Modern methods and tools of assessing students' knowledge, skills, and competencies in mathematics

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Abstract. This article examines modern methods and tools used for assessing students' mathematical knowledge, skills, and competencies. Alongside traditional assessment methods, innovative approaches such as competency-based assessment, project activities, digital evaluation systems, and interactive technologies are discussed. The article also highlights the role of modern educational software and online platforms in improving the effectiveness, objectivity, and motivation of students in mathematics learning.

Keywords: mathematics education, assessment, digital technologies, competency-based approach, formative assessment, online learning, interactive methods, educational software.

Introduction

In the digital era, the educational system requires new approaches to assessing students' achievements in mathematics. Modern assessment should evaluate not only computational accuracy but also critical thinking, reasoning, creativity, and the ability to apply mathematics in practical situations. Therefore, teachers increasingly use innovative pedagogical methods and digital technologies to improve the quality of assessment.

Modern Assessment Methods in Mathematics

Criterion-Based Assessment

Criterion-based assessment evaluates students according to clear indicators such as correctness of calculations, logical explanation, use of appropriate methods, and presentation of the solution.

For example, when solving systems of equations, students are assessed according to each stage of the process:

$$\begin{cases} 2x + y = 7 \\ x - y = 2 \end{cases}$$

Competency-Based Tasks

Competency-oriented tasks connect mathematics with real-life situations.

Example:

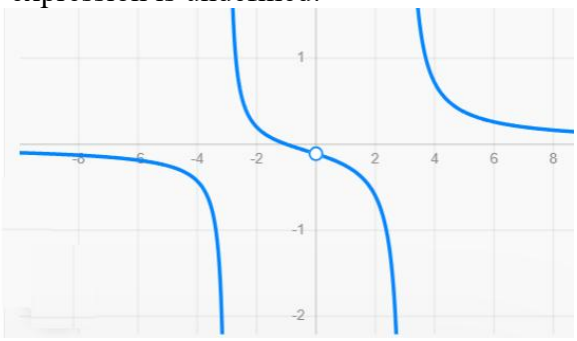
A store offers a 15% discount on a product costing 200 dollars. Students must calculate the final price after the discount using percentage formulas.

Problem-Based Learning

Problem-solving activities encourage analytical and creative thinking.

Example: Find all values of (x) for which the expression is undefined:

$$f(x) = \frac{x+1}{x^2-9}$$



Students must determine where the denominator equals zero and explain the restrictions of the function.

Project-Based Activities

Project activities help students apply mathematics in practical and research contexts. Learners may investigate statistical data, create geometric models, analyze environmental changes, or study mathematical applications in economics and technology.

Digital Tools and Educational Software

Modern technologies make assessment more effective, visual, and interactive.

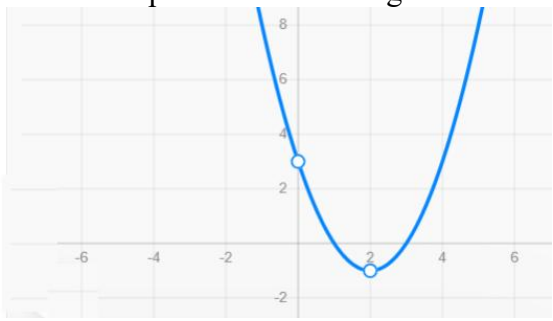
Learning management systems such as Canvas and Blackboard help teachers organize assignments, monitor academic progress, and conduct online assessments.

Interactive platforms including Quizlet, Nearpod, and Socrative provide opportunities for live quizzes, immediate feedback, and automatic grading.

Mathematical software such as MATLAB, Maple, and Microsoft Math Solver supports visualization, symbolic calculations, graph analysis, and verification of mathematical solutions.

For example, graphing quadratic functions improves conceptual understanding:

$$y = x^2 - 4x + 3$$



Digital assessment systems also help teachers identify common mistakes, analyze learning outcomes, and personalize instruction according to students' needs.

Interactive Forms of Assessment

Interactive assessment methods include mathematical competitions, online olympiads, collaborative problem-solving activities, educational games, and virtual simulations. Such activities increase students' motivation, communication skills, and teamwork abilities while improving mathematical understanding.

Conclusion

Modern methods and digital tools for assessing mathematical knowledge contribute to a more comprehensive evaluation of students' competencies. Innovative assessment approaches develop analytical thinking, creativity, independence, and practical problem-solving abilities. The integration of interactive technologies and educational software makes mathematics learning more engaging, objective, and effective. Consequently, modern assessment systems play an important role in improving the quality of mathematics education in contemporary society.

REFERENCES

1. Umarova Umida Umarovna Interactive methods in teaching mathematics // *Scientific Progress*. 2021. Vol. 2, No. 6. P. 867–875.

2. Umarova Umida Umarovna Problem-based learning technology in mathematics education // *Scientific Progress*. 2021. Vol. 2, No. 6. P. 832–838.

3. GeoGebra in mathematics education and visualization of functions // Educational Technologies Journal. 2022. P. 45–50.

4. Digital assessment platforms such as Quizlet and Canvas in modern education // International Journal of Educational Technology. 2023. P. 56–61.

5. Umarova U.U. The method of "Working in small groups" in teaching the topic of logical operations on feedback // Scientific progress, 2: 6 (2021), p. 803-809.
6. Umarova U.U. “Relationships. “Binary Relationships” and “Domino” methods for lectures and practical classes // Scientific progress, 2: 6 (2021), p. 982- 988.