This is a special type of mathematical exercise with several significant features	An inscription written using numbers, operations, and sometimes parentheses.	Equality given by numbers, operations, and letters

One of the most important problems is to distinguish between different types of mathematical exercises presented in Table 2. The authors of textbooks on mathematics of the new generation in primary schools Ospanov T. K., Kosanov B., Kayynbayev zh.in their article "let's break the gap" (Ospanov et al., 1993) note that in the methodology of teaching mathematics in primary schools, there is still a lack of consistency in explaining the meaning of the concept that defines the term «accounting», and the problem of mathematical terminology in the Kazakh language is not solved to the extent that it meets the requirements of today.

In addition to being able to distinguish between different types of mathematical exercises, future specialists should also know that they have their own algorithm for working with them.

We believe that the exercise itself should be divided into three stages:

1. analysis of the exercise.

2. performing the exercise.

3. generalization of the exercise.

Analysis of the exercise means identifying the problems that are expressed in the text of the exercise, conducting vocabulary work, determining what to perform, in what order, and how to perform it. As a result of this analytical work, it turns out what type of exercise it is, and then an algorithm for performing it according to each type of exercise is obtained.

Table 2 shows the algorithm for performing the above types of exercises.

156 · (6075 + 9980 – 15 996) : 26 **for example**	Write and **check** the equation: 27 401 the division of the numbers X is equal to the sum of the numbers 398 and 119
Execution algorithm:	***Execution algorithm:***
1. teach the exercise; 2. define the training requirement; 3. teach an example; 4. determine how many tricks there are; 5. verbally determine which operation is performed first; 6. specify the Order of execution of the operation in numbers; 7. perform each operation of the example separately in writing as a column; 8. check the value of each operation; 9. digest the exercise; 10.find out how many operations were performed, which operation was performed first, why this operation was performed, which last operation was performed, and specify the result of the example.	- Teach the exercise; - Determine the training requirement; - Create an equation; - Teach the equation; - Pay attention to the positive part of the equation; - Find out what is given in this part; - Verbally determine what you need to find first; - Tell me why you need to find the value of the sum; - After finding the value of the sum, determine which equation will come out; - Identify an unknown component in this equation; «Tell me how to find him»; - Perform the exercise; - Digest the exercise; - Find out if the equation is solved correctly, if the root is found correctly; - Check the equation; prove that the exercise is performed correctly.

Table 3-mathematical exercises and methods of their implementation

Report: Two ships sailed from two berths simultaneously in two opposite directions from each other. The speed of one is 43 mph, and the other is 36 mph. The distance between the Two Harbors is 440 miles. What will be the distance between the ships in 4 hours?

Execution algorithm:

- Teach the report;
- Define the type of movement in the report;

«Tell me what it says»;

- Determine how many ships, in which direction they went;
- Determine the known value in the report;
- Define the value that is unknown or sought in the report;
- Tell me how fast one of them is;
- Determine the speed of the second ship;
- Tell me what you can find by knowing the speed of two bodies;

«Tell me what you found»;

- Determine the time;
- Determine what to find if the speed and time are known;

«Now find out if you can answer the question»;

- Tell me how to find out what will be between the ships in 4 hours;
- Write down the solution and answer to the problem;
- Digest the exercise;
- Determine how many methods the report was issued;

«Prove the answer to the question».

Here we performed the tasks of written diagnostic control work for effective control and correction of the formation of algorithmic mathematical knowledge and skills in future primary school teachers. At first, this work was complicated after the 1st year, the methodological course and the special course were carried out by students of the 3rd year. They were offered 6 tasks according to The Bloom taxonomy (BT).

Table 4-content of the written work

Stages of thinking on Bloom's taxonomy	Tasks
To know	**What do you know about the algorithm and its types? Write a real-life example for each type.**
To understand	**Understand the pattern and write down each row of numbers, continuing with four digits:**
To apply	**Create a report using the following algorithm and extract it:** • Come up with a plot or situation. • Name the objects mentioned in the report. • Give a numerical description of objects. • Create a report question or requirement. • Create the full text of the report. • Create a report. • Write down the solution and answer to the problem.
To analysis	**Write down the algorithm for analyzing the report:** from two villages with a distance of 17 km, two skiers simultaneously came out of each other in opposite directions, and after a while stopped. During the stop, the distance of skiers from each other was 110 km. The speed of the first skier is 14 km/ h, and the second-17 km/ h. How many hours were the skiers on the road before the stop?

To summarize	**The value of the expression is found using separate operations. What expression is that?** **Write an expression and write the order of operations in the expression on top.**
Rating	**Check the algorithm of the operation, if there is an error, find it, correct it, and put the algorithm in order.**

Similar tasks were carried out after three courses: «Theoretical foundations of mathematics» (TFM), «Methods of teaching mathematics» (MTM), «Methods of teaching algorithms» (MTA). Of the 86 students, 42 were in the control group (CG), and 44 were in the experimental group (EG), that is, the experimental group taught the textbook «fundamentals of updated mathematical knowledge of primary school children» and a special course «Methods of teaching algorithms», in which students studied memos and algorithms, and the control group did not provide such special algorithmic materials, classes were conducted according to the curriculum.

The above-mentioned descriptions of written diagnostic control tasks were determined, which determined the competencies and abilities of students in the educational process.

Table5-written diagnostic evaluation descriptor of work tasks

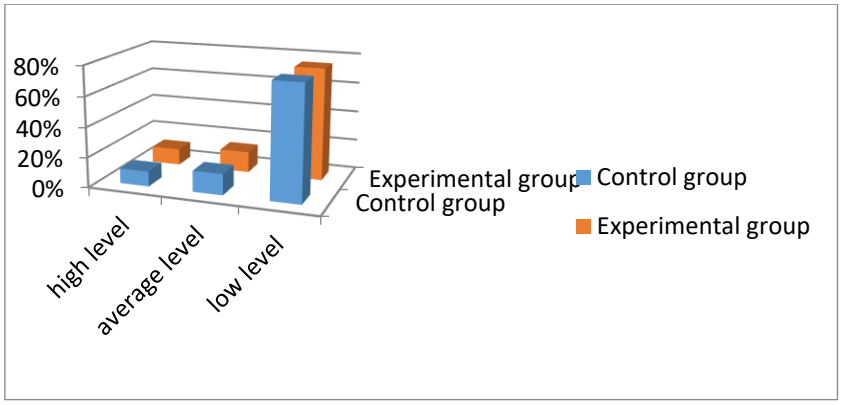
Exercise №	Descriptors	Number of points	Max. score
1.	✓ He knows what an algorithm is.	1	5
	✓ Knows the types of algorithms.	1	
	✓ Can give an example of a linear algorithm.	1	
	✓ Can give an example of a branched algorithm.	1	
	✓ Can give an example of a cyclic algorithm.	1	
2.	✓ Understands what legitimacy is.	1	5
	✓ Can identify patterns in a row.	1	
	✓ It understands that it is a" binary series".	1	
	✓ You can write 4 numbers in the first row.	1	
	✓ You can write 4 numbers in the second row.	1	
3.	✓ Can use the algorithm.	1	7
	✓ He knows what the report is.	1	
	✓ The plot can be thought out.	1	
	✓ Can compile the full text of the report.	1	
	✓ Can issue a report.	1	
	✓ Can record the solution of the problem.	1	
	✓ Select the answer to the report.	1	
4.	✓ Can understand and issue a report.	1	5
	✓ Can distinguish the type of movement.	1	
	✓ Can analyze the report.	1	
	✓ Can choose the right approach to solving the problem.	1	
	✓ Can write down the solution and answer to the problem.	1	
5.	✓ Knows the sequence of operations.	1	3
	✓ Can define an expression.	1	
	✓ Correctly finds the meaning of the expression.	1	
6.	✓ Knows the algorithm of the written division operation.	1	5
	✓ Knows the sequence of the algorithm.	1	
	✓ Can find an error in the algorithm.	1	
	✓ Understands terms in the algorithm.	1	
	✓ Can streamline the algorithm.	1	

	Total:	**30**

Table 6-the results of the control work carried out at the beginning of the experimental work.

№	Levels	Groups	
		CG(42)	EG (44)
1	High	10%	11%
2	Average	14%	14%
3	Low	76%	75%

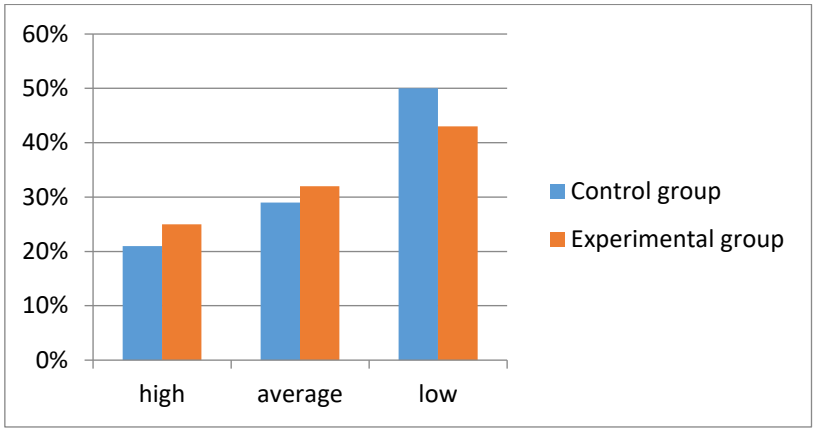
You can display this as a chart as follows:



Although no specific algorithmic materials were taught in the courses «Theoretical foundations of mathematics» and «Methods of teaching mathematics», the algorithms of some materials, in particular, such as adding and subtracting numbers, performing written operations, solving problems, were considered. After completing these courses, in order to determine the level of development of the IAS of future specialists, tasks similar to the previous ones, but somewhat changed, were given. Write a linear algorithm for drawing rectangles according to the «know» level; According to the level of «understanding», «understand the problem generation algorithm and put the algorithm in order», according to the level of «evaluation», «correct the error in the algorithm associated with the sets given in the student's work and put the algorithm in order».

The diagram of the control work obtained after studying the first two courses is as follows:

№	Courses	TFM and MTM	
	Levels		
		БТ(42)	ЭТ (44)
1	High	21%	25%
2	Average	29%	32%
3	Low	50%	43%



If you look at the table and diagram, you can see that the progress of development of future specialists in the main course has significantly increased compared to the beginning of the experiment. However, after completing the methodological courses, you can see that the algorithmic methodological and mathematical literacy of future specialists is still at an average level. It can be seen that the high level itself does not reach 30%, on the contrary, it is dominated by low-level future teachers. Therefore, a special course «Methods of teaching algorithms» has been prepared, 15 hours of lectures, 30 hours of practical work, 60 hours of independent work of students under the guidance of a teacher and 60 hours of independent work of students. In the lessons, in addition to exercises from primary school mathematics textbooks (problem, example, equation), work with special types of exercises was organized.

Here is an excerpt from the special course «Methods of teaching algorithms» and the content of 1 practical lesson:

Table 7-excerpt from the syllabus of the course «Methods of teaching algorithms»

Week/ Day	Title of the topic (lecture, practical lesson, SRS)	Number of hours	Maximum score
1	**2**	**3**	**5**
1	**Module 1.** **Theoretical block** 1. Algorithm and its types. ***Professional business block 1.*** The essence and purpose of the algorithm learning methodology, analysis of algortm types.	2 2	1 5
2	**Module 2.** **Lecture 2.** The relationship between logical and algorithmic thinking of Primary School students ***Professional business block 2.***Analysis of the methodology of formation of logical and algorithmic thinking of students	2 2	1 5

For the development of algorithmic methodological and mathematical literacy of future primary school teachers, we offer the following types of exercises::

- the concept of an algorithm and exercises for determining its properties;
- exercises related to ways to write algorithms;
- exercises related to mastering the structure of the algorithm;
- exercises related to the analysis of algorithms;
- exercises related to methods of constructing algorithms and constructing algorithms;

-ability to create a flowchart based on the content of the exercise and create tasks based on a flowchart.

Content of practical work № 5, which was prepared and tested on a special course «Methods of teaching algorithms».

Topic: development of an algorithm for analyzing numbers, preparation of a methodology. Creating an algorithm for implementing arithmetic operations.

1. Prepare a flowchart for the algorithm used to pass the numeration of numbers in the amount of 10.

2. Prepare an algorithm for extracting full decimals (hundreds).

3. Prepare an algorithm for reading any multi-digit number according to the algorithm «reading multi-digit numbers» in the lecture.

4. Write down the analysis algorithm for any two-digit number in the form of a 30-second video.

5. Prepare an algorithm for implementing any operation.

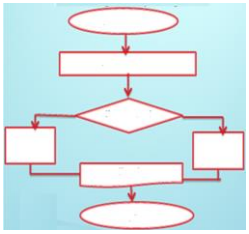
6. Using the flowchart as a template, prepare an algorithm for multiplying the sum by a number and dividing the number by the sum.

BLOCKS	
	Stop block representing the beginning and end
	An I / O block that enters the transmitted data and outputs the results
	Process block that performs arithmetic operations
	Block on which a decision is made to verify the non-fulfillment or non-fulfillment of the contract
	Repeat block

By the end of the experimental work, future teachers received a written summative assessment paper (its content is shown in Table 8).

Table 8-written summative assessment tasks and descriptors

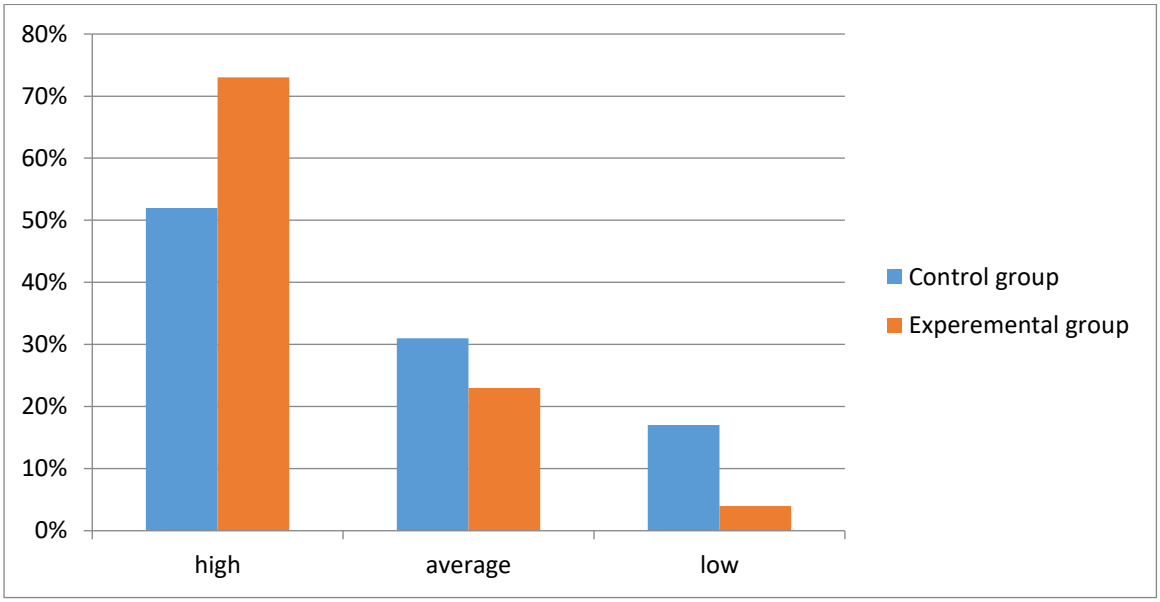
Group level of control	Content of the exercise	Descriptors	Number of points
To know	There is a distinction between an algorithmic definition and an algorithm.	1. Knows what an «algorithmic definition» is. 2. Knows what an «algorithm» is. 3 .Knows the properties of the algorithm.	 1 1 1

To understand	Create an algorithm for the exercise: «draw a rectangle using a grid».	1. Understands that the task assigned to the construction work is; 2. Understands the algorithm; 3. Can write an algorithm.	1 1 1
To use	«In parentheses, the operation inside parentheses is performed first». Give the algorithm as follows: A) in the form of a memo; B) with a list of commands; B) flowcharts	1. Applies the rule; 2. Can write a memo to the rules; 3.Writes the algorithm based on specific commands; 4. Creates flowcharts. 5.gives a detailed description of the algorithm using a specific example.	1 1 2 2 1
To analysis	Solve the equation: 7x-9= 5x+13 a) by selective method; based on the property of direct equality; b) based on the reciprocity of actions; c) based on the property of direct equality.	1. Defines the type and class of the equation; 2. Analyzes the algorithm for solving the equation by selecting the value of the unknown. 3. The equation written by analyzing the solution algorithm because the addition and subtraction operations are mutually inverse. 4. Writes an equation based on the property of direct equality, analyzing the algorithm for solving it.	1 1 2 2
to summarize	Look at the flowchart and build an example. 	1. Understands flowchart, can read; 2. Can find the type of algorithm based on the block diagram. 3. Create an algorithm for generating a flowchart report; 4. Create an algorithm for solving an equation based on a flowchart; 5. Can create an algorithm for finding the value of an example using a flowchart; 6. Can clearly determine the order of the algorithm according to the flowchart.	1 1 2 2 1 1
Rating	Find an error in the logic problem output algorithm. Why do you think that? Justify your answer.	1. Find the order of actions performed in a logical problem; 2. Is able to determine the most convenient and effective from the implemented algorithm; 3. Can detect an error made by a student.	1 1 1

The result of written summative assessment tasks is shown in the table and diagram below.

№	Levels	End of the experiment	
		CG (42)	EG (44)
	high	52%	73%
	average	31%	23%
	low	17%	4%

Based on the data at the end of the experiment in the table, a diagram was constructed:



If you look at the diagram and table, you can see that the dynamics of the development of algorithmic methodological and mathematical literacy of specialists has significantly increased in the course of conducting a special course «Methods of teaching algorithms» for future specialists, lectures and practical classes, as well as completing tasks of IWS and IWST. In the course of the previous two subjects, the level of knowledge in the experimental group was only 25%, and according to the results of the written summary Control conducted at the end of the special course, it was increased by 73%.

$t = \frac{\bar{x} - \bar{y}}{\sqrt{m_1^2 + m_2^2}}$. Then $\bar{x}_{opm} = \frac{\sum f_i \cdot x_i}{n}$; $\bar{x}-$ for control groups, $\bar{y}-$ average values for the experimental group; $m_1 = \frac{S_1}{\sqrt{N_1}}$ and $m_2 = \frac{S_2}{\sqrt{N_2}}$, $S = \sqrt{\frac{\left(x_i - \bar{x}_{opm}\right)^2 f_1}{N-1}}$.

From the table $t_{0,05} = 1{,}984$ because, $t < t_0$, hence, H_0 the forecast is accepted.$\bar{x}_{орт}$=39,5 and $\bar{y}_{орт}$=58,3. S_1 = 14,1and S_2=24,2. m_1=2,2 and m_2 =3,6.

t_0=7,8, and $t_{0,05}$=3,18. So that, $t<t_0$, that is 3,18<7,8.

4. Discussion

In Table 1, future teachers are well versed in the algorithm and have a small level of understanding, but do not know the types of algorithms, the types of algorithms considered in primary schools, the types of exercises in primary school mathematics, confuse the exercises with each other, use their names incorrectly, cannot analyze and summarize the algorithm, it is difficult to give an accurate assessment of the algorithmic material in the student's work.

Therefore, it was determined that future primary school teachers should make efforts to master the methodology of teaching algorithms. In accordance with the updated content of primary school education, it was necessary to develop a methodology for the development of algorithmic methodological and mathematical literacy of future primary school teachers and teach its content.

Today, Primary School teachers cannot distinguish the types of mathematical exercises from each other, and all exercises on the page of the textbook called «calculation». We also noticed this when attending classes for primary school teachers, observing them, and giving lectures at the Republican and Almaty regional institutes for advanced training of teachers. It is known from

experience that in most cases primary school teachers use the term «report» instead of «problem report», «content report», «word report», «text report», «arithmetic report», and instead of «example» - «example report».

The purpose of experimental and experimental work related to the development of algorithmic methodological and mathematical literacy of future primary school teachers was to determine the level of development of theoretical and methodological algorithmic literacy of future specialists. The task:

1. Teaches you to distinguish between the meaning of the concept of «exercise» and the types of mathematical exercises;

2. Helps in familiarization with the content of the special course" methodology of teaching an algorithm", training and conducting appropriate types of work (drawing up an algorithm, constructing an algorithm, mastering the methodology of teaching an algorithm, preparing the algorithm for each exercise and the sequence of its teaching methods).

3. Helps in the preparation of types of exercises aimed at developing algorithmic methodological and mathematical literacy of the future teacher in accordance with Bloom's taxonomy, determination of the content of the written work, descriptors and evaluation criteria.

4. Obtaining a written diagnostic work, processing its results.

5. Summing up the results of experimental and experimental work.

Plan of Experimental Research: identification of students of the control and experimental group; determination of the scope, content and timing of completion of tasks; verification of written diagnostic tasks, summing up the results.

In science, any learning task is called exercise. The knowledge gained during the exercise «any person applied repeatedly and variously in different situations and in different relationships. In the process of performing the exercise, the learner is always in search, forms a desire to find new ways to solve the tasks and problems set for him, based on familiar ways» (Lvov, 1988). Exercises - a system of methodological approaches or tasks that serve to consolidate students ' knowledge, develop their skills and abilities (Koyanbayev R. M., 2003; Agranovich et al., 2019)

Training is a set of simultaneous tasks, the sequence of which is assigned and selected, contributes to the achievement of a specific goal-the formation of full knowledge, skills and abilities (Ospanov, 2012). Some mathematicians and methodologists purport it as, «Any mathematical substantive tasks, including tasks, in which exercise is interrelated with each other» (Ospanov & Kdyrbayeva, 2012). Zhumabayeva et al., (2019) define it as «exercises are the integrity of interrelated actions aimed at a single goal» (Zhumabayeva, 2009).

Summarizing the above, we can conclude that exercise is one of the main methods of consolidating knowledge and forming skills and abilities, as well as developing students ' thinking. Future specialists introduced to the types of exercises in mathematics. In general, it is advisable to divide mathematical tasks into three groups. These are examples, equations, and problems. Reasonable use of these words and related concepts should understood as a manifestation of literacy and mathematical culture in general. Therefore, future primary school teachers should also pay attention to the correct and appropriate use of these concepts, that is, they should trained to accurately find examples and problems in the exercises.

The mechanism of evaluation of written diagnostic work of future specialists is as follows:

21-30 points-high level;

10-20 points-average level;

0-9 points is a low level.

High level: knows what an algorithm is, its types, can give specific examples, understand and apply the algorithm, understand the essence of the algorithm and conduct analytical work according to it, determine what expression is executed according to individual operations, find errors in written calculation methods.

Average level: knows what an algorithm is, its types, but can give an example only for the type of linear algorithm, understands the algorithm and can not contain the text of the problem with the help of the algorithm, understands the problem and outputs it, can analyze only the operations that produced the problem, determine what expression is executed by individual operations, can not fully find the error in written calculation methods.

Low level: knows what an algorithm is, its types, but can not create an example of all three types, can determine the regularity in a row, but can not create a problem at all, can compile and execute an expression, can only output the problem, does not analyze it at all, can determine what expression is executed by individual operations, can not find errors in written calculation methods at all, believes that everything is correct.

5. Conclusion

In the course of writing the article, several conclusions were drawn:

1. analysis of the theory of research of the problem of developing algorithmic methodological and mathematical literacy of a future specialist was carried out;

2. exercises aimed at the development of algorithmic methodological and mathematical literacy of the future specialist were prepared, written diagnostic work was carried out to determine the dynamics of student literacy development, and the results were summed up;

3.the results of experimental work carried out in connection with the development of methodological and mathematical literacy of the future specialist were worked out, and the possibility of developing algorithmic methodological and mathematical literacy of future specialists in the course of teaching a special course «Methods of teaching algorithms» was proved.

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