УДК 37.016:51:37.091.3
DOI: 10.31652/3041-2277-2025-4-20-27

Дидактичні технології з математики

Акірі Іон

Державний педагогічний університет «Іон Крянге», м.Кишинів, Республіка Молдова
E-mail: iakiri8@gmail.com
ORCID: https://orcid.org/0000-0002-8874-2329

Анотація

Розглянуто проблему кореляції методів/технік навчання з формами організації навчальної діяльності на уроках математики. Успіх уроку математики та досягнення його цілей залежить і від кореляції вибраних методів/технік та засобів навчання з формою організації навчальної діяльності. Розробки сучасної дидактики та педагогіки відкривають широкі можливості для вчителя математики у реалізації відповідної кореляції. Сформульовано визначення поняття дидактичної технології. Наведено приклади методів та технік навчання математики у кореляції з формами організації навчальної діяльності та у контексті формування компетентностей. Вчитель математики повинен застосовувати на уроках сучасні інноваційні технології навчання для формування математичної компетентності учнів, у тому числі: технології розвитку пізнавального інтересу учнів; методи/техніки реалізації на уроках математики методів кооперативного навчання та колективно-групового навчання; методи/техніки розвитку емоційного інтелекту учнів; сучасні методи/техніки розвитку креативного мислення учнів; методи/техніки проектного навчання під час уроків математики, зокрема проведення проектів STEM/STEAM/STREAM; методи/техніки опрацювання проблемних та дискусійних питань; технології ситуативного моделювання (навчання у грі); методи/техніки розвитку творчої активності учнів.

Освітня практика доводить, що використання сучасних цифрових інструментів та ресурсів робить навчання більш наочним та інтерактивним. Завдяки захоплюючим формам роботи та методів/технік викладання учні краще ставляться до математики, збагачується освітній процес, розвиваються комунікативні навички, логічне та критичне мислення, а також виявляється здатність застосовувати знання на практиці. У статті представлено систему сучасних інноваційних технологій навчання для формування математичної компетентності учнів.

Ключові слова: дидактичні технології, математика, методи навчання, техніки, форми, кореляція, компетентності.

UDC 37.016:51:37.091.3
DOI: 10.31652/3041-2277-2025-4-20-27

Didactic technologies in mathematics

Akiri Ion

State Pedagogical University «Ion Creanga», Chisinau, Republic of Moldova
E-mail: iakiri8@gmail.com
ORCID: https://orcid.org/0000-0002-8874-2329

Abstract

The problem of correlating teaching methods/techniques with forms of organizing learning activities in mathematics lessons is examined. The success of a mathematics lesson and the achievement of its objectives also depend on the correlation between the selected teaching methods/techniques and tools and the form in which learning activities are organized. Developments in modern didactics and pedagogy provide mathematics teachers with wide opportunities to implement such correlations. A definition of the concept of didactic technology is formulated. Examples are provided of methods and techniques for teaching mathematics in correlation with forms of organizing learning activities and in the context of competence formation. A mathematics teacher must apply modern innovative learning technologies during lessons to develop students' mathematical competence, including: technologies for fostering students' cognitive interest; methods/techniques for implementing cooperative and collective-group learning in mathematics lessons; methods/techniques for developing students' emotional intelligence; modern methods/techniques for developing students' creative thinking; methods/techniques of project-based learning during mathematics lessons, particularly for implementing STEM/STEAM/STREAM projects; methods/techniques for addressing problem-based and discussion tasks; situational modeling technologies (game-based learning); and methods/techniques for developing students' creative activity.

Educational practice demonstrates that the use of modern digital tools and resources makes learning more visual and interactive. Through engaging forms of work and instructional methods/techniques, students develop more positive attitudes toward mathematics; the educational process becomes enriched; communication skills, logical and critical thinking improve; and the ability to apply knowledge in practice emerges. The article presents a system of modern innovative learning technologies aimed at developing students' mathematical competence.

Keywords: didactic technologies, mathematics, teaching methods, techniques, forms, correlation, competences.

Дидактика математики: теорія, досвід, інновації, 2025, № 4, 20-27.

Problem statement. Modern didactics allows a mathematics teacher to diversify mathematics lessons by using different forms of organizing educational activities, different teaching methods and techniques, as well as different learning aids. The main task of a modern teacher is to choose the optimal didactic technology for each lesson.

Didactic technology is a set of forms, methods, techniques and means of learning, with the help of which the goal of the lesson or the corresponding educational event will be achieved.

In practical activities, *didactic teaching technologies (teacher technology), didactic learning technologies (student technology)* and *didactic technologies for assessing school results (assessment technology)* are used.

Purpose of the publication. This article examines the problem of the use of didactic technologies by a teacher in the process of teaching mathematics at school.

Presentation of the main material. The problem of studying methods of teaching mathematics was studied by G.P. Bevz, Z.I. Slepkan, V.G. Bevz, O.I. Pometun, V.A. Shvets, O.I. Matyash, M.I. Burda, L.F. Mykhailenko, O.O. Moskalenko,

O.O. Sydorenko, I.M. Dychkivska, M.V. Mykhailichenko, Y.M. Rudik, T.G. Kramarenko, V.V. Korolsky, S.O. Semerikov, S.V. Shokalyuk, M.I. Zhaldak and others.

The choice and application of teaching methods is interrelated with the forms of organization of educational activities and the means of teaching mathematics in the context of achieving the goals of the lesson.

In the context of competence formation, didactic technologies should be integrated in accordance with the Credo of Active Learning (according to Kees Both):

What I hear – I forget!

What I hear and see – I remember!

What I hear, see and ask – I begin to understand!

What I hear, see, ask and practice – I acquire and form skills!

What I apply in practice – I learn for real!

Also, in his professional activities, the mathematics teacher will correlate the selected didactic technologies with the *MOTIVATION-BASED ALGORITHM OF MATHEMATICS TEACHING:*

- *Start teaching by giving an example of a funny situation, a specific case study, a small story related to the studied theory or the problem proposed for solving;*
- *Question students on previously studied topics in relation to the new phenomenon or theory that will be studied;*
- *Present the lesson plan in the form of questions (this way of presenting the plan forces students to focus on significant aspects and to find answers to the questions posed);*
- *Present knowledge/information in the form of diagrams that make it possible to highlight the relationships between concepts;*
- *Provide interesting examples for students;*

- *Use analogies (thus forcing students to find connections between familiar and new areas).*[1]

We believe that the success of a mathematics lesson and the achievement of its goals also depends on the correlation of the selected methods/techniques and teaching aids with the form of organization of educational activities. Developments in modern didactics and pedagogy open up wide opportunities for the mathematics teacher to implement the appropriate correlation. Below are some examples in this context.

I. In the frontal form of organizing educational activities, the recommended methods of teaching mathematics are both traditional methods: *Presentation, Explanation, Story, Lecture, Empirical methods (Observation, Measurement, Experiment), Exercise method, Textbook method, and interactive methods and techniques: Analysis of a real situation (Case Study), Brainstorming, Brainsketching, Brainwriting, "BBB" method (Batelle - Bilmappen - Brainwriting), Concept map in mathematics, Laboratory work in mathematics, Practical work in the field and others.*

Let us consider the didactic features of some of the mentioned methods and techniques.

1) Creating favorable conditions for search, research, and discovery is possible when using the method of *Analysis of a Real Situation (Case Study).* Practice shows that this method allows the student to freely express his opinion, as well as find the optimal solution as a result of discussion. The following stages are provided for the implementation of the method:

1. *Choosing a specific case/specific situation (the most valuable, in the context of forming and developing interest in mathematics, are cases/situations from students' practical activities).* The teacher chooses a specific case/specific situation and formulates a problem that corresponds to the age characteristics of the students in the class and their level of mathematical preparedness.

2. *Presentation of the selected case by the teacher.*

The teacher explains the essence of the relevant case/situation to the students in an accessible manner.

3. *Discussion of the case/situation by the students.*

A conversation between the teacher and the students is held, through which the case/situation is analyzed in detail and argued to find the reasons leading to it and all relevant factors.

4. Search for solutions to the problem.

The teacher stimulates students to find solutions using a system of questions.

5. Comparison of different solutions to the problem.

Depending on the methods of organizing the activity, the received solutions are compared.

6. Choice of solutions.

The best solutions are selected.

7. Evaluation.

The teacher evaluates how the relevant situation was resolved.

When applying this method, students should be offered significant situations of practical activity, in which the applied orientation of mathematics teaching and the formation of competencies are implemented.

2) The “BBB” method (Batelle – Bilmappen – Brainwriting)

This method is also called: Brainwriting – a picture portfolio.

It is implemented according to the following algorithm:

1. The task is set before the whole class.

2. Oral brainstorming with the whole class. Ideas are formulated to solve the task.

3. The class is sequentially offered drawings (photographs), in the context of solving the discussed task.

4. Individual brainstorming in silence. Students write down their ideas for each of the pictures (photos).

5. Several students read their ideas for the corresponding picture (photo).

6. The class discusses these ideas to find other options.

The method can be applied to *functions, planimetry, stereometry, statistics*, and others.

3) Technique Concept map in mathematics.

Starting from the first lesson and throughout the entire period of passing the corresponding section, students gradually fill in a table on a separate sheet of A4 paper containing all the mathematical aspects of the concepts studied in this section.

The teacher will find examples of such maps in mathematics textbooks for lyceums published in the Republic of Moldova. [For example, 2]

By completing such maps for each section, students will create a Mathematical Atlas for the corresponding class at the end of the school year. Concept maps can be used in final lessons, during final revision, for other sections, during preparation for exams, etc.

II. When organizing group/team activities in the lesson, modern pedagogy and didactics of mathematics offer the mathematics teacher a wide range of methods and techniques. Including *simulation methods*: *Didactic game, Role play, Functional game, Business game; cooperative learning methods: Pair work, Rotational (changing) threes, Quad-pair learning, Carousel, T-group (skill training group), Synthesis of thoughts, Circle of ideas, Aquarium, General circle, Microphone, Unfinished ideas, Think - Work in pairs - Share, Brownian motion, Mosaic, Openwork saw, Situational modeling method (lesson-debate, business game, intellectual game, lesson-conference, lesson-staging, lesson-game or quest, lesson-research, lesson-journey, lesson-defense of project works* and others); *methods related to the technology of critical thinking Analysis, Synthesis, Generalization, Concretization, Abstraction, Comparison, Analogy, Induction method, Deductive method* (these methods are aimed at developing the ability to analyze, evaluate and synthesize information, form a deep understanding of mathematical concepts) and *methods related to the technology of vitagenic learning: Intrigue, Cloud tag, Scrapbooking, Eidoskonsepty, Intellect maps, Fishbone, Euler-Ven circles, Storytelling; methods related to the technology of problem-based and heuristic learning include: Problem-solving method, Immersion method, Decision tree. Senectics, Discussions, PRESS method, Take a stand, Debate, Quest, Web-quest* and others.

Let's consider the didactic specificity of some methods and techniques for group/team learning.

a) Association Matrix Technique.

An Association matrix is a table with two entries that allows you to represent various associations between mathematical concepts and their properties. With the help of such matrices, you can implement

a synthesis of the studied material within the section. The matrix can be compiled individually or as a result of group activity. The arrangement of such matrices can also be offered as a homework assignment. This technique is recommended for use in final lessons.

For example, regarding the topic Quadrilaterals, you can offer students the following Association Matrix to complete:

Quadrilateral	Elements	Signs	Properties	Image on the plane
Square				
Rectangle				
Parallelogram				
Rhombus				
Trapezoid				

b) The Four Corners technique helps develop students' interest in mathematics. The class is divided into four groups/teams, each of which is located in one of the four corners of the room (hence the name of the technique). The teacher formulates four tasks. Each student has the right to choose the task that interests him. In this way, four groups will be formed and group activity will be implemented to solve the selected task. For example, the teacher will offer 5-8 tasks to solve on the following topics: *a) Triangle; b) Parallelogram; c) Rhombus; d) Trapezium*. The solutions will be recorded on posters.

The teacher will allocate time in class to introduce students to the proposed solutions using the Gallery Tour method.

III. With an individual form of organizing educational activities, in combination with a frontal form, a mathematics teacher can also apply the *"BBB" METHOD (Batelle - Bilmappen - Brainwriting).*

a) 3-2-1 Technique. Before the end of the lesson, students are asked to individually write down on a piece of paper 3 terms (concepts) learned in the lesson, 2 ideas about what they would like to learn more about in the future, and 1 skill (one ability) that the student believes was formed (o) in the lesson. After studying the students' answers, the teacher will receive quick feedback on the effectiveness of the lesson.

b) The Association Matrix technique can also be used for individual activities. The student independently compiles a matrix for the section

c) The Project method is one of the most effective methods of forming competencies. The method is applicable both in the context of group activities and in the context of individual work. A variety of projects (*research, creative, informational, game, practice-oriented, STEM projects*) provide an opportunity to involve students in the study of various problems. Mathematics teachers have already gained sufficient experience in organizing and conducting project activities.

Conclusions. A teacher who wants to become a successful teacher must be diverse from lesson to lesson. Modern didactic technologies allow for the effective implementation of the appropriate diversity. A mathematics teacher must use modern innovative teaching technologies in lessons to form students' mathematical competence, including:

- *technologies for developing students' cognitive interest;*
- *methods/techniques for implementing cooperative learning and collective-group learning methods in mathematics lessons;*
- *methods/techniques for developing students' emotional intelligence;*
- *modern methods/techniques for developing students' creative thinking;*
- *methods/techniques for project-based learning during mathematics lessons, in particular, conducting STEM/STEAM/STREAM projects;*
- *methods/techniques for working through problem and discussion issues;*
- *situational modeling technologies (learning in the game);*
- *methods/techniques for developing students' creative activity.*

The teacher should create his own *Professional Treasury of teaching methods and techniques* in his subject. He should also master modern information and communication technologies, including technologies related to artificial intelligence [11]. Educational practice proves that the use of modern digital tools and resources makes learning more visual and interactive.

Thanks to exciting forms of work and teaching methods/techniques, students have a better attitude towards mathematics. The educational process is enriched, communication skills, logical and critical thinking are developed, and the ability to apply knowledge in practice is also revealed.

Конфлікт інтересів. *Автор декларує, що не має конфлікту інтересів стосовно даного дослідження, в тому числі фінансового, особистісного характеру, авторства чи іншого характеру, що міг би вплинути на дослідження та його результати, представлені в даній статті.*

Використання засобів штучного інтелекту. *Автор підтверджує, що не використовував технології штучного інтелекту при створенні представленої роботи.*

Список використаних джерел

Корольський В.В., Т. Г. Крамаренко Т.Г., Семеріков С.О., Шокалюк С.В. (2011) Інформаційно-комунікаційні технології в системі управління підвищенням кваліфікації сучасного педагога. *Вісник Черкаського університету. Випуск 201. Частина І. Серія «Педагогічні науки».* с.61-69. Retrieved from: https://lib.iitta.gov.ua/id/eprint/106660/1/Інформаційно-комунікаційні%20технології%20в%20системі%20управління%20підвищенням%20кваліфікації%20сучасного%20педагога.pdf

Матяш О.І., Матяш А.Д. (2025) Формування стереометричної культури майбутніх учителів математики. *Дидактика математики: теорія, досвід, інновації*, *3*, 67-76. https://doi.org/10.31652/3041-2277-2025-3-67-76

Михайленко Л.Ф., Андрієвська М.Ю. (2024) Психологічні та педагогічні засади формування інформаційно-комунікативної компетентності школярів в умовах змішаного навчання. (2024). *Дидактика математики: теорія, досвід, інновації*, *2*, 56-69. https://doi.org/10.31652/3041-2277-2024-2-56-69

Огієнко, О.І., Калюжна, Т.Г., Мільто, Л.О., Красильник, Ю.С., Радченко, Ю.Л., Годлевська, К.В. and Кобюк, Ю.М. (2015) *Інноваційні педагогічні технології*. Інститут педагогічної освіти та освіти дорослих НАПН України, м. Київ, Україна. 314с. https://lib.iitta.gov.ua/id/eprint/705797/1/Посібник.pdf

Пометун О. І., Пироженко Л. В. (2004) Сучасний урок. Інтерактивні технології навчання. Київ : А. С. К. 192 с.

Васильєва Д.В. (2017). Впровадження елементів STEM-освіти у навчання математики.. In Summer session “WEB-STEM-SCHOOLS – 2017” [Video]. YouTube. https://youtu.be/HLN36eNYWks?si=sQNIOcODxtay278N

Achiri, I. (2013). Didactics of mathematics. Lectures. Chișinău: Prut International.

Achiri, I., Ciobanu, V., Efros, P., Garit, V., Neagu, V., Poștaru, A., Prodan, N., Taragan, D., & Topală, A. (2023). Matematică: Manual pentru clasa a XII-a. Chișinău: Prut International.

Besedin, B., & Kyrychenko, A. (2021). Organization of project activities in mathematics lessons as a way to develop students' cognitive competence. Humanization of the Educational Process, 1(100).

Cherkasova, T. (2015). Methods of teaching mathematics in the structure of critical thinking lessons as a way to form students' competence.

Dychkivska, I. M. (2015). Innovative pedagogical technologies: A manual for students of higher education (3rd ed., rev.). Kyiv: Akademvydav.

Mykhailichenko, M. V., & Rudyk, Ya. M. (2016). Educational technologies: A manual. Kyiv: KOMPRINT.

Ochkan, G. (Comp.). (2016). Innovative teaching technologies: A methodical manual. Vinnytsia: Knyga-Vega.

References

Korolskyi, V. V., Kramarenko, T. H., Semerikov, S. O., & Shokaliuk, S. V. (2011). *Informatsiino-komunikatsiini tekhnolohii v systemi upravlinnia pidvyshchenniam kvalifikatsii suchasnoho pedahoha* [in Ukrainian] (*Information and communication technologies in the system of managing professional development of a modern teacher*). *Visnyk Cherkaskoho universytetu*, Issue 201, Part I, Series "Pedagogical Sciences", 61–69. https://lib.iitta.gov.ua/id/eprint/106660/1/Інформаційно-комунікаційні%20технології%20в%20системі%20управління%20підвищенням%20кваліфікації%20сучасного%20педагога.pdf

Matiash, O. I., & Matiash, A. D. (2025). *Formuvannia stereometrychnoi kultury maibutnikh uchyteliv matematyky* [in Ukrainian] (*Formation of stereometric culture of future mathematics teachers*). *Dydaktyka matematyky: teoriia, dosvid, innovatsii*, 3, 67–76. https://doi.org/10.31652/3041-2277-2025-3-67-76

Mykhailenko, L. F., & Andriievska, M. Yu. (2024). *Psykholohichni ta pedahohichni zasady formuvannia informatsiino-komunikatyvnoi kompetentnosti shkoliariv v umovakh zmishanoho navchannia* [in Ukrainian] (*Psychological and pedagogical foundations of forming students' information and communication competence in blended learning*). *Dydaktyka matematyky: teoriia, dosvid, innovatsii*, 2, 56–69. https://doi.org/10.31652/3041-2277-2024-2-56-69

Ohiienko, O. I., Kaliuzhna, T. H., Milto, L. O., Krasylnyk, Yu. S., Radchenko, Yu. L., Hodlevska, K. V., & Kobiuk, Yu. M. (2015). *Innovatsiini pedahohichni tekhnolohii* [in Ukrainian] (*Innovative pedagogical technologies*). Institute of Pedagogical Education and Adult Education of the National Academy of Educational Sciences of Ukraine. https://lib.iitta.gov.ua/id/eprint/705797/1/Посібник.pdf

Pometun, O. I., & Pyrozhenko, L. V. (2004). *Suchasnyi urok. Interaktyvni tekhnolohii navchannia* [in Ukrainian] (*Modern lesson. Interactive learning technologies*). A. S. K.

Vasylieva, D. V. (2017). *Vprovadzhennia elementiv STEM-osvity u navchannia matematyky* [in Ukrainian] (*Implementation of STEM education elements in mathematics teaching*). In *Summer session "WEB-STEM-SCHOOLS – 2017"* [Video]. YouTube. https://youtu.be/HLN36eNYWks

Achiri, I. (2013). *Didactics of mathematics. Lectures*. Prut International.

Achiri, I., Ciobanu, V., Efros, P., Garit, V., Neagu, V., Poștaru, A., Prodan, N., Taragan, D., & Topală, A. (2023). *Matematică: Manual pentru clasa a XII-a*. Prut International.

Besedin, B., & Kyrychenko, A. (2021). Organization of project activities in mathematics lessons as a way to develop students' cognitive competence. *Humanization of the Educational Process*, 1(100).

Cherkasova, T. (2015). Methods of teaching mathematics in the structure of critical thinking lessons as a way to form students' competence.

Dychkivska, I. M. (2015). *Innovative pedagogical technologies: A manual for students of higher education* (3rd ed., rev.). Akademvydav.

Mykhailichenko, M. V., & Rudyk, Ya. M. (2016). *Educational technologies: A manual*. KOMPRINT.

Ochkan, G. (Comp.). (2016). *Innovative teaching technologies: A methodical manual*. Knyha-Veha.

Отримано / Received 17.10.2025
Прийнято до друку / Accepted 26.11.2025
Опубліковано / Published 22.12.2025