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ALGORITHM FOR THE DEVELOPMENT OF FUNCTIONAL LITERACY IN GENERAL EDUCATION STUDENTS

ALGORITMO PARA EL DESARROLLO DE LA ALFABETIZACIÓN FUNCIONAL EN ESTUDIANTES DE LA EDUCACIÓN GENERAL

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ABSTRACT

In the context of international comparative studies, functional literacy is considered an integral indicator of the national education system quality and a key parameter for assessing the level of student readiness. However, teachers still face the acute lack of assessment and diagnostic materials for determining the level of functional literacy development in general and its individual types. In this study, both theoretical (analysis, analogy, deduction, etc.) and empirical methods were used, including observation, description, and comparison. The study aimed to create an algorithm for developing original assignments for functional literacy development, which allows preparing a significant number of educational assignments for schoolchildren of different ages in a short time. The algorithm, consisting of several steps, allows teachers (both at school and at university) to tackle the lack of assignments for functional literacy development and assessment, to take the individual characteristics of their students into account, and to adapt assignments to the socio-cultural characteristics of a group or class. The presented algorithm is concise, reproducible, easy to use, simplifying the work of teachers and contributing to increased functional literacy of students.

Keywords:

Functional literacy, Mathematical literacy, Scientific literacy, Reading literacy, Pedagogical algorithms.

RESUMEN

En los estudios comparativos internacionales, la competencia funcional se considera un índice integral de la calidad del sistema educativo nacional y un parámetro clave para evaluar el nivel de preparación de un estudiante. Sin embargo, los profesores siguen enfrentándose al problema más apremiante de la falta de materiales evaluativos y diagnósticos para determinar el nivel de formación de la competencia funcional en general y de sus distintos tipos. En el ámbito de este estudio se han utilizado métodos teóricos (análisis, analogía, deducción, etc.) y empíricos, como la observación, la descripción y la comparación. El objetivo del estudio era crear un algoritmo de elaboración de tareas de autor para el desarrollo de la competencia funcional, que permitiera preparar en poco tiempo un número significativo de tareas de aprendizaje para alumnos de diferentes edades. El algoritmo de varios pasos permite a los profesores (tanto de escuelas como de universidades) resolver el problema de la falta de tareas orientadas al desarrollo y la evaluación de la competencia funcional, tener en cuenta las características individuales de sus estudiantes y adaptar las tareas a las características socioculturales de un grupo o de una clase. El algoritmo presentado se caracteriza por su brevedad, reproducibilidad y facilidad de uso, lo que simplifica el trabajo de los profesores y contribuye a la elevación el nivel de competencia funcional entre los estudiantes.

Palabras clave:

Competencia funcional, Competencia matemática, Competencia en ciencias naturales, Competencia en lectura, Algoritmos pedagógicos.

INTRODUCCIÓN

Continuous and exponentially increasing volume of information is an acute challenge for the world's education system; both teachers (including teachers-to-be) and ordinary people in general face it directly in their professional and everyday lives. Streams of "information noise" and so-called fake news require modern teachers to have skills in working with information and various texts, critical analysis of information and a level of pedagogical reflection that allows them to draw their own well-founded conclusions.

The concepts of the VUCA world (Volatility, Uncertainty, Complexity, Ambiguity) and the BANI world (Brittle, Anxious, Nonlinear, Incomprehensible) theoretically reflect changes in the modern world and, with noticeable differences, reflect the general idea of instability, unpredictability and non-linearity of society in the 21st century. In these conditions, formation, development and corresponding effective assessment of students' functional literacy is paramount.

An analysis of modern pedagogical literature shows a wide variety of approaches to defining functional literacy. Authors note (Kappassova et al., 2024) that the content of the concept undergoes significant changes as society and science develop. Notably, the concept is expanding – in particular, today scientists are studying not only the classical mathematical, reading, natural science and financial literacy but also, for example, functional medical literacy (Janmyr et al., 2024), literacy in social networks (Shiang et al., 2024), media literacy (Shevchenko et al., 2021), etc. At the same time, an increasing number of studies are looking into methods for developing functional literacy not only for schoolchildren but also for adults (Kindl & Lenhard, 2023). Most experts use the definition of functional literacy by A.A. Leontiev who believed it was the "use of all the knowledge, skills and abilities constantly acquired throughout life to solve the widest possible range of life problems in various spheres of human activity, communication and social relations" (Kovtsun & Kokhichko, 2022).

The problem of developing functional literacy was studied for several decades by major international organizations (UNESCO, OECD, Council of Europe) due to "the concern of researchers and policymakers in the field of education about the increasing number of cases when an individual has basic writing and reading skills but is unable to apply them in the context of their life" (Morgacheva et al., 2023).

Numerous studies (Chishti et al., 2017) show a high correlation between the level of functional literacy and the level of socio-economic development of the state.

The issue of increasing functional literacy level is also considered due to other factors, such as the changing socio-cultural conditions in which modern students find themselves, and national tasks. It is no coincidence that Russia entering the top ten world countries in terms of general education was listed among the national goals for the development of education in Russia until 2024, this goal was finally achieved only by combining the "efforts of all subjects of the education system" (Gotnoga, 2022). Another important aspect is the requirements of the international program for assessing the educational achievements of PISA students (Bryakova et al., 2022), "which focuses on assessing the practical skills of basic school students (15-year-olds) and their ability to apply academic (theoretical) knowledge in life", including in unfamiliar situations both in and outside the educational organization (Afanasyeva et al., 2021).

Designing own tasks aimed to develop and assess functional literacy is certainly a complex methodological problem (Vlasova et al., 2022).

Teachers need to independently create tasks for developing students' functional literacy for the following reasons:

1. Only a small number of tasks for assessing and developing functional literacy are freely available.
2. Assignments to texts, as a rule, aim to develop one type of functional literacy, although, in our opinion, a systematic approach that includes tasks for the same text meant to develop 2 or more types of functional literacy is more effective and at the same time interesting for children.
3. Assignments that are freely available often do not contain correct answers or detailed explanations and comments to them.
4. The wording of the tasks is often overly academic and scientific, difficult for students to understand, which reduces interest in completing them.
5. Repetitive tasks (Musaeva et al., 2025).
6. The need to use computers and the Internet, since he majority of tasks used in PISA or PIRLS studies include "navigation and dynamic functions – animation, hyperlinks, tabs and pop-up windows" (Kostenko & Ladilova, 2024).

Another specific problem is as follows: the question of defining the concept of functional literacy was raised in 1965, and its content is constantly expanded, improved and clarified, and new skills and competencies necessary for a modern specialist to meet the growing and numerous

requirements of a rapidly changing world are added to its structure (Ksenofontova & Parshina, 2023). Thus, some of the tasks developed in past years are outdated, others require modification, and continuously creating new tasks to form and assess functional literacy is a necessity.

Thus, the study aims to create an algorithm for developing various educational tasks for functional literacy development in students of comprehensive schools. The objectives of the study involve a theoretical description of the structure, stages and content of this algorithm, its testing while working with teachers, collecting the necessary data and their subsequent analysis, as well as improving the proposed algorithm based on the feedback received.

The practical significance of the study lies in creating a simple, convenient and consistent algorithm, following which teachers will be able to quickly create a significant number of original tasks of various types that allow assessing the functional literacy level of students and contribute to its improvement. The theoretical significance is due to the fact that the presented algorithm, the principles of selecting texts and developing tasks, and the proposed types of tasks contribute to the theory and methods of teaching various disciplines.

MATERIALES Y MÉTODOS

The object of the study is educational tasks for developing functional literacy of comprehensive schools students. The subject of the study is the stages and content of the development of such tasks. Primarily theoretical (analysis and generalization of scientific literature on the topic) and empirical methods (comparative analysis, description, direct and indirect observation and survey in the form of questionnaires) were used.

The data for the study were obtained during special training sessions and practical classes with teachers of comprehensive schools in Grozny (Chechen Republic, Russian Federation) through their survey (questionnaires) and analysis of the content and quality of the tasks developed by them based on the results of the relevant training sessions.

When collecting and evaluating data, special attention was paid to: the practical focus of the tasks developed by teachers; the teachers using an interdisciplinary approach; clear criteria for assessing students' answers; the compliance of the tasks with current educational standards. The obtained data allowed us to identify the deficiencies (problems) that teachers encounter when implementing the developed algorithm and to eliminate the shortcomings of the algorithm that were noted by the study participants. It allowed increasing the efficiency of the algorithm and developing recommendations for its integration into the educational process. Thus, the methodology of this study was based on the preliminary development of the corresponding algorithm by the author of this work, its testing by teachers, analysis of their work and receiving feedback, as well as subsequent revision of the algorithm based on the recommendations and comments by teachers.

RESULTADOS-DISCUSIÓN

This algorithm was based on the following principles:

1. Almost any text can be used.
2. The text is considered in a broad sense – to achieve the set goals, not only classical text (articles, excerpts from fiction or scientific works) are used, but also tables, diagrams, infographics, videos or illustrations.
3. Variability: since the teacher is the author of the task, they can independently alter its volume and complexity, so that the same task can be used at literally all levels, from elementary school children to teachers; this is also important, since the teacher can take into account the goals and objectives of the lesson and time constraints.

Stages of creating tasks for forming functional literacy:

Text selection. Articles and other materials from the largest Russian media and excerpts from fiction and journalistic works can be used as a source. A more effective option would be if the text corresponds to current or relatively recently covered topics in a particular discipline. Taking into account the peculiarities of perception of modern children and the size of text assignments on the Unified State Exam, it is best to use material no more than 2000 characters long, which roughly corresponds to an A4 page.

We proceed from the fact that the assignment writer must be guided by the following principles when selecting texts:

a. Variety: it is necessary to regularly offer students texts of different types and kinds: continuous (description, story, instruction, official documents, regulatory legal acts), non-continuous (table, infographics, illustration, diagram, map, graph, etc.) or mixed (instructions in the form of text with pictures, a drawing with a detailed description, an article with infographics).

b. Correctness of sources and the need for preliminary fact-checking. It is necessary to use texts only from verified sources, use current versions of laws, be skeptical about materials from social networks, and double-check the facts presented.

c. Complexity and content of the text are to correspond to the age, psychological and other characteristics of students. In other words, the text and the respective tasks are not to be too simple or overcomplicated for students but to either correspond to their current level

of training or be in their zone of proximal development in accordance with the concept of L.S. Vygotsky.

d. Some other principles, in our opinion, are optional, but contribute to increasing the interest of students in completing the proposed tasks and general motivation for learning.

e. Relevance: the contents of texts are to reflect the latest news and events in Russia and worldwide, and not the events of 20 years ago. Today's children simply do not need a text on

f. how compact discs "defeated" audio cassettes.

g. Correspondence to the socio-cultural experience of students. The text about Soviet poets of the 1960-70s will most likely be of little interest to modern children, unlike an article devoted to the peculiarities of anime culture.

Websites of the largest media, reports of government agencies and speeches of government officials, official statistical information, maps, instructions, posters, posters, announcements, literary texts and many others can be used as sources.

Preparation of questions (tasks) is to meet the following conditions:

a. Sufficiency. The number of tasks for each text must correspond to the time available to students. Depending on the complexity of the exercises, their optimal number is from 3 to 7. Teaching practice shows that sometimes it is useful to design more tasks than a bright student can do in the given time. Uncompleted tasks can become an incentive for further work on them, for the growth and development of children.

b. Variety. There is no point in using the same task more than twice. Offering tasks for the text exclusively on choosing the right judgments or calculating percentages is pedagogically inappropriate – simply put, children will quickly get bored with such tasks. The most effective option is when all the proposed tasks differ in their form and type.

c. Practice-oriented. Tasks should reflect real and significant social problems that children face or may face. In this case, solution should aim to develop useful skills and abilities, to form competencies (primarily soft skills) that are most in demand in the modern world.

d. Complexity. For one and the same text, tasks for various types of functional literacy – natural science, financial, mathematical or reading – can be developed.

The experience of the author of the present study indicates high effectiveness of a number of other techniques: indicating the names of real characters who are close to children instead of abstract N or X, taking into account the students' interests and even making them personally the main characters of the tasks, adding a certain humor and irony to the tasks, taking into account the local and regional context, etc.

Below are 30 options for various educational tasks that can be used in any combination, based on the goals and objectives of the lesson, time and other conditions.

1. Think of a title/heading for the text.
2. Make an outline, giving a title to each paragraph or semantic part of the text.
3. Identify 2 or more points of view.
4. Find common and different positions.
5. Make comparative analysis by criteria.
6. Select true or false judgments.
7. Identify a trend.
8. Argue in favor of/against a particular opinion, measure, product, service, etc.
9. Suggest a solution to the problem.
10. Analyze fake news or identify the reliability of the text.
11. Give advice (requires students to offer their own recommendations for solving a problem).
12. Make mathematical analysis of data: find a percentage or share; calculate the rate of growth or decline; calculate the sum of 2 or more indicators; find the average, median or mode; compare the proportions of several indicators, etc.
13. Find evaluative judgments and facts in the text.
14. Determine the author's attitude to the topic.
15. Consistently reduce the text (to one paragraph – to one sentence – to one phrase – to one word).
16. Find a term by definition or vice versa.
17. Find synonyms or antonyms.
18. Come up with alternative titles for the article.
19. Find relationships and patterns in series of numerical data.
20. Find an analogy.
21. Find errors in the text that the teacher deliberately added to its content.
22. Make as many mistakes as possible and explain why they are mistakes.
23. Find the advantages and disadvantages of a process, phenomenon, product or service.
24. Make a plan (algorithm) of actions
25. Change the style of the text (for example, from fiction to scientific or from journalistic to colloquial).

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26. Formulate examples of similar or opposite situations.
27. Arrange paragraphs in the correct order.
28. Express your feelings (emotions) in relation to what you read.
29. Analyze the probability of events, etc.
30. Search for interdisciplinary connections.

The latter is especially important, since experience shows that "formation of functional literacy within the framework of one subject is ineffective, and the effect is achieved by going beyond the subject into a wider educational space," as noted by the well-known Russian expert in the field of functional literacy, Rutkovskaya (2020).

Determining the number (set) of tasks and the assessment criteria for them. This stage is especially important, since students must clearly know and understand the criteria for assessing their work, which ensures the transparency and objectivity of pedagogical assessments. It is no coincidence that broad research devoted to the qualities of the best teachers according to schoolchildren calls the teacher's objectivity in assessing students a key characteristic.

Reflection. After completing the work, it is extremely important to find out the children's opinions about the tasks offered to them – what problems they experienced, what they liked or disliked most, how difficult these tasks were for them. Feedback can be obtained through an online survey in Google forms, or in the form of written or oral comments from students.

An interesting format for homework and creative assignments for children would be to offer them to make up similar tasks themselves.

Let us consider an example of implementing this algorithm for creating educational assignments for developing various types of functional literacy, using an excerpt from the article Analysts explained why financial literacy is important from a Russian media outlet: "In order to be able to earn money on your own expenses, it is more profitable to keep your own funds in a savings account or deposit, receiving income from them, while simultaneously earning cashback using credit funds," financier Andrey Ponomarev explained. "You are renovating and have large expenses. It is easy to calculate that if you buy goods in a store for 100 thousand rubles on a credit card with a 1% cashback, you get 1 thousand rubles back. At the same time, your own funds, let us say the same 100 thousand rubles, can be on deposit. Even with a relatively modest rate of 6% per annum, in a month you will earn about 500 rubles more as profit from your own funds. Thus, using interest-free credit funds, you can get 1,500 rubles, or 1.5% of the large amount spent on renovations" (RIA Novosti, 2022).

The second stage of the algorithm involves developing various tasks. Based on the level of students' preparation and the teacher's available time, we determine the number of tasks. For this example, we will offer 5 tasks.

We go on over to the list of 30 possible tasks and select 5 tasks based on the form and content of the text:

A. Offering recommendations and advice (No. 11).

B. Thinking up alternative titles/headlines for the article (No. 17).

C. Mathematical analysis of data (No. 12).

D. Arguments in favor of or against a particular opinion, measure, product, service, etc. (No. 8).

E. Analysis of fake news or identification of the text reliability (No. 10).

The next step is vital yet challenging – the teacher needs to make up tasks based on its type. Let us offer several ideas for each of the above-chosen tasks:

A. Offer 3 recommendations for adults (schoolchildren) to improve their financial literacy. Give 5 recommendations for combating financial fraudsters. You received a call from a bank, and you think it is a fraudster; suggest three options how to act in this situation. Give three "bad" pieces of advice on how to fall into the clutches of financial scammers.

B. Think of your own title for the text. Write down the title of the text in a foreign language. What could this article be called if it appeared in a military magazine, a fashion magazine or as an advertisement?

C. What amount can a person earn by opening a 300-thousand-rubles bank deposit at the interest rate specified in the text? What profit will it bring per year (according to the terms of the text)? How much does said person earn per day according to the terms of their deposit? For what period does said person need to open a deposit at 20% per annum in order to earn 15,400 rubles if the amount of their deposit is 70 thousand rubles?

D. Fatimah believes that credit cards are true evil. Give three arguments for and against this opinion. A lot of people believe the cashback system is just a marketing ploy to deceive consumers. Give two arguments for and against this opinion.

E. Under what conditions can an expert's calculations be erroneous? Do you trust the financier's estimates and calculations? Explain your answer. Suggest 3 ways to verify the accuracy of the information in this article. What

information should be provided in the text to dispel doubts about its accuracy? What information can be removed from the text, changed or added to increase doubts about its accuracy?

The effectiveness of this algorithm was tested during a series of functional literacy Olympiads in the Chechen Republic which were attended by over 600 teachers of general education organizations in 2022-2024. Trainings and practical classes were organized for the Olympiad participants on developing their own assignments aiming to form and assess functional literacy. According to the survey, over 90% of teachers noted the convenience and simplicity of the proposed algorithm, over 85% of respondents added that they would use it in their work, and about 90% of teachers positively assessed their experience of creating similar tasks based on this algorithm. At the same time, about 78% of teachers noted that they had not previously independently developed such tasks for schoolchildren.

The following conclusions were made during the study: an analysis of the available scientific literature shows that the overwhelming majority of articles both in Russia and worldwide are devoted to the analysis of the concept of functional literacy, its content and structure, ways to improve it in schoolchildren or students, and to the study of the factors that influence its level, etc. At the same time, studies related to the specifics of developing tasks and testing the author's algorithms for their creation are practically non-existent.

We fully share the opinion of the leading modern experts (Barber & Mourshed 2008) who (like Andreas Schleicher, Head of the PISA program) note that the quality of the education system cannot be higher than the quality of training of the teachers working in it. In the context of this study, we can formulate this idea differently – the average level of functional literacy of students cannot be higher than the average level of functional literacy of their teachers. At the same time, it is important to note that in recent years more and more practical developments aim to training teachers to create (design) their own assignments for the development of various types of functional literacy (Vlasova et al, 2022).

We agree with a number of authors (Desnenko, 2022; Petrushkina & Khrisanova, 2022) that training future teachers requires more emphasis on developing their skills in designing educational assignments to improve the functional literacy of children. Some researchers (O'Toole et al., 2020) also note that the author's assignments for functional literacy development of not only increase the level of this skill formation but also increase students' motivation.

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CONCLUSIONES

The conducted theoretical and applied research confirmed the high relevance of the problem of developing tasks meant to form, develop and assess various types of functional literacy, which experts worldwide consider today an integral indicator of the quality of education and the level of a school graduate's training.

An easy-to-use and consistent algorithm allows school teachers to quickly create a large number of diverse original author's tasks that allow assessing the level of functional literacy of students and contribute to its improvement. Using this algorithm is also possible in organizations of secondary vocational and higher education. On the one hand, it can act as a tool for teachers (who can also use it to develop original tasks). On the other hand, the algorithm can be used directly by students during practical work, giving them the opportunity to better understand the technique of creating tasks for the development of functional literacy, the criteria for their assessment, and the advantages and disadvantages of this approach.

Further development of the study may be associated with the search for answers to the following questions: Have teachers begun to create their own tasks for functional literacy development more often? Does the level of students' functional literacy increase when these educational tasks are used? Thus, the present study suggests creation of a practice-oriented tool that allows school teachers to increase the level of their students' functional literacy.

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