

Review Article

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Formation of Students' Natural Science Skills in Teaching Natural Sciences

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ABSTRACT

In the introductory part of the research, the relevance and necessity of the topic are substantiated, the goal, objectives, object, subject of the research are described, its compliance with the priority areas of science and technology development of the republic is indicated, and information on scientific novelty, practical results, their reliability, scientific and practical significance, implementation into practice, published works, as well as the structure of the research is provided.

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In the first chapter of the study, entitled "Theoretical Foundations for Improving Educational Assignments for Assessing Students' Science Literacy", it is stated that the foreign experience of assessing the science literacy of schoolchildren is considered on the example of the experience of developed countries. In particular, the achievement of high results by Finnish students gained worldwide attention after the results of the International Student Assessment Program (PISA).

The concept of natural scientific literacy means understanding scientific knowledge, understanding the scientific method, and applying scientific knowledge in everyday life. J. Miller defined natural science literacy as the ability to understand scientific concepts, understand the scientific method, and make decisions on scientific issues, while Rodolfo Linz de Carvalho defined natural science literacy as the ability to understand and apply natural science knowledge necessary for full participation in society and life. Bill Copley defined natural science literacy as the ability to apply scientific knowledge to solve problems in everyday life.

Natural science literacy in physics is the ability to understand and use the basic concepts, laws, and methods of physics, as well as to understand the nature of scientific knowledge and reason based on scientific evidence. Natural science literacy in physics includes the following (see Table 1).

Table 1: Criteria for Assessing Scientific Literacy in Physics

No	Criteria	Life examples (essence of meaning)
1.	Understanding basic concepts of physics	for example, energy, motion, force, electricity, light, etc.
2.	Understanding the laws of physics	for example, Newton's laws, the law of conservation of energy, the laws of thermodynamics, etc.
3.	Application of physical methods	for example, conducting measurements, conducting experiments, analyzing data, etc.
4.	Understanding the essence of scientific knowledge	the reliance of scientific knowledge on empirical foundations, the temporality and variability of scientific theories, the importance of scientific debates, etc.
5.	Reasoning based on scientific evidence	ability to critically evaluate scientific evidence, distinguish from false scientific claims, make scientifically based decisions, etc.

Based on the generalization of these definitions and the research results, the author's approach was put forward, according to which scientific literacy means the ability of an individual to take an active civic position in matters related to the development of natural sciences and the use of their achievements, as well as their readiness to study scientific ideas.

A person with scientific literacy in physics can understand physical phenomena, explain their causes, and predict them. During the study, it was also proven that such a person can evaluate scientific and technical innovations and make informed decisions on scientific issues important to society.

International assessment programs assess students' scientific literacy and mathematical literacy.

Preparation for the research of international assessment programs requires strengthening interdisciplinary integration in the process of teaching natural sciences (physics, chemistry, biology, geography), teaching the subject in connection with various fields and life processes. Traditional approach: Write a formula that relates the speed, period, and length of sound waves. Science literacy: How and how long can we know about an earthquake thousands of kilometers away? This example helps to strengthen the interdisciplinary connection between the sciences of physics and geography. When improving students' scientific literacy in geography lessons, it is advisable to pay more attention to the following issues:

- use of active and interactive teaching methods;
- development of students' skills in understanding and working with the text;
- Complete various types of questions and assignments (text, graphics, pictures...);
- Completion of tasks of a problematic, partially exploratory, research nature;
- development of teachers' and students' skills in using computer technology;
- their focus on implementing interdisciplinary connections.

The Finnish assessment system is based on the improvement of education, and most of them are current assessments and are used to improve education. In Finland, student assessment takes three forms: during classroom sessions, during graduation, and during university entrance exams.

The scientific novelty of the research is as follows: it is necessary to improve the quality of textbooks used, to establish the practice of using foreign teaching aids as additional or alternative teaching materials; in order to organize international research in the field of assessing the quality of education in the public education system, to create a national system for assessing the quality of education in secondary schools RISA (The Programme for International Student Assessment), aimed at assessing the level of literacy of students in reading, mathematics and natural sciences; to introduce new methods for determining the qualification requirements of teaching staff, as well as skills acquired for the implementation of updated educational standards, it is critically and analytically stated that urgent problems and shortcomings awaiting their solution remain in the public education system.

Target Component: The structure of the model element is aimed at the development of students' written speech competence through

the effective organization of learning activities, which is the main component of the studied process. The implementation of this goal has its own regulatory framework, and the necessary tasks have been carried out within the framework of the tasks defined in the regulatory legal acts. Based on the regulatory framework defined as a social necessity in the target component, it is aimed at developing students' written speech competence through the effective organization of educational activities in native language lessons.

The Content-Process Component: Assessment of students' scientific literacy - implementation based on educational approaches, mechanism, methodology, and assessment criteria in the subject of physics, as well as the stages of developing students' competencies.

Result-Evaluation Component: The component approach is a set of general principles for setting educational goals, selecting educational content, organizing the educational process, and evaluating educational outcomes. The resulting assessment component consists of criteria and results for assessing the development of students' natural science competence. The development of students' natural science competence was assessed at the "high," "medium," and "low" levels.

Table 2: Evaluation Criteria and Indicators

Criteria	Content and essence
Motivational	Creative evaluation of addition, subtraction, division, and multiplication
Cognitive	link topic and non-text information to the topic, identify subtext meanings based on keywords
Reflective	data exchange, processing, inference, decision making, logical thinking, comprehension, reflection, and application

In the third chapter, entitled "Practical Application of Tasks for the Development of Natural Science Literacy", the content of the experimental work is described. Experimental materials prepared for several grades, issues of organizing experimental lessons, and parameters for conducting control work are described.

During the experiment, the levels of professional and pedagogical training of students of general education schools 7th grade for the development of their natural science literacy through the teaching of physics, as well as for teaching them independent, creative thinking, were determined. With the help of questionnaires, students' interest in special exercises and assignments that systematically develop reading literacy skills, as well as their level of knowledge, were determined. The following also became known (see Table 3).

Table 3: Some Examples of Tasks and their Answers to Check the Level of Knowledge of The Subject's Significance

No.	Question and assignment	1st student	Student 2	Student 3
1.	Write down what you know about the importance of physics for human life.	The importance of physics for human life - for this example, a person knows in advance how much strength is needed and makes their work easier. Either they can simplify their work with physical phenomena, or they can easily calculate the force required to move something from its place.	For example, everything we do comes down to physics. For example, human movement. Lighting a fire on a gas stove by lighting a match at home is also an example of physics.	Physics is important for life because physics is useful for human life, for example, in life people often study physics. Studying physics has its place in life.

In order to determine the composition of educational materials for the systematic development of natural science literacy skills in physics textbooks of general education schools and the current state of physics teaching, experimental sites were initially identified. Experimental work was carried out in schools No. 1, 19, 34 of the Karakul district of the Bukhara region; Schools No. 20, 21, 22 of the Pakhtachinsky district of the Samarkand region; In schools No. 127, 135, 319 of the Yakkasaray district of the city of Tashkent.

A total of 350 students participated in the experiment. Of these, 175 were taken to the experimental group and 175 to the control group. In the first days of the experiment, written assignments were taken from both the control and experimental classes. It turned out that the level of mastery of the lessons in both groups was practically the same.

In order to determine the cause of this situation, when conducting a survey among teachers of schools No. 1, 19, 34 of the Karakul district of the Bukhara region, the following questions and tasks were used:

- What is the connection between physics and mathematics? Explain with an example.
- Write down what you know about the importance of physics for human life.
- Why is walking recommended for a healthy person? What is the connection between physics and biology?
- Why do we have difficulty climbing altitudes?
- How does a person's height and weight affect their speed in motion?

- An airplane spends more time traveling the same distance and less time returning. What is the reason for this?
- Why are older people advised to walk more, not run?
- Determine the reason why a person loses weight when they go into the water.
- What physical phenomena occur when using a vacuum cleaner?
- The vacuum cleaner absorbs a certain amount of air.
- Why is human voice louder in the morning and lower at noon?

Now, based on the results of the experimental and control groups, we will reflect the indicators at the end of the experiment from Table 3.2.1 in the following table:

Indicators of the effectiveness of the level of formation of practical skills and abilities for the development of natural science literacy in 7th grade students through the teaching of physics at the end of the experiment are presented in Table 4.

Table 4

	Number of students	Levels of assimilation		
		Done correctly and completely	Partially and incorrectly executed	Wrongly executed
Experimental group	175	29.	80.	66.
Control group	175	33.	75.	67.

Based on the above results, we will calculate the quality indicators of the experimental work. We know $=2.32$; $=1.82$; .

From this, the quality indicators:

$$K_{\text{yc6}} = \frac{(\bar{X} - \Delta_x)}{(\bar{Y} + \Delta_y)} = \frac{2,32 - 0,11}{1,82 + 0,11} = \frac{2,21}{1,93} = 1,15 > 1;$$

$$K_{\text{6o6}} = (\bar{X} - \Delta_x) - (\bar{Y} - \Delta_y) = (2,32 - 0,11) - (1,82 - 0,11) = 2,21 - 1,71 = 0,5 > 0;$$

From the obtained results, it can be seen that the criterion for assessing the effectiveness of training is greater than one, and the criterion for assessing the level of knowledge is greater than zero. It is known that the assimilation in the experimental group is higher than in the control group. Consequently, the experimental work conducted to determine the level of mastery of the formation of skills and abilities in 7th-grade students through educational tasks that assess scientific literacy is effective.

Conclusion

In the context of globalization, the main focus of the methodology of teaching physics is on the content of the problem, the formation of skills and abilities of natural science literacy, as well as the development of life skills. It is intended to prepare the student for scientific knowledge and real situations that will be necessary in their present and future life. In particular, students' scientific literacy does not meet the requirements of today. If the development of students' natural science literacy skills is not achieved, physics lessons will remain an ineffective learning activity.

A systematic approach to the development of students' logical thinking skills, in particular, natural science literacy, in particular, the methodology of forming students' independent work skills in one lesson through working on a problem, has a significant impact on the improvement of physics education.

When analyzing the content of education, in particular, state educational standards, programs, and textbooks, it became clear that there is a lack of educational materials that develop scientific literacy. During the period when the educational goal was defined, the content and method of education were also chosen correctly, that is, the method of education was inductive, and teaching began with a pragmatic approach. In this way, it is possible to achieve the development of students' natural science literacy skills. Today, there is a great need for the systematic development of natural science literacy skills and a pragmatic approach.

Recommendations and new approaches to the systematic improvement of educational materials in physics education were presented. For the development of scientific literacy, it is necessary to work on problems in schools, to develop questions and tasks that reveal the essence of the problem. It is necessary to develop learning tasks that develop students' logical thinking skills.

From the obtained results, it can be seen that the criterion for assessing the effectiveness of training is greater than one, and the criterion for assessing the level of knowledge is greater than zero. It is known that the assimilation in the experimental group is higher than in the control group. Consequently, the experimental work conducted to determine the level of mastery of the formation of

skills and abilities in 7th grade students through educational tasks that assess scientific literacy turned out to be effective.

Recommendations for the systematic improvement of educational materials in physics education, the presentation of new approaches, work on problems in schools for the development of natural science literacy, the creation of questions and assignments that reveal the essence of the task, will become the basis for the development of students' skills in understanding, identifying, and drawing conclusions.

In the systematic development of scientific literacy, along with scientific texts, the use of scientific, journalistic, and popular science texts yields good results. It is advisable that text-oriented learning tasks simultaneously develop understanding and learning skills.

It is possible to achieve the development of scientific literacy by developing a system of special tasks aimed at the formation of skills for understanding, researching, and summarizing the text at the same time and applying them in the lesson process. In physics education, it is necessary to introduce a set of texts and problems of a scientific nature, created on various topics and methods that develop scientific literacy, inspiring enthusiasm in students, and a system of educational tasks aimed at creative thinking aimed at working with them.

In the development of natural science literacy in students of 7-grade through teaching physics, taking into account their age characteristics, the organization of natural science literacy skills based on interactive approaches yields good results. Firstly, the student acquires the necessary skills of scientific literacy within the framework of the topic, and secondly, during the lesson, they also acquire skills of collaborative work, speed, quick-wittedness, and logical thinking.

The experiment showed that the criterion for assessing the effectiveness of training is greater than one, and the criterion for assessing the level of knowledge is greater than zero. Consequently, the assimilation in the experimental group is higher than in the control group. The effectiveness of the experimental work conducted to determine the level of formation of such skills and abilities as understanding, research, and drawing conclusions through working on the development of reading literacy through teaching physics to students of the 7th grade has been proven.

Based on the Results of the Dissertation, the following Recommendations were Developed:

- based on the results obtained during the study, the conclusions drawn, to improve the qualifications of physics teachers in the republic in the field of natural science literacy, to familiarize students with scientific, theoretical, practical, and methodological innovations in the development of skills and abilities to understand the essence of the problem, research, and draw conclusions;
- creation of methodological manuals for specialists, physics teachers, expanding the content and deepening the essence of considerations on teaching complex aspects related to educational tasks that develop scientific literacy in physics education, noted in the dissertation;
- inclusion of the course "Methods of Compiling Educational Tasks for Assessing Natural Science Literacy," recommended as a specialty or elective subject in the areas of physics education (master's degree) of universities, among the main subjects of higher educational institutions;
- at the stage of general secondary education, it is advisable

to hold scientific and practical conferences dedicated to the problems of continuity in the creation and use of educational tasks that develop and assess scientific literacy.

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