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## **Methodology of Organizing Formative Assessment in Mathematics Lessons**

### **Abstract**

In general education schools, intra-school assessment is carried out using diagnostic, formative and summative assessment types. The article discusses the formative type of intra-school assessment, its methods and tools, and the methodology for organizing formative assessment in mathematics. It has been determined that formative assessment is a type of assessment that correctly guides the learning process and ensures its efficiency and allows for the study of students' learning needs. The article will be useful in developing the formative assessment skills of mathematics teachers and increasing their professionalism.

**Keywords:** mathematics, intra assessment, formative assessment, analytical, holistic

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## **Riyaziyyat dərslərində formativ qiymətləndirmənin təşkili metodikası**

### **Xülasə**

Ümumtəhsil məktəblərində məktəbdaxili qiymətləndirmə diaqnostik, formativ və summativ qiymətləndirmə növləri ilə həyata keçirilir. Məqalədə məktəbdaxili qiymətləndirmənin formativ növündən, onun üsul və vasitələrindən, riyaziyyat fənni üzrə formativ qiymətləndirmənin təşkili metodikasından bəhs edilir. Müəyyən edilmişdir ki, formativ qiymətləndirmə təlim prosesini düzgün istiqamətləndirir və səmərəliliyini təmin edən, şagirdlərin təlim ehtiyaclarının öyrənilməsinə imkan yaradan qiymətləndirmə növüdür. Məqalə riyaziyyat müəllimlərinin formativ qiymətləndirmə bacarıqlarının inkişaf etdirilməsi və onların peşəkarlığının artırılmasında faydalı olacaqdır.

**Açar sözlər:** riyaziyyat, məktəbdaxili qiymətləndirmə, formativ qiymətləndirmə, analitik, holistik

### **Introduction**

The “Programme for Reform in the Field of Education of the Republic of Azerbaijan” (Education Reform Program of the Republic of Azerbaijan, 1999), approved by the decree of the President of the Republic of Azerbaijan on June 15, 1999, changed the approach to the learning process in all educational institutions, especially in general education schools. The main goal of the reform is to form the student as a personality based on the principles of democratization, humanization, integration, differentiation, individualization and humanitarianization. Therefore, the school should pave the way for each student to feel like a person.

Documents were prepared and decisions were made to implement the requirements of the reform programme. One of these documents is the “Concept of Assessment in the General Education System of the Republic of Azerbaijan” (Concept of Assessment in the General Education System of the Republic of Azerbaijan, 2009), approved on January 13, 2009. The Concept of Assessment played a major role in determining the quality of education, improving the teaching and

learning process, and also in solving the problems of assessing achievements in education. According to the Law of the Republic of Azerbaijan on Education (Law of the Republic of Azerbaijan on Education, 2010), the curriculum includes the syllabus, subject-specific instructional programs, methodological recommendations, assessment tools, and other relevant educational technologies. At the same time, it emphasizes that the primary goal of education is "...to train professionals who protect and develop national-spiritual and universal values, possess a broad worldview, are capable of valuing initiatives and innovations, acquire both theoretical and practical knowledge, and are modern in thinking and competitive..." (Law of the Republic of Azerbaijan on Education, 2010). Therefore, conducting assessments in the teaching process is a requirement placed upon teachers.

Assessment of student achievements in general education schools of our country is carried out in accordance with the requirements of the "Assessment Concept in the General Education System of the Republic of Azerbaijan" (Concept of Assessment in the General Education System of the Republic of Azerbaijan, 2009). In terms of monitoring the progress, development, and quality of educational work, and directing it in a timely and correct manner, assessment of students' daily activities and achievements is of great importance.

The Concept of Assessment in the general education system of the Republic of Azerbaijan states that assessment is carried out in three directions: international, national, and intra-school assessment (Concept of Assessment in the General Education System of the Republic of Azerbaijan, 2009). It presents the main principles, objectives, components, and implementation mechanisms for the assessment directions, describes the necessary activities, and at the same time, forecasts of expected results are also noted. Intra-school assessment is carried out using diagnostic, formative, and summative assessments (Mehdiyeva, 2018).

Internal assessment implements learning outcomes in line with the content lines of the curriculum for educational levels; creates a real basis for continuing mathematical education and learning other subjects; creates real opportunities for our students to acquire the knowledge, skills, and habits necessary to apply mathematical knowledge in practical activities.

## Research

The main essence of internal assessment is formative assessment. Formative assessment is carried out in order to monitor the activities of students aimed at mastering the content standards defined in the educational program (curriculum) for each subject, including mathematics, to identify the difficulties they encounter in this process, and to eliminate them. In other words, formative assessment is the process of receiving oral or written answers from students, correctly interpreting this information, determining the level of student learning, taking it forward, and deciding how best to do this. It should be noted that formative assessment is not a formal assessment.

Formative assessment is characterized by a number of important features:

1. Compliance with training objectives;
2. The presence of assessment criteria;
3. Constructive notes in solving exercises;
4. Effective question-and-answer, organization of class assignments;
5. Organization of mutual learning and mutual assessment of students and orientation to self-assessment.

As a pedagogical term, formative assessment is interpreted as monitoring students' learning activities and its significant impact on their learning outcomes and achievements in summative assessment is noted. Thus, the teacher teaching the subject regularly monitors the learning activities of students according to criteria during the school year, studies the students' learning needs, identifies the reasons affecting the learning activities, removes obstacles, and also takes measures to stimulate activity. Formative assessment is considered important for an effective learning process because it promotes a student-centered approach to learning. It directs students not to memorize, but to understand the problem more deeply. The teacher regulates the learning process through formative assessment. In particular, it helps the teacher to monitor how students behave, think, and learn during the learning process.

During formative assessment in mathematics lessons, methods such as assignment, observation, oral survey, rubric, analysis of students' written work, presentation, project, test, oral or written reflection, and self-assessment are used. Through formative assessment methods, the student's learning activity is monitored, and this activity is evaluated. For example:

- During the teaching of the topic "Adjacent and Corresponding Angles" in the 6th grade, the activities demonstrated by students in acquiring the skills of identifying, constructing, and solving problems related to adjacent and corresponding angles and their properties are monitored and evaluated (Ismayilova & Huseynova, 2021).

- In the 9th grade, during the teaching process of the "Functions. Graphs" educational unit, students' activities towards acquiring graphing, researching, and problem-solving skills, rather than their skills in constructing and investigating graphs of functions and solving problems using quadratic functions, are monitored and evaluated (Kahramanova et al., 2019).

It is considered appropriate to use the following tools to assess the knowledge and skills required to implement the standards in the subject (Mehdiyeva, 2018): Multiple-choice questions, observation sheets, short-answer questions, criteria table, assessment scale for achievement levels, poster, student presentations, observation sheets, questionnaire, criteria table, test tasks, self-assessment sheets, oral or written reflection questions, etc.

Formative assessment data helps to answer the following questions (New Zealand Ministry of Education, n.d.):

- What is the student's goal, that is, what will the student learn?
- What skills should be formed?
- What steps should be taken for development?

For example, let's examine the 9th-grade unit "Functions. Graphs" (Kahramanova et al., 2019).

In this unit, students will learn:

- How to construct a graph of a quadratic function;
- How to write the formula for a quadratic function based on its given graph;
- How to solve a problem using a quadratic function;
- How to construct a graph of the  $y = |x|$  function;
- How to construct a graph of the  $y = x^3$  function.

Skills are formed in students during the training of the educational unit "Functions. Graphs" (Kahramanova et al., 2019):

- Constructs the graph of a quadratic function by compiling a table of values;
- Constructs the graph of a quadratic function using the graph of the  $y = x^2$  function;
- Constructs the graph of a quadratic function according to the forms  $y = a(x - m)^2 + n$  and  $y = a(x - p)(x - q)$ ;
- Determines the zeros of the function;
- Constructs and examines the graph of a quadratic function according to the general  $y = ax^2 + bx + c$  form;
- Solves problems using the application of a quadratic function;
- Constructs the graph of the  $y = |x|$  function;
- Constructs the graph of functions in the form of  $y = a|x - m| + n$ ;
- Constructs the graph of the  $y = x^3$  function.

Students should be directed to apply the acquired knowledge and skills to real life in order to develop the skills related to the "Functions. Graphs" educational unit. It is necessary to develop the ability to replace real-life tasks with their models. Thus, the integration of the content of the tasks into life situations will form a holistic and indivisible image of the world in the minds of students.

Formative assessment is an assessment of the level of formation of students' knowledge and skills based on the results determined for any stage of the learning process. Formative assessment is

carried out according to two established rubrics: analytical and holistic.

Assessment rubrics have the following functions:

- Describe the skills required of students and the mechanism for their assessment;
- Serve as a reliable database for assessing student progress;
- Provide information to students, parents and interested parties about learning achievements.

Analytical assessment is the consistent monitoring and assessment of specific skills intended for students over a specified long period of time (Table 1).

- Analytical assessment is mainly carried out on the basis of surveys and tests;
- It determines the student's grades in individual areas of activity;
- A 4-5-point scale is mainly used in the assessment;
- In this case, students' activities are consistently assessed, providing more detailed information about their achievements;
- This assessment requires a lot of time (Abdullayeva, 2020).

**Table 1. Analytical evaluation**

Subject Months	Mathematics			
	March	April	May	June
Indicators	Number of students			
Excellent	6	5	7	8
Good	7	8	9	9
Average	7	6	5	4
Poor	4	5	3	3

Holistic rubrics assess a student's ability as a whole and provide a general description of achievements without dividing the ability into parts. Holistic assessment is a short-term overall assessment of the student's development level by separately assessing the skills determined according to the goals in the learning process. Since it is carried out in a short period of time, this assessment is also called "rapid assessment".

Today, formative assessment in the learning process is mainly carried out using holistic rubrics. A rubric is an assessment table with specific criteria and acting as a guide. The main purpose of the rubric is to measure the student's performance.

In mathematics lessons, it is advisable to use the group work form at the "Conducting Research" stage (Abdullayeva, 2020). When organizing group work, the teacher announces the purpose of the group work, assessment criteria, and the time allocated for conducting the research to the students before starting the research, and presents the worksheets with tasks to the groups. The teacher prepares a criteria table in advance and familiarizes the students with the criteria (Table 2). The teacher can conduct an evaluation using the "+" and "-" signs or appropriate symbols.

**Table 2. Assessment by groups**

Groups Criteria	Group I	Group II	Group III
Task 1 was completed completely and correctly			
Task 2 was completed completely and correctly			
Collaboration			
Effective use of time			
Presentation			
<b>Conclusion</b>			

In mathematics lessons, it is advisable to use an individual work form at the “Creative Application” stage and assess students by level (Abdullayeva, 2020). For example, suppose a teacher prepares a plan for the topic “Quadratic function and its graph” in grade 9 (Kahramanova et al., 2019). At this time, he first determines the goals:

- 1) Constructs a graph of a quadratic function in accordance with the general  $y = ax^2 + bx + c$  form;
- 2) Examines a graph of a quadratic function in accordance with the general  $y = ax^2 + bx + c$  form;
- 3) Solves problems using the application of a quadratic function.

A criterion table or rubric is prepared to determine the level of achievement of training objectives (Table 3). The criteria are determined in accordance with the objectives. At the end of the lesson, each student is assessed by level based on the criteria for graph construction, investigation, and solution.

**Table 3. Individual assessment**

<b>Level I</b>	<b>Level II</b>	<b>Level III</b>	<b>Level IV</b>
It is difficult to construct a graph that matches the general form of a quadratic function.	Constructs a graph of a quadratic function with help from the general form.	Constructs a graph of a quadratic function that conforms to its general form, with partial errors.	Freely constructs a graph that matches the general shape of a quadratic function.
It is difficult to study the graph of a quadratic function in its general form.	It helps to examine the graph of a quadratic function according to its general form.	Freely explores the graph of a quadratic function according to its general form.	Freely explores and applies the graph of a quadratic function according to its general form.
Solves problems with difficulty by applying quadratic functions.	Solves problems with the help of applying a quadratic function.	Solves problems freely by applying quadratic functions.	Solves problems in efficient ways by applying the quadratic function.

## Conclusion

School-based assessment implements learning outcomes in line with the content lines of the mathematics curriculum; creates a real basis for continuing mathematical education and learning other subjects; creates real opportunities for our students to acquire the knowledge, skills and habits necessary to apply mathematical knowledge in practical activities.

During formative assessment, students learn the right approach to solving mathematical problems, helping them understand the correct and different ways to solve problems.

Through formative assessment, students can understand their strengths and weaknesses more clearly. This ultimately allows them to determine their own learning strategies.

Formative assessment allows students to develop free and independent learning skills. They learn the skills of identifying problems, correcting misconceptions, and solving problems in different ways. This helps students understand how successful they are in the learning process and in solving each mathematical problem.

Formative assessment ensures the correct direction and efficiency of the learning process, allows for the study of students' learning needs, and at the same time makes it possible to monitor students' progress in the field of learning.

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