CZU: 373.5.091.32:51:004 **https://doi.org/10.59295/sum5(185)2025_13**

PARAMETRIC ASSESSMENT IN MOODLE FOR IMPROVING MATHEMATICAL PERFORMANCE IN MIDDLE SCHOOL

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The digitalization of education has significantly transformed the teaching and assessment process, offering personalized and interactive learning opportunities. In the field of mathematics, online learning platforms such as Moodle provide the necessary tools to develop digital educational resources that support skill acquisition and offer immediate feedback. This study explores the advantages of parametric assessment in Moodle, demonstrating how individualized test items can enhance students' mathematical performance. The research was conducted in a middle school setting, comparing traditional assessment methods with automated, parameterized evaluations. The results indicate a significant improvement in student engagement and comprehension through personalized digital assessments.

Keywords: *Moodle, Individual Digital Educational Resources (IDER), middle school mathematics.*

EVALUAREA PARAMETRICĂ ÎN MOODLE PENTRU ÎMBUNĂTĂȚIREA PERFORMANȚEI MATEMATICĂ ÎN ȘCOALA GIMNAZIALĂ

Digitalizarea educației a transformat semnificativ procesul de predare și evaluare, oferind oportunități de învățare personalizate și interactive. În domeniul matematicii, platformele de învățare online precum Moodle oferă instrumentele necesare pentru a dezvolta resurse educaționale digitale care sprijină dobândirea de abilități și oferă feedback imediat. Acest studiu explorează avantajele evaluării parametrice în Moodle, demonstrând modul în care elementele individualizate ale testului pot îmbunătăți performanța la matematică a elevilor. Cercetarea a fost realizată într-un cadru de școală gimnazială, comparând metodele tradiționale de evaluare cu evaluări automate, parametrizate. Rezultatele indică o îmbunătățire semnificativă a implicării și înțelegerii studenților prin evaluări digitale personalizate.

Cuvinte cheie: *Moodle, Resurse Educaționale Digitale Individuale (IDER), matematică de gimnaziu.*

Introduction

In the era of digital education, online learning platforms such as Moodle have revolutionized the teaching and assessment process by providing personalized and interactive learning opportunities. In mathematics, these platforms allow for the implementation of digital educational resources that not only support the development of students' skills but also offer immediate feedback, adapting to individual learning needs [5, p. 90].

Research problem: Static online testing tasks and their use in exams drastically reduce assessment quality, as correct answers are quickly collected and shared in files or databases. The accessibility of modern IT&C tools such as computers, tablets, smartphones, and smartwatches enables students to find answers easily, even when tests consist of multiple variants created from extensive question banks. On the other hand, manually creating and grading individual tasks for each student at each test iteration is not feasible for teachers.

Hypothesis and key findings: Instead of static test items, mathematics assessments should use individualized questions with variable values at each test attempt. These items can be generated in any required number using parameterized models and formulas. The parameters and variable values can be set by teachers according to different difficulty levels [18, p. 78]. This method significantly reduces the risk of cheating, as the exact test items and values remain unknown even to the teacher before the test is taken. Additionally, automatic grading saves teachers' time, allowing them to focus on instructional strategies rather than repetitive administrative tasks.

Relevance and importance:

- There is a shortage of qualified mathematics teachers, ranging between 10%-20% in certain regions and up to 30% in rural and underdeveloped areas.
- Existing teachers have limited time to efficiently evaluate a large number of student responses, preventing timely personalized feedback.

***Objective*:** The main goal of this study is to enhance the efficiency and quality of assessment by:

1. Generating any required number of individualized test items.
2. Saving teachers' time in test creation and correction.
3. Minimizing opportunities for cheating.
4. Improving students' mathematical skills through repeated self-assessment and unlimited practice.
5. Reducing rote memorization and emphasizing conceptual understanding.

Specific objectives include exploring Moodle's opportunities for developing individual digital educational resources/IDER by generating parameterized tasks and testing tailored to individual student/student progress.

Methodology

The legislative basis in Romania, E.U. and the framework plans for Mathematics

In the current educational context of Romania, the assessment of learning in Mathematics at the lower secondary level is regulated by the National Education Law No. 1/2011, which stipulates that all evaluations are conducted based on national standards for each subject, with the aim of guiding and optimizing the learning process [9].

To modernize and enhance the efficiency of the assessment process, the Ministry of Education has launched the project "e-Assessment, e-Examination in Education (4E-Education)," funded through the National Recovery and Resilience Plan (PNRR). Implemented between March 2024 and September 2025, this project aims to develop a secure platform for assessing students' competencies and to create 200,000 items and tests for national assessments and examinations [10].

According to the current framework plans for lower secondary education, Mathematics is allocated a fixed number of weekly hours, ensuring rigorous student training. The integration of digital assessment into the educational process is essential for aligning with European standards and for developing students' digital competencies [4]. Furthermore, it facilitates the personalization of assessment tasks and enhances the efficiency of teachers' time spent preparing and grading tests [10].

Thus, the transition to digital assessment, supported by legislative initiatives and national projects, represents a significant step in adapting the Romanian educational system to contemporary requirements and improving the quality of education [6].

Complementing the legislative framework and national initiatives on Mathematics teaching and assessment in lower secondary education, the Romanian Mathematical Society (SSMR) plays a crucial role in promoting and enhancing Mathematics education.

***1. Promoting mathematical knowledge and supporting research*.** The Romanian Mathematical Society (SSMR), one of the oldest professional organizations in Romania, has as its primary goal the promotion and dissemination of mathematical knowledge, as well as the guidance and support of original research in this field. Additionally, the society focuses on fostering an interest in mathematics among young people, a crucial aspect for developing the essential competencies of the 21st century [16].

2. Initiatives for modernizing mathematics teaching. As part of the European project Le-MATH, SSMR has promoted innovative mathematics teaching methods, such as MATH-Factor, which encourages learning and teaching mathematics through communication activities. These approaches aim primarily at increasing the appeal of mathematics for students, teachers, and parents, adapting the educational process to the needs and interests of current generations [17].

***3. Adapting to contemporary challenges*.** In the context of the COVID-19 pandemic, SSMR demonstrated flexibility and commitment to excellence in education by proposing the online organization of mathematics olympiads. This initiative aimed to ensure the continued training of talented students, providing

them with opportunities to develop their skills and participate in international competitions, even under challenging conditions.

4. Continuous professional development for teachers. SSMR annually organizes the Summer School in Bușteni, dedicated to mathematics teachers in pre-university education. The primary objective of this initiative is to promote excellence in education and to develop a teaching body capable of preparing students for outstanding mathematical performance. Through participation in these professional development courses, teachers expand their mathematical knowledge and acquire modern teaching techniques adapted to current educational demands.

Through these efforts, the Romanian Mathematical Society actively contributes to the modernization and improvement of mathematics education, aligning with European standards and addressing contemporary challenges in education.

Specific objectives

1. The *first specific objective* of this study aims to identify and explore various types of parameterized items in Moodle that are suitable for mathematics.

2. All these activities are personalized for each student, considering their progress and level of understanding. The adaptive assessment system in Moodle facilitates the creation of activities that cater to students' individual needs, ensuring rapid and effective feedback [14, p. 103]. Parameterization in Moodle is based on the use of variables (letters) instead of fixed values, allowing them to take different numerical values, either predefined or automatically generated [12, p. 56]. This technology can be applied to various types of items available on the platform:

Types of questions that allow parameterization:

- *Calculated question:* Questions that use mathematical formulas and variables, automatically generating unique numerical values for each student.

- *Calculated multichoice:* Multiple-choice questions generated from parameterized expressions.

- *Formula question:* Allows the use of multiple variables and complex expressions, making it ideal for advanced mathematical exercises.

- *Numerical question:* Questions requiring an exact numerical answer, with tolerance intervals for responses.

The diversity of these items enables a personalized and engaging approach to student assessment. Each game is designed to evaluate specific mathematical competencies, such as arithmetic operations, algebraic manipulation, geometry, and data analysis [1]. This section analyzes how these games can be adapted for different mathematical topics and integrated into the curriculum, providing a detailed understanding of how Moodle supports personalized learning.

3. The *second specific objective* focuses on the application of parameterized items for various types of assessments: formative, intermediate, and final. This section will provide recommendations for best practices in using parameterized items in Moodle. Emphasis is placed on simplicity and reusability, ensuring that teachers can easily adapt and distribute these games for various educational objectives. Reusability is essential in the context of collaborative teaching, as items can be modified or reused by different educators [2, p. 45]. Moodle's ability to provide real-time feedback through these games ensures that students benefit from personalized and adaptive assessments. The article will explore how games can be adapted to different educational goals, such as problem-solving assessment, conceptual understanding, and mastery of skills [14, p. 103].

- *Strengthening terminology and definitions through thematic games:* Definitions, lemmas, and specific terminology can be effectively reinforced through crossword-style activities [3, p. 56]. These are generated from thematic glossaries, allowing students to consolidate their knowledge in an engaging and interactive manner. Furthermore, the final assessment can include the random selection of items from all glossaries, ensuring diversity and a comprehensive verification of understanding [13, p. 78].

- *Identifying correct answers with the help of distractors:* Another type of item involves identifying correct answers from a set of options that include distractors based on students' common mistakes. These exercises can be transformed into "Millionaire"- style games that stimulate competition and engagement.

Final assessments can be automated through the random selection of items from various thematic collections [14, p. 12].

4. *Solving calculable problems:* Calculable items, such as solving equations and inequalities, calculating areas and angles, or applying formulas, are essential for practical learning. The automatic generation of these items allows for the creation of an unlimited number of individualized exercises, personalized for each student, with automatic correction. This method reduces the possibility of cheating and encourages authentic learning [15, p. 47].

Experimental stage

The study was conducted as part of the doctoral project *"Intelligent Support System for Accelerating Mathematical Acquisitions in Middle School Students"* at the Doctoral School of Natural Sciences, State University of Moldova. The practical component was implemented on the Moodle educational platform, using item models suitable for mathematics instruction, with students from School No. 10 in Bacău, Romania[13]. The study observed two parallel eighth-grade classes during the *"Linear functions"* learning unit. One class followed traditional teaching and assessment methods (control group), while the other used a Moodle-based teaching and assessment system with individually adaptive tests, automatically generated and graded from parameterized items based on predefined models/formulas (experimental group).

The study was structured as follows:

- *Pre-test:* Determining the students' initial level of mathematical competence.
- *Intervention:* Implementing IDER-based exercises in Moodle, including interactive activities such as quizzes, puzzles, and educational games.
- *Post-test:* Assessing progress using statistical analyses.

The effectiveness of IDER-based teaching and assessment in the Moodle environment was evaluated based on student engagement, problem-solving accuracy, and overall performance improvement.

Methodological observations on the algebra assessment test for the 8th grade B, theme Functions, Lesson Type is for verifying and assessing academic results (Evaluation). Lesson Duration: 60 minutes, include Actual Evaluation (0 minutes).

Forms of evaluation include:

- Formative evaluation, includes among others exercise method and student self-assessment;
- Normative evaluation through checking the correctness of the results obtained by students during in-class assignments.

Specific competencies:

1. Identifying functional dependencies in various given situations
2. Describing a functional dependency in a given situation using diagrams, tables, or formulas
3. Representing functions in various ways to characterize them
4. Using specific language to formulate opinions regarding different functional dependencies
5. Analyzing functions in both intra- and interdisciplinary contexts
6. Modeling real-life phenomena using functions

Examples of learning activities:

- Describing a function in various ways (diagrams, tables, formulas);
- Recognizing correspondences that are functions;
- Determining the domain and codomain of a function;
- Finding the set of values of a function defined on a finite set;

Calculating the value of a function at a point;

- Conditions for two functions to be equal;
- Writing the formula that defines a function on a finite set;
- Recognizing the coordinates of a point represented in an xOy coordinate system;
- Representing a point with given coordinates in a plane;
- Specifying the geometric shape of the graph before plotting it;

- Representing, in an orthogonal coordinate system, the graph of functions:
  - Defined on finite sets, given by diagrams, tables, formulas;
  - Defined on $\mathbb{R}$ with values in $\mathbb{R}$, given by the formula $f: R \to R, f(x) = ax + b$
- Determining the points of intersection of the graph of a linear function with the coordinate axes.
- Verifying the membership of a point to the graph of a function;
- Using the values of functions in solving equations and inequalities;
- Determining a function $f: R \to R, f(x) = ax + b$ whose graph contains two given points.
- Investigating the collinearity of three points, given their coordinates;
- Solving plane geometry problems starting from the representation of points in the plane.

At the end of 8th grade, one of the synthesis topics is also FUNCTIONS. The concepts from this chapter are new to the students and are very important for the study of mathematics in high school. Without a thorough understanding of the concept of function, the student will not be able to grasp subtle notions such as: injectivity, surjectivity, inverse function, and function graphs (elementary or composite), (Fig. 1).

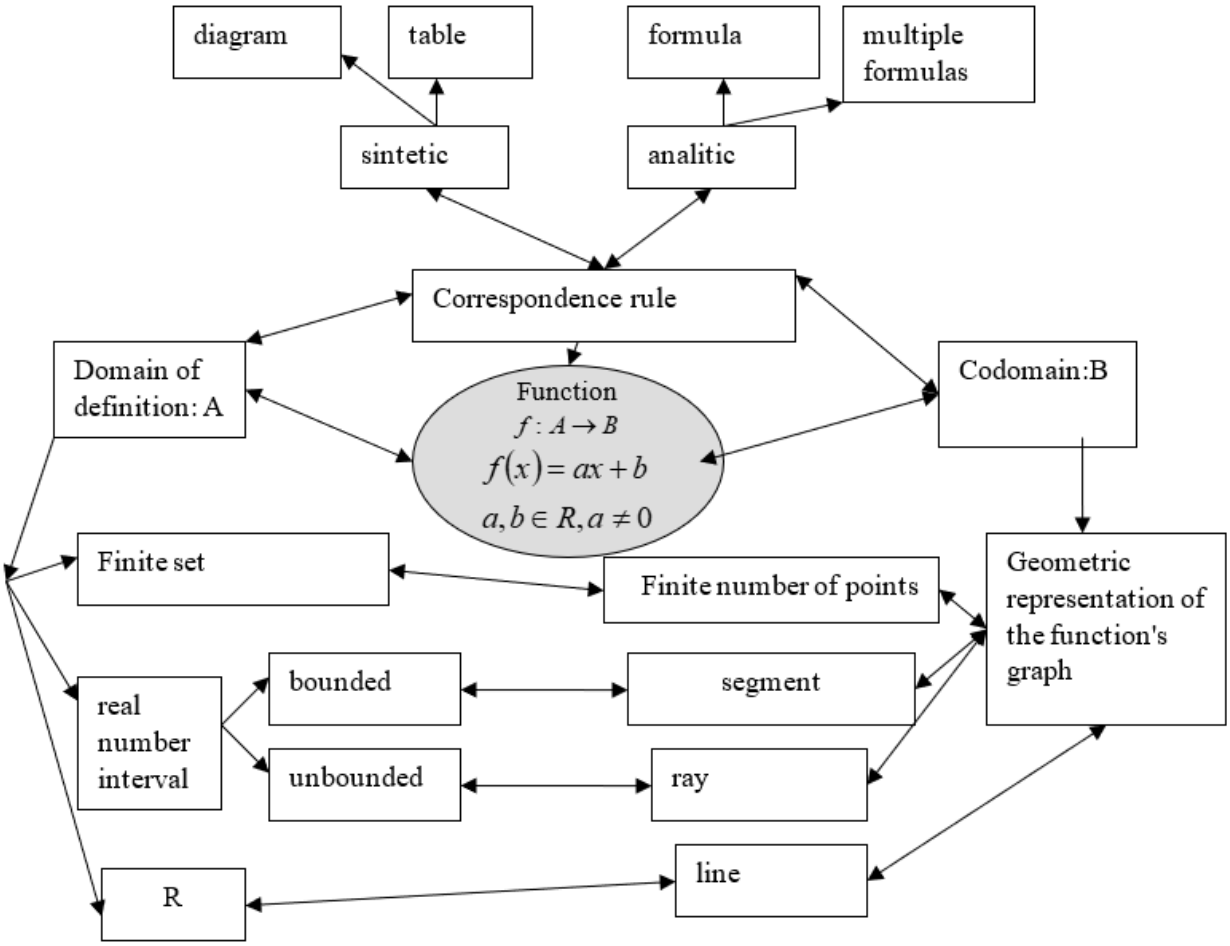


Figure 1. Conceptual map for the „Functions” chapter, 8th grade

The test was announced to the students and prepared through the recap plan, the worksheet from the previous lesson before the test, and through the homework assignment.

After the test, the results obtained by the students were analyzed, and possible methods of solving, typical mistakes, and the grading procedure were discussed.

If the test results do not meet the expectations of the teacher or the students, the test can be repeated in an equivalent form within a short period, and the final grade can be calculated as the arithmetic average. This way, we can check the test's reliability and give students the opportunity for a second chance.

Students should be encouraged to view the test as a formative assessment tool. We should not give the impression that the test is more important than it really is, as this can make students more anxious and stressed.

The teacher outlined the topics and the way the assessment would take place. The docimological test is a complex task, consisting of a set of work assignments (items), which allow the determination of the degree of knowledge acquisition by the students or the level of development of certain abilities based on precise assessments.

The assessment test was composed of the following categories of items:

- Section I contains 5 semi-objective completion items.
- Section II contains 5 objective multiple-choice items.
- Section III contains 2 subjective problem-solving items that assess the students' ability to coherently and thoroughly write the solution to a problem.

Functions - Summative assessment test:

Section I. On the test sheet, write only the results (25 points)

5p. 1. Let the function be $f : A \to B, f(x) = x + 1$. Set A is called …… …

5p. 2. If we have the function $f : R \to R, f(x) = -4x + 3$ then $f(1) =$

5p. 3. If we have the function $f : R \to R, f(x) = 2x - 7$ and $f(a) = 3$ then a is ……...

5p. 4. The point M(0,1) is located on the ..... axis. (*Ox* or *O*y).

5p. 5. For the function $f : R \to R, f(x) = 3x - 1$ calculate $f(0) \cdot f(1) \cdot f(2) =$ ...

Section II. On the test sheet, write the letter corresponding to the correct result (25 points)

5p. 1. For the function f : $\{-3; -1; 1; 3\} \to B, f(x) = x + 5$, set B is:

A. $\{-1; 0; 2; 3\}$ B. $\{2; 4; 6; 8\}$ C. $\{-4; 0; 1; 3\}$ D. $\{0; 2; 3; 6\}$

5p. 2. Let the function be $f : \{-5; -3; 1; 2; 3\} \to R$, $f(x) = x - 1$. If the point $M(m; 2) \in Gf$ then $m =$ ...

A. 2 B. −1 C. 0 D. 3

5p. 3. Let the function be $f : \{-1; 0; 1; 2; 3\} \to R$, $f(x) = x + 2$. If the point $M(m; 2) \in Gf$ then $m =$ ...

A. 2 B. 1 C. 4 D. −1

5p. 4. Let the function be $f : R \to R$, $f(x) = 4x + b$. If the point $M(1; 5) \in Gf$ then $b =$ ...

A. 1 B. 2 C. 3 D. 4

5p. 5. Let the function be $f : R \to R$, $f(x) = ax + b$. If the points $M(1; 1) \in Gf$ and $M(-1; 9) \in Gf$, then the correspondence rule for the function f is:

A. $f(x) = 4x + 2$ B. $f(x) = -4x + 5$ C. $f(x) = 3x + 4$ D. $f(x) = -3x + 1$

Section III. On the test sheet, write the complete solutions (40 points)

1. Let the function be $f : R \to R$, $f(x) = (x/2) - 1$.

5p. a) Draw the graph of the function f.

5p. b) Find the area of the triangle formed by the graph of the function f and the axes of the xOy coordinate system.

5p. c) Calculate the distance from the origin of the xOy coordinate system to the graph of the function f.

5p. d) Calculate the tangent of the angle formed by the graph of the function with the Ox axis.

5p. e) Find the coordinates of the point of intersection of the lines representing the graph of the function f and the function $g : R \to R, g(x) = x - 2$.

15p. 2. Determine a linear function $f : R \to R, f(x) = ax + b$ that satisfies the condition $f(2x + 1) = -6x + 1$

All problems are mandatory

The final grade is calculated by dividing the score obtained by 10.

Grading and scoring key

10 points are awarded by default.

Parts I and II

- Only the result is scored as follows: for each answer, either the maximum score specified next to each requirement is awarded, or 0 points.
- No intermediate scores are awarded.

Part III

- For any correct solution, even if it differs from the one in the grading key, the corresponding maximum score is awarded.
- No fractional points are awarded, but intermediate scores may be given for partial solutions, within the limits of the grading key.

Automated and traditional assessment balance in the 8th grade Linear Function Unit

Modern digital assessment tools, such as Moodle, provide efficient methods for evaluating students' mathematical competencies through automated grading and parameterized questions. The linear function unit in 8th grade is particularly suited for digital transformation, as most assessment items rely on algebraic manipulation rather than graphical representations.

A detailed analysis of the summative assessment test for Linear Functions reveals that:

- 70-80% of test items can be transformed into automatically graded parameterized questions using the general form of the linear function $f : R \to R, f(x) = ax + b$
- 20-30% of the test still requires manual grading, primarily for graphical representation tasks.

Items suitable for automated assessment (75%)

The following types of questions can be fully parameterized and graded automatically in Moodle:

1. Function evaluations and algebraic manipulations
- Finding function values at specific points
- Solving for unknowns given functional conditions
- Determining function intersections with axes
- Identifying function properties based on algebraic expressions
2. Multiple-choice and true/false questions
- Recognizing function definitions and behaviors
- Selecting correct statements about linearity and slope
3. Short-answer numerical input questions
- Computing x-intercepts and y-intercepts
- Determining function parameters based on given points
4. Calculated questions with variable values

Moodle allows teachers to set parameterized formulas where values of a and b are randomly assigned within a range. Each student receives a unique version of the test while ensuring equivalent difficulty.

Items requiring traditional evaluation (25%)

Although most of the linear function assessment can be automated, some elements still require manual grading:

- Graphical representation of functions
- Plotting the function in an orthogonal coordinate system
- Sketching lines and verifying geometric accuracy
- Complex reasoning and explanations
- Describing function transformations in words
- Justifying algebraic steps in problem-solving

These items constitute only 25% of the total assessment, meaning that the majority of grading effort can be eliminated through automation.

Example*: *Converting a traditional test to a digital parameterized test in Moodle

Given the function $f : R \to R, f(x) = ax + b$ where:

- a is randomly chosen between $[-5, 5]$
- b is randomly chosen between $[-10, 10]$

1. Compute $f(2)$ (Automatically graded numerical input question).
2. Find the x-intercept (Automatically graded formula-based question).
3. Identify the slope (Automatically extracted from function parameters).
4. Only the graphing task (point 4) requires manual grading.

Advantages of parameterized digital assessment

By implementing parameterized questions in Moodle, the grading process becomes 70-80% automated, significantly reducing teacher workload. The only manual assessment necessary is the graphical representation of functions, which accounts for a small portion of the test (20-30%).

This hybrid approach ensures:

- Consistent and objective evaluation for most algebraic tasks

- Immediate feedback for students, allowing them to identify errors instantly
- Reduced grading time, as only graphical representations need manual correction
- Adaptability to student level, as difficulty can be adjusted by modifying the ranges of a and *b.*

By leveraging digital automation, teachers can focus more on instructional strategies rather than grading routine calculations. The linear function unit is ideally suited for this approach, making it an essential advancement in modern mathematics education.

Subsequently, conclusions were drawn regarding the students' preparation level, and differentiated tasks for remediation/development will be proposed.

Comparative analysis between traditional assessment methods and automated assessment in Moodle – Linear functions Unit, 8th grade

The summative assessment of the *"Functions"* learning unit in the 8th grade is a crucial step in measuring students' understanding of fundamental concepts such as identifying functional dependencies, graphical representation, and applying theoretical knowledge in real-world contexts. According to the attached summative test, students are evaluated based on the competencies defined in OMEN No. 3393/2017, which include identifying functional relationships, correctly using mathematical terminology, and performing graphical analysis of linear functions.

This section provides a detailed comparative analysis between the traditional assessment method (paper-based test) and automated assessment through the Moodle platform, focusing on the time required by teachers for test preparation and grading, the impact on assessment quality, and overall efficiency in the teaching process.

The following table presents a *clear comparison of the time and effort required for different assessment* methods in an 8th-grade *Linear Functions* unit test.

Tabel 1. Comparison of the time and effort required for different assessment

Assessment type	Traditional paper-based test	Oral examination at the board	Digital assessment in Moodle
Test format	5 objective, 5 semi-objective, 2 subjective items	Individual oral responses at the board	Parameterized questions, automatically generated values
Preparation time	30 min (test creation) + 5-10 min (printing)	No test creation, only question selection	30 min (reusable test creation) + 10 min (variable setup)
Execution time	50 min per class	150 min (5 min/student)	50 min (same as paper test)
Grading time	210 min (manual grading) + 20 min (reporting)	Immediate but subjective	0 min (automatic grading) + 20 min (reporting)
Total teacher effort	~4h 30min per test	~3h 30min per full class assessment	~1h per test (75% time reduction)
Accuracy & objectivity	Possible grading inconsistencies	High subjectivity	Objective and consistent grading
Feedback speed	Delayed (manual correction required)	Instant but lacks written feedback	Immediate, with detailed analytics
Student personalization	Same test for all students	Individual, but limited engagement for peers	Unique tests for each student, adapted difficulty
Risk of cheating	Moderate (students can copy answers)	Low	Very low (each student receives a unique test)
Reusability & sustainability	Requires reprinting for each test	Not reusable, requires teacher repetition	Fully reusable, no paper waste

Impact on teachers and the efficiency of the teaching process

Reduction of workload

- Time saved per assessment: ~3h 30min
- Creating the parameterized test is a one-time activity – the test can be reused annually
- More time available for interactive teaching activities

Improvement in education quality

- Minimization of cheating risks – each student receives a unique test
- Immediate feedback for students – they can correct their mistakes instantly

Detailed analysis of results – Moodle generates charts and progress reports

By comparing traditional methods with digital assessment, it is clear that Moodle reduces the time allocated to assessments by over 75%, improving objectivity and the overall quality of teaching. Implementing such a method in the educational system would represent a crucial step toward digitizing the assessment process, aligning with modern educational requirements.

Results about students

Following the implementation of the two teaching approaches, significantly different results were obtained in terms of student performance. The class that used the Moodle platform and interactive educational games showed considerable improvements in understanding and applying mathematical concepts, compared to the class that followed a traditional learning process (Fig. 2).

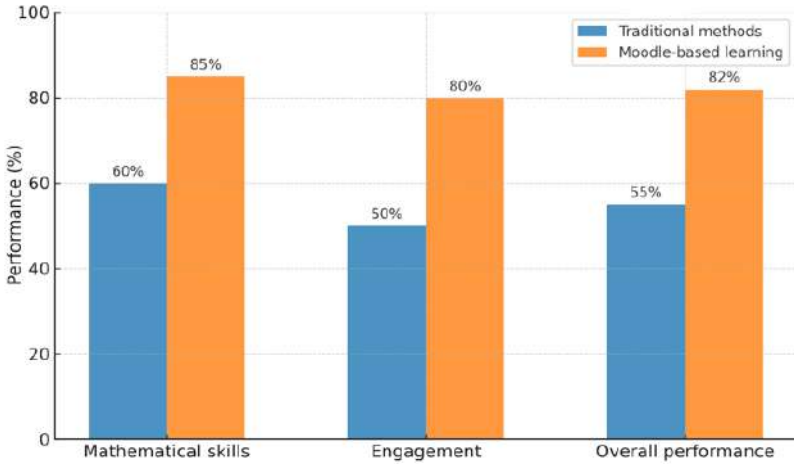


Figure 2. Comparison of the performance and motivation between the control - experimental groups

1. Student performance: Students in the class that benefited from educational games achieved higher scores on mathematical competency assessments. Analyzing the results of exercises involving the development of algebraic expressions, area and volume calculations, and solving geometric problems, a 25% improvement in answer accuracy was observed compared to the control class.

2. Active student engagement: Students in the class that used the Moodle platform demonstrated a higher level of engagement and motivation, being more active during lessons and in completing learning tasks. They received immediate feedback, which allowed them to correct mistakes and consolidate their knowledge in an interactive and personalized manner.

3. Differences in approach: Of course, there were differences in how students approached activities. Students in the traditional methods class had a more limited understanding of the concepts, requiring more time to assimilate the notions and to connect theory with practice.

The effectiveness of the IDER system was evaluated based on student engagement, accuracy in solving linear function problems, and overall performance improvement. The experimental group, which used IDER-based assessments and interactive educational games, demonstrated significant improvements in mathematical performance compared to the control group.

This analysis highlights the advantages of digital assessment, demonstrating how Moodle optimizes the evaluation process for both teachers and students.

Conclusions

This study highlights the potential of IDER-based parametrized assessments and interactive educational games mediated by Moodle for improving mathematical learning outcomes, offering numerous advantages for students, teachers, and schools:

Item models parameterized on the respective themes are ***universally applicable*** for the study of mathematics in any types of schools throughout the country, by all teachers.

By dynamically generating individualized exercises and using interactive activities, IDER ***minimizes the desire for mechanical memorization, promotes active problem solving and ensures academic integrity, making assessment more objective and impartial***.

The comprehensive use of IDER essentially ***diminishes the gap between the planned-taught-assessed curriculum***, including by different teachers.

IDER relieves teachers of most of the routine work of composing-correcting and manual grading of items, estimated as ***up to 30% of their weekly time at the expense of time they can spend on lesson planning and developing innovative teaching strategies*** and more (Vasile 90).

IDER has great potential and can be applied to other disciplines with numerous formulas and items, which can be modeled using traditional Moodle tools. Additionally, Moodle allows the use of proprietary/ paid plugins like Wiris, specifically designed for mathematics, which open new horizons. However, Wiris, STAC, etc., will be the subject of further studies.

Despite the advantages offered, e-learning and IDER will not be effective if students are not supported by voluntary efforts for deep, thorough learning. This is where the role of the teacher as a human communicator and creative educator comes in—something that cannot be replaced by computers and pre-defined, algorithmic resources. With a balanced and well-planned integration, digital resources can significantly improve education quality and prepare students for future challenges, helping both teachers and students achieve desired outcomes [7, p.87].

The comparison between the two groups of students confirms the hypothesis that integrating interactive educational games into the mathematics learning process can significantly improve student performance and motivation. The Moodle platform provides an efficient framework for personalized, adaptive, and interactive learning that meets the needs of each student, facilitating quicker understanding and correct application of mathematical concepts.

However, e-learning cannot replace the teacher's role and may have significant disadvantages if not supported by deep, voluntary learning efforts. With a balanced and well-planned integration, digital resources can significantly improve the quality of education and prepare students for future challenges.

Development ideas

Expanding the use of digital games to other learning units and continuously monitoring their effects. Tracking the long-term impact of technology on larger sample groups, focusing on motivation and academic performance improvements in mathematics.

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Presented: 28.02.2025