

**MoPED: Modernization of Pedagogical Higher Education by
Innovative Teaching Instruments
586098-EPP-1-2017-1-UA-EPPKA2-CBHE-JP**

HANDBOOK

Subject: *Innovative Study Technologies of the School Course of
Mathematics*

For students of the specialty '*014 Secondary Education (Mathematics)*',
Higher education level: *bachelor*

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2019

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Abstract

The current stage of higher education reformation in Ukraine is known by intensive search for new approaches to theory and practice of learning and education, active implementation of new technologies and educational models. The center here lies in the problem of teacher training, especially the one who is characterized by innovative style of thinking and operation; he is able to use creative approaches to solving educational tasks and shows personal and professional growth for the whole life. Today innovative teacher activity appears to be the key factor of modernized reforms realization in school education and one of the most important trends of the transformation to the innovative development model in Ukraine in general. Preceding from it the urgent task of the course 'Innovative Study Technologies of the School Course of Mathematics' comes – Mathematics teacher training who is competent in innovative professional activity, capable for effective solving of the tasks of school modernization system, creating and implementing of pedagogical innovations.

The course aims at the providing of general and professional development of would-be Mathematics teacher and obtaining the knowledge, skills and abilities system in the sphere of innovative learning organization in further professional activity. The course content implies students introduction to the specific features of the following innovative pedagogical technologies implementation in Mathematics educational process of the institutions of secondary general education: interactive technologies, information and communication technologies, research teaching technologies.

Key concept: innovations, technologies, interactive, ICT, STEAM, educational process, learning, the school course of Mathematics.

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1. Subject description

1.1. Subject content in ECTS credits and its hours apportionment in the forms of educational process organization and types of lessons.

Subject content: 3 ECTS credits

Total hours: 90, including full-time studying: 20 lecture hours, 24 hours of practical lessons, 46 hours for students' independent work tutorials.

Part-time studying includes: 6 lecture hours, 6 of practical lessons, 78 for students' independent work tutorials.

1.2. Subject characteristic for studying form: full-time and part-time.

1.3. Subject status: compulsory subject.

1.4. Basics for subject studying: Elementary Mathematics, analytic geometry, linear algebra, mathematical analysis

1.5. Year of training, term: 3-d year, 6-th term.

1.6. Form of final control: examination.

1.7. Teaching language: Ukrainian.

1.8. Internet address of permanent arrangement of the subject educational content:

<https://moodle.dls.udpu.edu.ua/course/view.php?id=4811>
 password to log: 123456

1.9. Authors, workgroup:

PhD in Education, Associate Professor, associate professor at Department of Higher Mathematics and Methods of Teaching Mathematics Tetiana Hodovaniuk.

PhD in Education, Associate Professor, Dean of Faculty of Physics, Mathematics and Informatics Tetiana Makhometa.

PhD in Education, associate professor at Department of Higher Mathematics and Methods of Teaching Mathematics Iryna Tiahai.

1.10. Studying purpose of the subject: to form students' readiness and ability for modelling and conducting lessons of different forms and extracurricular work of the Mathematics school course using innovative teaching technologies.

1.11. Competences that are being formed while studying the subject.:

Integral competence (IC)	The ability to solve difficult and specific tasks and practical problems using obtained knowledge, abilities and skills of using innovative teaching tools and technologies in professional activity. They are based on Pedagogics, Psychology and Methods of Teaching Mathematics and are characterized by the principal of complex and uncertain conditions.
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General competences (GC)	GC 1. Ability for abstract and critical thinking, analysis and synthesis. GC 2. Ability to use knowledge in practical situations and generate new ideas (creativity).
Profession (specific) competences (PsC)	PsC 1. Ability to implement the knowledge systems of the professional training courses in practice. PsC 2. Ability to use the knowledge of Methods of Teaching Mathematics in order to perform an effective implementation of innovative teaching technologies in educational process. PsC 3. Ability to organize and conduct Mathematics educational process in institutions of secondary general education using modern approaches (including activity-based, competence-based, personally-oriented, systematic, technological, individual and creative, etc.). PsC 4. Ability to use traditional and innovative teaching methods, tools, forms and technologies aimed at forming key competences for life in school learners.

1.12. Subject teaching results:

- 1) To know traditional and innovative Mathematics teaching methods and modes in institutions of secondary general education.
- 2) To demonstrate fundamental knowledge of actual material of Mathematics school course and be able to use its current teaching methodology.
- 3) To plan pedagogical activity, identify and motivate pedagogical tasks; choose a complex of effective systems and innovative pedagogical technologies in order to solve complicated specific tasks and practical problems in the professional sphere.
- 4) To use innovative technologies in order to solve complicated specific tasks and practical problems in the would-be professional activity that is known to be performed with complex and uncertain conditions.
- 5) To know the modes of data collecting, classification, generalizing, interpreting and implementing with the methods of data analysis and processing, be able to use these results in professional sphere.
- 6) To demonstrate the ability to form and develop school learners' mathematical and digital competence.

- 7) To demonstrate the ability to detect psychological and pedagogical specific features of school learners educational information learning, the development of their skills in order to reveal, predict effective and corrective Mathematics pedagogical process in institutions of secondary general education.
- 8) To demonstrate the ability to account responsibility for decision making in the sphere of their competence with unpredictable professional and educational contexts.
- 9) To show the ability to form communicative strategy with all participants of educational process.
- 10) To be able to use the abilities of independent and professional self-improvement.

1.13. Control of students' educational results:

The tools for teaching results identification	Final control, tasks accomplishment on a practical lesson, creative writing, test control, independent tasks, etc.																												
Final evaluation	<p>Evaluation system include the following types of educational activity: 11 interim creative writings to estimate PsC 1 (11%), PsC 2 (11%), PsC 3 (11%) and PsC 4 (22%). Activity on a practical lesson to estimate PsC 2 (11%), PsC 4 (11%), final control (examination) to estimate PsC 1 (2%), PsC 2 (3%), PsC 3 (5%) and PsC 4 (5%). Students' activity to estimate general competences GC 1 (4%) and GC 2 (4%). The final evaluation (point) is to be provided as following: PsC 1 (11%+2%)+ PsC 2 (11%+11%+3%) + PsC 3 (11%+5%) + PsC 4 (22%+11%+5%) + GC 1 (4%) + GC 2 (4%).</p> <table border="1" data-bbox="528 1487 1498 1823"> <thead> <tr> <th>Competences</th> <th>Interim evaluation, %</th> <th>Final control, %</th> <th>Total, %</th> </tr> </thead> <tbody> <tr> <td>PSC 1</td> <td>11%</td> <td>2%</td> <td>13%</td> </tr> <tr> <td>PSC 2</td> <td>22%</td> <td>3%</td> <td>25%</td> </tr> <tr> <td>PSC 3</td> <td>11%</td> <td>5%</td> <td>16%</td> </tr> <tr> <td>PSC 4</td> <td>33%</td> <td>5%</td> <td>38%</td> </tr> <tr> <td>GC 1</td> <td>4%</td> <td></td> <td>4%</td> </tr> <tr> <td>GC 2</td> <td>4%</td> <td></td> <td>4%</td> </tr> </tbody> </table>	Competences	Interim evaluation, %	Final control, %	Total, %	PSC 1	11%	2%	13%	PSC 2	22%	3%	25%	PSC 3	11%	5%	16%	PSC 4	33%	5%	38%	GC 1	4%		4%	GC 2	4%		4%
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PSC 1	11%	2%	13%																										
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PSC 4	33%	5%	38%																										
GC 1	4%		4%																										
GC 2	4%		4%																										
Communication and feedback	Information about the accomplishment of practical writings, individual and creative writings and independent work etc results is demonstrated with																												

	<p>every student personally and for the whole group in general.</p> <p>Information about the evaluation point of individual and creative writings accomplishment is performed for a student (a group of students); the results of writing accomplishments are presented by them (including public).</p> <p>Student's results of writing accomplishments on practical lessons are performed according to lesson schedule.</p> <p>Results of final control (examination) are demonstrated for students on the day of the examination.</p> <p>Individual and online tutorials are performed with the interactive communication apps (Telegram, Viber, WhatsApp).</p>		
<p>Evaluation scale of the institution of higher education</p>	<p>Total points for all educational activities</p>	<p>ECTS points</p>	<p>Point in national scale</p>
	<p>90 – 100</p>	<p>A</p>	<p>excellent</p>
	<p>82 – 89</p>	<p>B</p>	<p>good</p>
	<p>75 – 81</p>	<p>C</p>	
	<p>69 – 74</p>	<p>D</p>	
	<p>60 – 68</p>	<p>E</p>	<p>satisfactory</p>
	<p>35 – 59</p>	<p>FX</p>	<p>unsatisfactory with an opportunity for reexamination</p>
	<p>0-34</p>	<p>F</p>	<p>unsatisfactory with compulsory repeated course</p>

2. Content and structure of the educational subject

Names of content units and themes	Hours apportionment											
	Full-time department						Part-time department					
	Total	Including					Total	Including				
		1	Pr.	Lab.	indiv	independent		1	pr.	lab	indiv	Independent
1	2	3	4	5	6	7	8	9	10	11	12	13
Unit 1												
Content Unit 1												
Theoretical Aspects of Innovations in School Education												
Theme 1. <i>Innovations: basic nature and types of innovations, conceptual apparatus and legal principles.</i>	6	2				4	6					6
Total content unit 1	6	2				4	6					6
Content Unit 2												
Interactive Teaching Technologies												
Theme 1. <i>Backbone and classification of interactive teaching technologies.</i>	6	2				4	6					6
Theme 2. <i>Interactive technologies of cooperative collective and group teaching.</i>	12	2	4			6	9	1	1			7
Theme 3. <i>Technologies of situational</i>	12	2	4			6	9	1	1			7

<i>modelling and debatable problems development.</i>												
Total content unit 2	30	6	8			16	24	2	2			20
Content Unit 3												
Information and Communicative Technologies												
Theme 1. <i>Implementation of e-learning elements to form a creative personality.</i>	16	4	4			8	16	1	1			14
Theme 2. <i>Mobile and cloud technologies of school learners Mathematics teaching.</i>	14	4	4			6	16	1	1			14
Total content unit 3	30	8	8			14	32	2	2			28
Content Unit 4												
Innovative Approaches to STEM-Education Implementation												
Theme 1. <i>Implementation of STEM-education elements in the conditions of current educational process.</i>	12	2	4			6	14	1	1			12
Theme 2. <i>Project technology as an element of innovative pedagogical technologies.</i>	12	2	4			6	14	1	1			12
Total content unit 4	24	4	8			12	28	2	2			24
Total hours	90	20	24			46	90	6	6			78

2.1. Content Unit 1. Theoretical Aspects of Innovations in School Education

2.1.1. Theme 1. Innovations: basic nature and types of innovations, conceptual apparatus and legal principles.

2.1.2. Objective and anticipated outcomes.

Objective: *to introduce students to basic innovation types and their nature, conceptual apparatus, legal principles of innovations implementation in education; to identify the role of innovative technologies in educational process of institutions of secondary general education.*

Anticipated outcomes:

- 1) To use the tools for collecting, classifying, generalizing, interpreting and implementing with the methods of data analysis and processing, be able to use these results in professional sphere (GC 1, PsC 1).
- 2) To use the skills of self-education and professional self-development (GC 1).

2.1.3. Criteria and forms of learning results evaluation on the theme (*forming ma final evaluation*).

Table 2.1.1. Criteria of learning results evaluation

Evaluation criteria	Quantitative and /or qualitative characteristics
The ability to work up literature sources independently, analyze legal principles of Ministry of Education and Science of Ukraine on innovations implementation in education; identify and differentiate types of innovations.	High level (3 points) – a student is independently able to: collect and work up necessary sources on the theme, differentiate the primary and secondary while processing it; analyze legal principles of Ministry of Education and Science of Ukraine on innovations implementation in education; use conceptual apparatus, classify and characterize types of innovations. Intermediate level (2 points) – a student may have difficulties in the following situations: while working up the necessary sources on the theme, differentiating the primary and secondary; analyzing legal principles of Ministry of Education and Science of Ukraine on innovations implementation in education. Partially he is able to use conceptual apparatus,

	<p>perform mistakes while classifying the types of innovations and their characteristics.</p> <p>Low level (1 point) – a student may have considerable difficulties in the following situations: while working up the necessary sources on the theme, differentiating the primary and secondary; analyzing legal principles of Ministry of Education and Science of Ukraine on innovations implementation in education. He is able to use poor conceptual apparatus, perform significant mistakes while classifying the types of innovations and their characteristics.</p>
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The form of teaching results evaluation: performance of independent work teaching results.

2.1.4. Digital tools

Electronic study course (ESC) on Moodle platform, online documents, services to work with video and audio.

2.1.5. Innovative teaching technologies: technologies of critical thinking development (brain storm), problem-based learning, blended learning, technologies of distant learning.

Innovative class rooms: studying zone and the one of student's personal space.

2.1.6. **Lecture 1. Innovations: basic nature and types of innovations, conceptual apparatus and legal principles.**

Purpose: *to introduce students to basic innovation types and their nature, conceptual apparatus; to identify the role of innovative technologies in educational process of institutions of secondary general education.*

Plan:

1. Innovative processes: historical aspect.
2. Innovations in education: *conceptual apparatus*.
3. Types of innovations in education.

2.1.7. Seminar /practical/ laboratory lesson 1 – *not provided*.

2.1.8. Themes of individual and /or group tasks – *not provided*.

2.1.9. Tasks for students independent work: to analyze current legal principles of Ministry of Education and Science of Ukraine on innovations implementation in education (abstract); to compose

terminological vocabulary on the theme in accordance with legal documents.

Table 2.1.2. Criteria for students independent evaluation

Criteria	High level (3 points)	Intermediate level (2 points)	Low level (1 point)
<i>Ability to work up independently necessary sources on the theme, analyze legal principles of Ministry of Education and Science of Ukraine on innovations implementation in education; identify and differentiate innovations types.</i>	<i>A student is independently able: to collect and work up necessary sources on the theme, differentiate the primary and secondary while processing it; analyze legal principles of Ministry of Education and Science of Ukraine on innovations implementation in education. He worked up no less than 4 legal documents; terminological vocabulary is formed on the processed documents.</i>	<i>A student may have inconsiderable difficulties in the following situations: while working up the necessary sources on the theme, differentiating the primary and secondary; analyzing legal principles of Ministry of Education and Science of Ukraine on innovations implementation in education. He worked up no less than 3 legal documents; terminological vocabulary is formed on the processed documents.</i>	<i>A student may have considerable difficulties in the following situations: while working up the necessary sources on the theme, differentiating the primary and secondary; analyzing legal principles of Ministry of Education and Science of Ukraine on innovations implementation in education. He worked up no less than 2 legal documents; terminological vocabulary is formed on the processed documents.</i>

2.1.10. Methodological materials and manual (if present)

Conspectus and the presentation of Lecture 1 are accessible on the following link:

<https://moodle.dls.udpu.edu.ua/course/view.php?id=4811>. Password to log: 123456.

2.2. Content Unit 2. Interactive teaching technologies

2.2.1. Theme 1. Backbone and classification of interactive teaching technologies.

2.2.2. Objective and anticipated outcomes

Objective: *to explain the backbone of interactive teaching technologies, introduce to methods and types of their classification; identify the role of the technologies in teaching Mathematics.*

Anticipated outcomes:

- 1) To use traditional and innovative methods and modes of teaching Mathematics (GC 1, PsC 4).
- 2) To know the modes of data collecting, classification, generalizing, interpreting and implementing with the methods of data analysis and processing, be able to use these results in professional sphere (GC 1, PsC 1).
- 3) To be able to use the abilities of independent and professional self-improvement (GC 1).

2.2.3. Criteria and forms of learning results evaluation on the theme (*forming ma final evaluation*).

Table 2.2.1. Criteria for learning results evaluation

Evaluation criteria	Quantitative and /or qualitative characteristics
Ability to identify interactive technologies to be a separate type of educational technologies, classify interactive teaching technologies, use methods of analysis and information processing.	<p>High level (3 points) – a student knows and takes in the content of interactive teaching technologies, educational purpose of their use, independently identifies their type; he independently chooses effective methods of analysis and information processing.</p> <p>Intermediate level (2 points) – a student knows but partially takes in the content of interactive teaching technologies use and educational purpose of their use, not always independently identifies their type; he independently chooses effective methods of analysis and information processing.</p> <p>Low level (1 point) – a student knows but doesn't take in the content of the technologies and educational purpose of their use, is not able to identify their type independently; he is not able to choose</p>

	effective methods of analysis and information processing independently.
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The form of teaching results evaluation: performance of independent work results.

2.2.4. Digital tools

Electronic study course (ESC) on Moodle platform, online documents, Google Drive, tool for forming evaluation Mentimeter.

2.2.5. Innovative teaching technologies

Technology of interactive learning (range of ideas, cluster), blended learning technology, mobile learning technologies.

Innovative class rooms: studying zone and the one of student's personal space.

2.2.6. **Lecture 2. Backbone and classification of interactive teaching technologies.**

Purpose: *to explain interactive teaching technologies, introduce to methods and types of their classification, possibilities to use ICT in interactive learning.*

Plan:

1. Interactive teaching content.
2. Classification of interactive teaching technologies.
3. Use of computer technologies in interactive students learning.

2.2.7. Seminar /practical/ laboratory lesson 1 – *not provided.*

2.2.8. Themes of individual and /or group tasks – *not provided.*

2.2.9. Tasks for students independent work: study and analyze historical aspects of interactive teaching implementation; explain methods of interactive technologies classification (forming of chronological map).

Table 2.2.2. Criteria for students independent work evaluation

Criteria	High level (3 points)	Intermediate level (2 points)	Low level (1 point)
<i>Ability to form chronological map of interactive teaching development</i>	<i>The task is done correctly: a student formed chronological map, independently analyzed and processed the information of the research</i>	<i>The task is done: a student formed chronological map, but made some inconsiderable inaccuracies, independently analyzed and processed the</i>	<i>The task is partially done: a student formed chronological map, but made considerable mistakes, wasn't able to analyze and process the information of the</i>

	<i>theme.</i>	<i>information of the research theme.</i>	<i>research theme independently.</i>
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2.2.10. Methodological materials and manual (if present)

Conspectus and the presentation of Lecture 2 are accessible on the following link:

<https://moodle.dls.udpu.edu.ua/course/view.php?id=4811>. Password to log: 123456.

2.2. Theme 2. Interactive technologies of cooperative collective and group teaching.

2.2.12. Objective and anticipated outcomes

Objective: *to identify specific features of interactive technologies of cooperative collective and group teaching, develop the abilities to apply the types of interactive technologies to the organization of educational and cognitive school learners' activity.*

Anticipated outcomes:

- 1) To use traditional and innovative methods and modes of teaching Mathematics in institutions of secondary general education (GC 1, GC 2, PsC 2, PsC 4).
- 2) To demonstrate the knowledge of actual material of Mathematics school course and use its modernized teaching methods (GC 2, PsC 1, PsC 2).
- 3) To plan pedagogical activity, identify and provide a rationale for pedagogical tasks; choose the complex of effective systems and innovative pedagogical technologies to solve complicated specific tasks and practical problems in professional sphere (PsC 3, PsC 4).
- 4) To perform the ability to form communicative strategies including every participant of educational process (GC 2, PsC 3).

2.2.13. Criteria and forms of learning results evaluation on the theme (forming ra final evaluation).

Table 2.2.3. Criteria for learning results evaluation

Eevaluation criteria	Quantitative and /or qualitative characteristics
Abilities: to plan pedagogical activity choosing effective technologies of cooperative collective and group teaching in accordance with the studied material of mathematics school course; independently	High level (9-10 points) – a student independently chooses the necessary material of Mathematics school course and corresponding effective technologies of cooperative collective and group teaching in accordance with the studied theme. Intermediate level (7-8 points) – a student independently chooses the necessary material of Mathematics school course, but

<p>work up lesson fragments using the given technologies.</p>	<p>meets some difficulties while selecting effective technologies of cooperative collective and group teaching in accordance with the studied theme. Low level (1-6 points) – a student meets considerable difficulties and needs teacher’s help while choosing the necessary material of Mathematics school course and corresponding effective technologies of cooperative collective and group teaching in accordance with the studied theme.</p>
<p>Ability to form communicative strategy including every participant of educational process using the technologies of cooperative collective and group teaching.</p>	<p>High level (4 points) – a student is able to express and motivate his opinion, respect and consider other opinions. Intermediate level (3 points) – a student is able to express, but partially motivate his opinion, respect and consider other opinions. Low level (1-2 points) – a student meets considerable difficulties while expressing and motivating his opinion, respects and considers other opinions.</p>

The form of learning results evaluation: performance of creative writing and its defense (students presenting of activity results, discussion), final teacher’s evaluation in accordance with student’s tasks results.

2.2.14. Digital tools

Electronic study course (ESC) on Moodle platform, tools for searching information on the Internet, online documents, Google Drive, tool for forming estimating Kahoot!.

2.2.15. Innovative teaching technologies

Technology of interactive learning (range of ideas, aquarium, line, study-while-teach), mobile learning technologies, problem-oriented learning.
 Innovative class rooms: studying zone, creative zone and the one of student’s personal space.

2.2.16. **Lecture 3. Interactive technologies of cooperative, collective and group teaching.**

Objective: *to find out the features of interactive technologies of cooperative, collective and group teaching, to develop the ability to*

apply these types of interactive technologies in the organization of educational and cognitive activities of students.

Plan:

1. The essence and features of interactive technologies of cooperative teaching.
 2. The content of interactive technologies of collective and group teaching.
- 2.2.17. Seminar/ practical/ laboratory lesson 1. *(brief description, in case of different student's activities it is necessary to indicate methods and evaluation criteria)*

Practical Session 1.

Theme: 'Interactive technologies of cooperative teaching'

Types of students' activities:

- Technology 'Circle of ideas'
- Technology 'Aquarium'
- Technology of mutual interrogation «Chain»

Instructions to students:

1. For technology '**Circle of ideas**':

- 1) Sit in a way to form a circle. The task written on the board is to be done for 7 – 10 minutes.
- 2) Investigate the function and draw a graph $y = \frac{8}{x\sqrt{x^2 - 4}}$.

A lecturer chooses the student to start the investigation. The student has to write the solution to the proper point of the task he /she is responsible for as well as to prove the idea. The next stage of investigation is for the other student. In case of student's mistake, one who wishes is able to point out it.

After completing the study of the function and discussing it, the lecturer announces the next task.

- 3) Discuss the rationality of technology 'Circle of ideas' in accordance with the specific topic of the school course of mathematics
2. For technology '**Aquarium**':
- 1) Form groups of four people.
 - 2) Choose a group that takes a place in the 'Aquarium' by drawing lots.
 - 3) The group in the 'aquarium' discusses the problem-solving progress $4\sin^4 x + \sin^2 2x = 2$.
 - 4) The group 'outer circle' listens to the discussion attentively, concentrating on scientific and accurate utterance of the group in

- ‘Aquarium’, correctness of its opinions, the rational choice of the problem solving technique.
- 5) The group ‘outer circle’ is to analyze the process of equation solving and questions of the group ‘Aquarium’.
3. For technology of mutual interrogation **“Chain”**:
- 1) The lecturer asks questions to the students.
 - 2) The first student who has given the correct answer asks a question to the next student.
 - 3) If the 2nd student has given the correct answer, he asks the 3rd student. If the answer of the 3rd student is not correct, then the 2nd student gives the answer to the question, etc.

Practical Session 2.

Theme: “Interactive technologies of collective and group teaching”

Types of students activities:

- Technology ‘Cluster’
- Technology ‘While teaching-study’

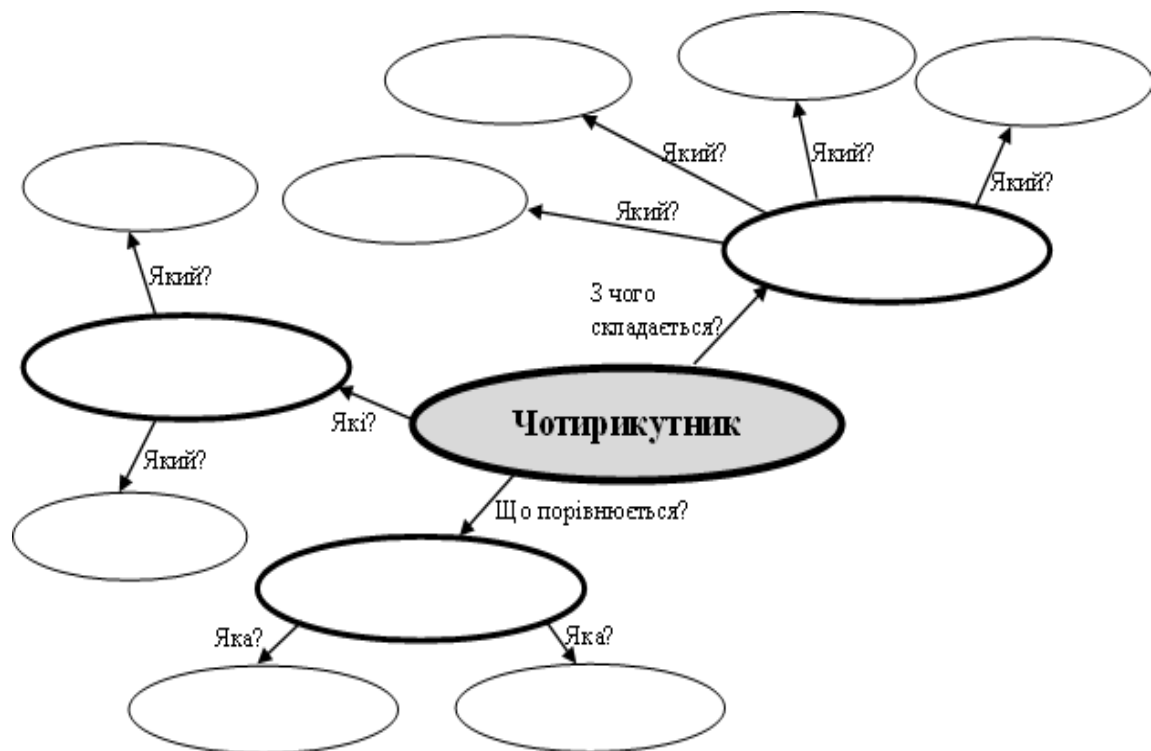
Instruction to students:

1. For technology **“Cluster”**:
 - 1) Fill in the blanks by answering the questions related to the topic “Quadrilaterals”:

What kind of?

What does it consist of?

What is compared with?



- 2) Students take turns filling in the blanks.
2. For technology **“While teaching-study”**:
- 1) In the previous session, some students were appointed to certain technologies.
 - 2) In the session, students speak on the appointed technology and give specific examples.
- 2.2.18. Topics of individual and/or group tasks – *not provided*.
- 2.2.19. Tasks for students’ independent learning:
Develop a part of the lesson with the use of cooperative or collective and group teaching (each student receives the topic of the school course of mathematics individually and, using the technologies of cooperative or collective and group teaching, develops a fragment of the lesson).

Table 2.2.4. Criteria for evaluating students’ independent work

Evaluation criteria	High level (9-10 points)	Intermediate level (7-8 points)	Low level (1-6 points)
Ability: to plan educational process taking into account effective	the student independently selects educational material from the school	the student independently selects educational material from the school course of	the student experiences significant difficulties and needs lecturer’s help in selecting

<p>technologies of cooperative or collective and group teaching according to the studying educational material in the school mathematics course; to develop fragments of lessons using these technologies independently .</p>	<p>course of mathematics, as well as appropriate effective technologies of cooperative and collective and group teaching to the specific topic.</p>	<p>mathematics but experiences some difficulties in selecting effective technologies of cooperative, and collective and group teaching on specific topic.</p>	<p>the educational material from the school course of mathematics and appropriate technologies of cooperative, and collective and group teaching to the specific topic.</p>
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2.2.20. Methodical materials and instructions (*if needed*)

Lecture compendium and its presentation №3 are available on: <https://moodle.dls.udpu.edu.ua/course/view.php?id=4811>. Password: 123456.

2.2.21. **Theme 3. Technologies of situational modelling and debatable problems development.**

2.2.22. Objective and anticipated outcomes

Objective: *to explicate the peculiarities of interactive technologies of situational modelling and debatable problems development, to teach students to use these technologies for the purpose of forming school learners' key competences for all throughout life, to develop the ability to use these types of interactive technologies in organizing the educational process in mathematics for school learners.*

Anticipated outcomes:

- 1) Know traditional and innovative Mathematics teaching methods and modes in institutions of secondary general education (GC 1, GC 2, PsC 2, PsC 3, PsC 4).
- 2) Demonstrate fundamental knowledge of actual material of Mathematics school course and be able to use its current teaching methodology. (PsC 1, PsC 2, PsC 3).
- 3) To plan educational process, to define and substantiate pedagogical tasks; to select the set of effective systems and innovative educational technologies for solving complicated specific tasks and practical problems in the field of professional development (PsC 3, PsC 4).

- 4) To use innovative technologies in order to solve complicated specific tasks and practical problems in the would-be professional activity that are known to be with complex and uncertain conditions (GC 2, PsC 2. PsC 4).
- 5) To show the ability to form communicative strategy with all participants of educational process (GC 1, GC 2)

2.2.23. Criteria and forms of learning outcomes evaluation on the topic (*formative and summative evaluation*).

Table 2.2.5. Criteria for evaluating learning outcomes

Evaluation criteria	Quantitative and / or qualitative characteristics
<p>Ability: to plan educational process selecting effective technologies of situational modelling and debatable problems development due to educational material; to develop fragments of lessons using technologies of situational modelling and debatable problems development independently.</p>	<p>High level (9-10 points) – the student independently: selects the most effective technologies of situational modelling and debatable problems development; understands the content of these technologies and the educational objective of their use; selects the educational material from the school course of mathematics and appropriate technologies to the specific topic.</p> <p>Intermediate level (7-8 points) – the student experiences some difficulties in selecting effective technologies of situational modelling and debatable problems development to the specified topic; understands the content of these technologies and the educational objective of their use; selects the educational material from the school course of mathematics and appropriate technologies to the specific topic. But he/she is not always able to substantiate the technology selection.</p> <p>Low level (1-6 points) – the student experiences significant difficulties and needs lecturer’s help in selecting educational material from the school course of mathematics and appropriate technologies of situational modelling and debatable problems</p>

	development to the specific topic; understands partly the content of these technologies and educational objective of their use.
Ability to form communicative strategy with all participants of educational process using technologies of situational modelling and debatable problems development.	<p>High level (4 points) – the student gives and proves his/her point of view, respects and listens to opinions of others.</p> <p>Intermediate level (3 points) – the student gives but proves partly his/her point of view, respects and listens to opinions of others.</p> <p>Low level (1-2 points) – the students experiences significant difficulties in giving and substantiating his/her point of view, respects and listens to opinions of others</p>

Forms of learning outcomes evaluation: creative work presentation and its defence (presentation of results of students' work, discussion), summative evaluation of students' tasks done in practical sessions and independently.

2.2.24. Digital tools

Online educational course (EEC) on Moodle platform, instruments for searching information on the Internet, online documents, Google Drive, instrument for formative evaluation Kahoot!.

2.2.25. Innovative educational technologies

Technologies of interactive education ('Public Listening', 'Role playing', 'Talk-show discussion'), mobile technologies in education, problem based learning.

Innovative classroom spaces: study area, creative area and student's personal space area.

2.2.26. **Lecturer 4. Technologies of situational modelling and debatable problems development.**

Objective: *to clarify the peculiarities of interactive technologies of situational modelling and debatable problems development, to introduce the peculiarity of forming school learners' key competences for all throughout life in mathematics lessons using these technologies.*

Plan:

1. Basic features and peculiarity of interactive technologies of situational modelling.

2. The content of interactive technologies of debatable problems development.

2.2.27. Seminar / practical / laboratory lesson 1. (a brief summary, to indicate methods and criteria for evaluation in case of different kinds of student's activities)

Practical lesson 3.

Theme: “Technologies of situational modelling”

Kinds of students' activities:

- Technology “Public listening”
- Technology “Role playing”

Students' instruction:

1. For technology “**Public listening**”:

1) Construct the function $y = 2 \sin\left(\frac{x}{2} - \frac{\pi}{6}\right) - 1$ by the method of geometrical transformations

2) Check up using the software environment GRAN-2D.

The student, who solves the task problem near the board, has to use algorithm of drawing graphic of the function, do drawing, and then the student has to check up the result using the software environment GRAN-2D in case. The last stage is possible only when public observers express their opinions about the correct solution of the given task.

2. For technology “**Role playing**”

1) Select students for playing the roles of mathematical concepts and explaining their main idea and peculiarities as well:

- trapezium;
- proportion;
- symmetry.

2) Discuss the peculiarity of this technology, propose new mathematical roles.

Practical lesson 4.

Theme: “Technologies of debatable problems development”.

Kinds of students' activities:

- Technology “**Talk-show discussion**”

Students' instruction::

1. For technology “**Talk-show discussion**”:

Task: What method of solving linear equation is the most accurate.

1) Select 5 participants who are experts

2) Make up questions or tasks for experts and clarify the position in the given task.

3) Experts have to prepare extra information on the theme of discussion.

4) Form semi-circle round the experts.

2.2.18. Topics of individual and / or group tasks Unprovided

2.2.19. Tasks for independent work of students: Develop the fragment of the lesson using technologies of situational modelling and debatable problems development (Each student receives the topic of the school course of mathematics individually and, using the technologies of cooperative or collective and group teaching, develops a fragment of the lesson).

Table 2.2.6. Criteria for evaluating students' independent work

Evaluation criteria	High level (9-10 points)	Intermediate level (7-8 points)	Low level (1-6 points)
Ability to develop lessons using technologies of situational modelling and debatable problems development	a task is done accurately: the student developed the fragment of the lesson on the specified topic, selected the effective technology independently and substantiated the selection.	a task is done but with insignificant inaccuracy: the student developed the fragment of the lesson on the specified topic, made slight mistakes, selected the technology independently (but not always effective).	a task is partly done or with rude mistakes: the student developed the fragment of the lesson on the specified topic, made rude mistakes, selected ineffective technology independently.

2.2.20. Methodical materials and instructions (if needed)

Lecture compendium and its presentation №4 are available on: <https://moodle.dls.udpu.edu.ua/course/view.php?id=4811>. Password: 123456.

2.3. Content module 3. Information and communication technologies

2.3.1. **Theme 1. Implementation of e-learning elements to form a creative personality.**

2.3.2. Theme and anticipated outcomes

Objective: to reveal the basic features, peculiarities and instruments of e-learning, to develop skills to use and implement its elements in the educational process to form a creative personality.

Anticipated outcomes:

- 1) To be able to use traditional and innovative methods as well as elements of methods of teaching mathematics in institutions of secondary general education (GC 1, GC 2, PsC 4).
- 2) To show knowledge of factual educational material from the school course of mathematics and be able to use the updated methods of its teaching (GC 2, PsC 1, PsC 3).
- 3) To plan educational process, to define and substantiate pedagogical tasks; to select the set of effective systems and innovative educational technologies for solving complicated specific tasks and practical problems in the field of professional development (PsC 3, PsC 4).
- 4) To be able to use innovative technologies for solving complicated specific tasks and practical problems in future professional work that are characterized by completeness and conditions uncertainty (PsC 1, PsC 2, PsC 4).
- 5) To be able to form and develop school learners' mathematical and digital competence (GC 1, GC 2).
- 6) To demonstrate the ability to account responsibility for decision making in the sphere of their competence with unpredictable professional and educational contexts (GC 2, PsC 4).

2.3.3. Criteria and forms of learning outcomes evaluation on the topic (*formative and summative evaluation*).

Table 2.3.1. Criteria for evaluating learning outcomes

Evaluation criteria	Quantitative and / or qualitative characteristics
To know the basic features and peculiarities of e-learning	<p>High level (4 points) – the student understands the basic features and peculiarities of e-learning, independently identifies its conceptual educational principles, determines effective means used in e-learning as well as forms of monitoring students performance in e-learning.</p> <p>Intermediate level (3 points) – the student partly understands the basic features and peculiarities of e-learning: identifies its conceptual educational principles, determines effective means used in e-learning as well as forms of monitoring students performance in e-learning.</p>

	<p>Low level (1-2 points) – the student partly understands the basic features and peculiarities of e-learning with the help of a lecturer: identifies its conceptual educational principles, determines effective means used in e-learning as well as forms of monitoring students performance in e-learning.</p>
<p>Ability to develop the fragment of the lesson using the technology of “flipped learning” independently.</p>	<p>High level (5 points) – the student independently: forms expected learning outcomes on the topic due to Bloom’s taxonomy using the technology of “flipped learning”, develops the lesson planning using this technology, distinguishes formative and summative evaluation.</p> <p>Intermediate level (3-4 points) – the student partly: forms expected learning outcomes on the topic due to Bloom’s taxonomy using the technology of “flipped learning”, develops the lesson planning using this technology, distinguishes formative and summative evaluation.</p> <p>Low level (1-2 points) – the student with the help of a lecturer: forms expected learning outcomes on the topic due to Bloom’s taxonomy using the technology of “flipped learning”, develops the lesson planning using this technology, distinguishes formative and summative evaluation.</p>
<p>Ability to use current and newly created educational courses using the Go-Lab system.</p>	<p>High level (5 points) – the student independently selects effective dedicated tools and inquiry learning apps in the Go-Lab Ecosystem for using current educational courses as well as creating new ones.</p> <p>Intermediate level (3-4 points) – the student partly selects effective dedicated tools and inquiry learning apps in the Go-Lab Ecosystem for using current educational courses as</p>

	<p>well as creating new ones. Low level (1-2 points) – the student with the help of a lecturer selects effective dedicated tools and inquiry learning apps in the Go-Lab Ecosystem for using current educational courses as well as creating new ones.</p>
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Forms of learning outcomes evaluation: creative work presentation and its defence (presentation of results of students' work, discussion), summative evaluation of students' tasks done in practical sessions and independently.

2.3.4. Digital tools

Electronic educational course (EEC) on Moodle platform, instruments for searching information on the Internet, online documents, Google Drive, dedicated tools of Go-Lab platform, tools for designing the infographic Canva, PowToon, tools for searching educational video (YouTube) and its editing (Video Editor).

2.3.5. Innovative educational technologies

Critical thinking development technologies (brainstorming, circle of ideas), technology of research-based learning, technology of integrative learning, mobile technologies in education, technology of “flipped learning”, blended learning, technology of distance learning.

Innovative classroom spaces: study area, research area, creative area and student's personal space area.

2.3.6. **Lecture 5-6. Implementation of e-learning elements to form a creative personality.**

Objective: *to reveal the basic features, peculiarities and instruments of e-learning, to develop creativity and innovation of future teachers of Mathematics under the conditions of using e-learning, to form skills to implement e-learning elements in the educational process in institutions of secondary general education.*

Plan:

1. Basic features and peculiarities of e-learning.
2. Means of e-learning to form a creative personality.
3. Peculiarities of the use of “flipped learning” as a variation of e-learning technology.
4. Research-based learning in the Go-Lab system.

2.3.7. Seminar / practical / laboratory lesson 1. (a brief summary, to indicate methods and criteria for evaluation in case of different kinds of student's activities).

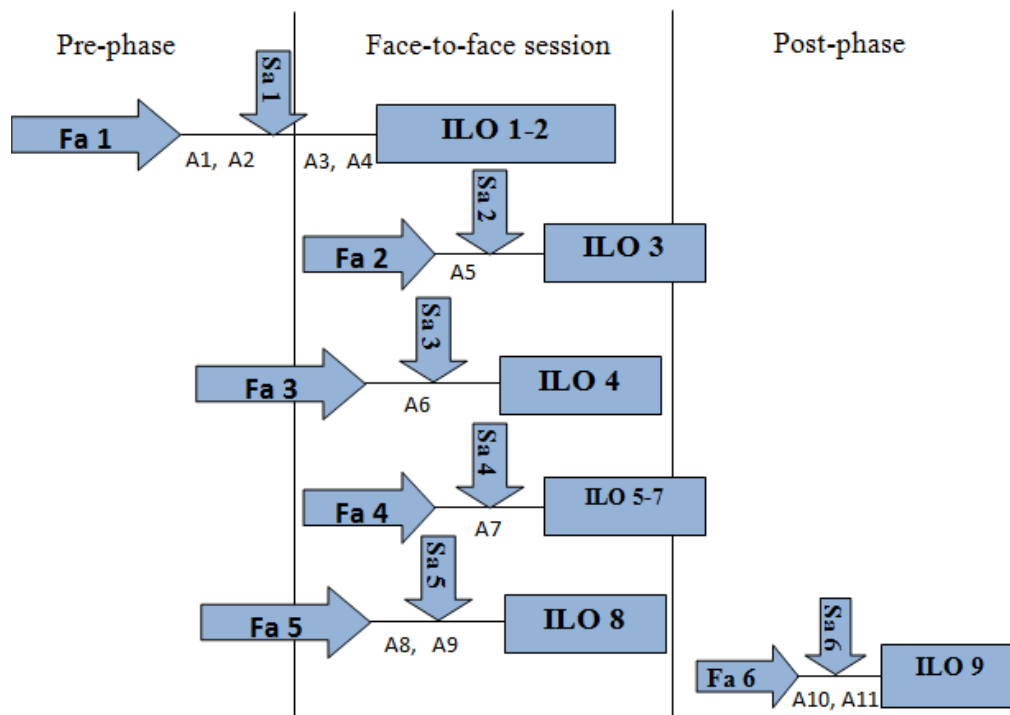
Practical lesson 5.

Theme: “Technology of flipped learning”.

Kinds of students' activities:

- Technology of **“flipped learning”**

The use of “flipped learning” technology on the topic “Interesting world of functions around us”. A scheme for technology:



The scheme is described below:

Formative Assessment (Fa) – formative evaluation of student outcomes.

Summative Assessment (Sa) – evaluation of student learning at the end of an instructional unit.

Pre-phase – work that was done before the lesson.

Face-to-face session – work with each other in the lesson.

Post-phase – work that was done after the lesson.

ILO (intended learning outcomes).

FA 1: by using Moodle system, students work with educational material (video, photo-materials, presentations, etc.), they discuss and share their impressions using the forum (ILO 1-2).

SA1: the use of collaborative online white board, evaluation by a lecturer (frontal quiz, express questioning, online tests, etc.).

FA2: group work (ILO 3)

SA2: students mutual evaluation

FA 3: student's project development and presentation (ILO 4)

SA 3: students self-evaluation, students mutual evaluation, evaluation by a lecturer.

FA 4: individual and cooperative tasks accomplishment (ILO 5-7)

SA 4: evaluation by a lecturer

FA 5: watching a video (ILO 8)

SA 5: general discussion, answers evaluation by a lecturer

FA 6: doing home individual tasks and presenting their results on MOODLE platform (ILO 9)

SA 6: general discussion on MOODLE

FA 7: finished project presentation (ILO 10)

SA 7: mutual evaluation and evaluation by a lecturer as well

Students' instruction:

Pre-phase

ILO 1-2:

- 1) watching a video about types of functions and their characteristics;
- 2) discussing controversial questions set by a lecturer on the topic forum.

Face-to-face session

ILO 1-2:

- 3) Frontal quiz for students based on individually learnt educational material

(3-5 min)

- 4) gaps removal (presentation of theoretical material)

(7-10 min)

ILO 3:

- 5) Pair work for doing tasks with completed figures in order to define:

- 1) type of a function;
- 2) types of performed elementary function transformations in general;
- 3) analytical item of a function presented in a figure;
- 4) characteristics of the specific function.

(10-15 min)

ILO 4:

- 6) Students division into groups for researching functions in use as well as their graphs in the environment (a mini-project "World of functions around us"):

- 1) in medicine;
- 2) in architecture;
- 3) in nature;
- 4) in science. *(10-15 min)*

ILO 5-7:

- 7) individual and cooperative tasks accomplishment aimed at:
- 1) drawing the graph of the function specified analytically in a standard form
 - 2) the easiest transformations of elementary functions graphs
 - 3) defining the type of a function using the specified graph
- (10-15 min)

ILO 8:

- 8) students watch a video proposed by a lecturer, in the video there are some samples of function graphs in the environment
(2-3 min)
- 9) Presentation of mini-project results “World of functions around us”.
(13-17 min)

Post-phase:

ILO 9:

- 10) develop the fragment of a lesson aimed at defining types of functions with the compulsory use of the information obtained while a mini-project has been carried out:
- 1) the 7th grade
 - 2) the 8th grade
 - 3) the 9th grade
- 11) upload the developed fragments of the lessons on Moodle for general discussion.

Practical lesson 6.

Theme: “Research-based learning. Work in the Go-Lab System”.

Kinds of students’ activities:

- Work in the Go-lab System

Students’ instruction:

- 1) Enter the Go-Lab System
- 2) Study in the developed online laboratories and spaces in the Go-Lab system.
- 3) Log in on Graasp.
- 4) Cooperate in groups of 4-5 students
- 5) In a group develop an inquiry learning space (ILS) on Graasp on topics of the school course of mathematics
- 6) Presentation of the developed educational space by each group.
- 7) Discuss presented ILS

2.3.8. Topics of individual and / or group tasks *Unprovided*

2.3.9. Tasks for independent work of students:

Task 1: Develop the lesson using the technology of “flipped learning” on one of the topics of the school course of mathematics

Task 2: Develop own ILS on the selected topic of the school course of

mathematics individually in the Go-Lab System.

Table 2.3.1. Criteria for evaluating students' independent work (total evaluation for two creative works performing)

Evaluation criteria	High level (9-10 points)	Intermediate level (7-8 points)	Low level (1-6 points)
<i>Ability to develop lessons using the technology of "flipped learning" and inquiry learning spaces in the Go-lab System</i>	<i>a task is done accurately: the student developed the lesson using the technology of "flipped learning" and inquiry learning spaces in the Go-lab System</i>	<i>a task is done but with insignificant inaccuracy : the student developed the lesson using the technology of "flipped learning" and inquiry learning spaces in the Go-lab System making some insignificant inaccuracy</i>	<i>a task is partly done or with rude mistakes: the student developed the lesson with the help of the lecturer using the technology of "flipped learning" and inquiry learning spaces in the Go-lab System</i>

2.3.10. Methodical materials and instructions (if needed)

Lecture compendium and its presentation №5-6 are available on:

<https://moodle.dls.udpu.edu.ua/course/view.php?id=4811>. Password: 123456.

2.3.11. **Theme 2. Mobile and cloud technologies in teaching Mathematics for school learners.**

2.3.12. Theme and anticipated outcomes

Objective – *to introduce students to the specific features of the use of mobile and cloud technologies, to develop skills to use these technologies aimed at organizing Mathematics educational process for solving specific tasks that are characterized by comprehensiveness and uncertainty of conditions.*

Anticipated outcomes:

- 1) To know traditional and innovative Mathematics teaching methods and modes in institutions of secondary general education (GC 1, GC 2, PsC 2, PsC 3, PsC 4).
- 2) To demonstrate fundamental knowledge of actual material of Mathematics school course and be able to use its current teaching methodology (PsC 1, PsC 2, PsC 3).
- 3) To use innovative technologies in order to solve complicated specific tasks and practical problems in the would-be professional activity that are known to be with complex and uncertain conditions (GC 2, PsC 2, PsC 4).
- 4) To demonstrate the ability to form and develop school learners' mathematical and digital competence (PsC 2, PsC 4).
- 5) To demonstrate the ability to detect psychological and pedagogical specific features of school learners learning of educational information, the development of their skills in order to reveal, predict effective and corrective Mathematics pedagogical process in institutions of secondary general education (PsC 1, PsC 3).

2.3.13. Criteria for evaluating learning outcomes on the topic (*formative and summative evaluation*)

Table 2.3.2. Criteria for evaluating learning outcomes

Evaluation criteria	Quantitative and / or qualitative characteristics
Ability to use mobile and cloud technologies in the Mathematics educational process, to plan professional activity, to select the set of effective systems and educational technologies.	<p>High level (4 points) – the student independently: selects the most effective mobile and cloud technologies due to specific topics; substantiates their selection; understands the content of these technologies and the educational objective of their use.</p> <p>Intermediate level (3 points) – the student partly selects the most effective mobile and cloud technologies due to specific topics but is not always able to substantiate their selection; understands the content of these technologies and the educational objective of their use.</p> <p>Low level (1-2 points) – the student with the help of a lecturer selects the</p>

	<p>most effective mobile and cloud technologies due to specific topics; partly understands the content of these technologies and the educational objective of their use.</p>
<p>Ability to form new educational products independently for school learners Mathematics learning using mobile and cloud technologies.</p>	<p>High level (9-10 points) – the student independently forms new educational products for Mathematics learning using mobile and cloud technologies.</p> <p>Intermediate level (7-8 points) – the student experiences some difficulties or makes some mistakes in forming new educational products for Mathematics learning using mobile and cloud technologies.</p> <p>Low level (1-6 points) – the student experiences difficulties and needs lecturer’s help in forming new educational products for Mathematics learning using mobile and cloud technologies.</p>

Forms of learning outcomes evaluation: creative work presentation and its defence (presentation of results of students’ work, discussion), summative evaluation of students’ tasks done in practical sessions and independently.

2.3.14. Digital tools

Online educational course (OEC) on Moodle platform, instruments for searching information on the Internet, online documents, Google Drive, tools for designing the infographic Canva, PowToon, tools for searching educational video (YouTube) and its editing (Video Editor), tools for formative evaluation Kahoot!, Mentimeter, Plichers.

2.3.15. Innovative educational technologies

Technologies of developing critical thinking (brainstorming, cobweb), technology of mobile learning, problem-based learning, blended learning, distance learning technologies.

Innovative classroom spaces: study area, creative area and student’s personal space area.

2.3.16. Lecturer 7-8. Mobile and cloud technologies of school learners Math teaching.

Objective: *to clarify the peculiarities of the use of mobile and cloud technologies, to teach to select effective mobile and cloud tools for determining the level of students learning performance*

Plan:

1. Mobile learning as a modern technology in the Mathematics education.
2. Peculiarities of monitoring students learning performance by the use of mobile tools.
3. Cloud technologies in the professional training of the future teachers of Mathematics.

2.3.17. Seminar / practical / laboratory lesson 1. (*a brief summary, to indicate methods and criteria for evaluation in case of different kinds of student's activities*).

Practical Lesson 7.

Theme: “Mobile technologies in Mathematics teaching”

Kinds of students' activities:

- Work with the programme Plichers;
- Work with the programme Kahoot;
- Work with QR codes and puzzles.

Students' instruction:

1. For the activity “work with the programme **Plichers**”:
 - 1) Doing the test with the help of mobile devices on the topic: “Solid of revolution”.
 - 2) Independent tests forming on selected topic of the school course of mathematics by using this programme.
 - 3) Group work on mutual examination of the formed tasks.
2. For the activity “work with the programme **Kahoot**”:
 - 1) Students do quizzes and tests in this programme using the mobile devices.
 - 2) Independent tests forming on selected topic of the school course of mathematics by using this programme.
 - 3) Group work on mutual examination of the formed tasks.
3. For the activity “work with **QR codes and puzzles**”:
 - 1) Every student gets QR code, and after decoding it the student gets the personal task of mathematics puzzle.
 - 2) Forming Mathematics puzzles.
 - 3) Encoding QR code.

Practical task 8.

Theme: “Cloud technologies in Mathematics teaching”.

Kinds of students' activities:

- Making Internet-inquiry on topic of the school course of Mathematics by using tools of cloud technologies

- Preparing Google-presentation on topics of the school course of Mathematics
- Preparing presentation on topics of the school course of Mathematics with the help of cloud service Prezi.com.

Students' instruction:

1. For the activity **“Making Internet-inquiry on topics of schools course by using tools of cloud technologies”**
 - 1) Select the topic of the school course of Mathematics for developing an inquiry.
 - 2) It is necessarily to enter Google Drive for making an inquiry. It is necessarily to select “Google Forms” on the menu “Create”. The completed template of the inquiry will be downloaded at once.
 - 3) To study new resources of Forms press “Show”, if there is no necessity – press “No, thank you”. While making inquiry by means of Google Forms, it is necessarily to indicate:
 - 1) name of form;
 - 2) description of inquiry – if needed;
 - 3) make up questions.
 - 4) Before making up questions, it is recommended to define proper settings. Settings are divided into general, presentation, and test.
 - 5) The following general settings can be arranged: - if it is necessarily to gather e-mails, - if you need the only answer, - if the participants can edit answers after e-mailing, - if the user can see final diagrams and answers. For saving arrangements – press “Save”, for cancelling arrangements – “Cancel”. The following settings can be defined in “Presentation”: display the pane, mingle questions (it is good for tests), and if it is necessary to show reference for another application form.
 - 6) For inquiry evaluation, that means it was interpreted as a test, it is necessarily to arrange “Tests” in settings, as well as to display marks. Other settings are accessible after the aforementioned actions: in what a way to display marks – at once or after checking by hand, and what exactly the participant may see at the end: wrong answers, correct answers, quantity of points. Thus, for making the typical inquiry it is necessarily to cancel last settings and work with a form.
 - 7) Enter the text of the question in the pane "Untitled Question" and select the type of answer options using the button:
 - with short answers - the user enters a short answer himself or herself;
 - paragraph - the user enters a full answer himself or herself;
 - with answer options - the user selects one of the answers;

- checkboxes - the user selects several answers;
 - drop-down list – the user selects one answer from the drop-down list;
 - file upload - the user uploads the file;
 - linear scale - putting the grade according to the specified scale;
 - the table with possible answers- you are to select an answer in each row (you can additionally set or request for an answer in each row while selecting this option);
 - grid of checkboxes - select an answer in each line (you can additionally set or request for an answer in each line when selecting this option);
 - date;
 - time.
- 8) When all questions are created, you need to click the "Submit" button, which is located in the upper-right corner of the screen.
 - 9) After submitting the form, you need to process the answers received to the created questionnaire. To do this, move from the "Questions" tab to the "Answers" tab in the form window.
 - 10) As the answers are received, the answer page will change its form, where all the answers can be viewed as a whole or for each respondent separately. For more convenient viewing, you can click the button with the Excel icon of the document and all answers will automatically be entered in a Google spreadsheet, where you can work with all personal data much easier.
2. For the activity **«Creating a Google presentation on the topics of the school course of Mathematics»**
- 1) Select the topic of the school course of Mathematics that you will start creating your presentation with.
 - 2) To create a presentation, go to Google Drive and select Google presentation.
 - 3) Select a topic for your presentation in the column on the right (you can import your own topic). You can also change the topic by selecting the horizontal menu item Slide – Change Topic.
 - 4) To create a new slide, you can:
 - Press the combination of buttons Ctrl + M;
 - Click the + button in the top menu;
 - Run Insert - New slide.
 - 5) To insert a text field, select Insert – Text Field or click the button with the letter "T". Also, a text field is immediately created with the text located in the clipboard (Ctrl + C). Only 8 fonts are available for formatting the text.

- 6) The change of the size, color and background color, indentation, spacing, alignment, etc. is available.
 - 7) To insert an image, you need to run Insert - Image and download the desired file: from your computer, take a picture from a webcam, insert a URL, select from your GooglePhoto or GoogleDrive, or find the desired image in the search. You can also do this by clicking on the "Image" button.
 - 8) To insert a shape, run Insert – Shapes and select the desired shape type first from the list, and then the shape itself.
 - 9) You can change the transitions between slides as follows: Slide - Transition and select one of the suggested ones.
 - 10) All the manipulations with the presentation are saved automatically.
3. For the activity **“Creating a presentation in a cloud service Prezi.com on the topics of the school course of Mathematics”**
- 1) Choose a topic from the school course of Mathematics.
 - 2) To create a presentation, go to the site Prezi.com and log in to the "Log in" system by entering your username and password (if the user is not registered, first register by clicking "Sign up". Prezi cloud service login window. After logging in to this cloud service, all available presentations for this user are immediately displayed. You can edit them at any time.
 - 3) To create a new presentation in this service, select "New Prezi", and then a new tab will open for selecting the presentation template. After selecting a template, click the "Use template" button.
 - 4) To switch between slides, you can use the thumbnail images of slides that are located on the left side of the screen.
 - 5) To add a title or text, click on the appropriate place on the slide "Click to add Title". To enter the text anywhere else on the slide, you just need to double-click on the desired location on the slide.
 - 6) The text that we enter has the right to format: the size, color, outline of the font, as well as its placement.
 - 7) To add slides, click the "Frames & Arrows" button, select the view of the corresponding slide and mark the place in the presentation where this slide should be inserted. In this service there is also a possibility to add images, photos, music files, video files, and so on.
 - 8) To insert an image, select the menu item Image, "Select files" then in the window that opens select, and after that an additional window will open for selecting a file from the computer on which the user is working. After each action, the cloud service automatically saves the presentation.

- 9) To view the presentation, click the button, to edit the slide queue, their sequence and placement on the main slide – the "Edit Path" button.
- 10) You can download the finished presentation as a portable presentation, share a link to it, and so on, to do this, select the desired item on the "Share" menu.

2.3.18. Topics of individual and/or group tasks are not provided

2.3.19. Tasks for independent work of students:

Task 1: Develop Test tasks using mobile devices on the topics of the school course of Mathematics.

Task 2: Create an educational product for teaching a school Mathematics course using cloud technologies

Table 2.3.3. Criteria for evaluating students' independent work

Evaluation criteria	High level (9-10 points)	Intermediate level (7-8 points)	Low level (1-6 points)
<i>Ability to develop test tasks using mobile devices and create educational products for teaching Mathematics using mobile and cloud technologies</i>	<i>the task is completed correctly: the student independently develops test tasks using mobile devices and creates educational products for teaching Mathematics using mobile and cloud technologies</i>	<i>the task is completed, but some minor inaccuracies are allowed: the student develops test tasks using mobile devices and creates educational products for teaching Mathematics using mobile and cloud technologies, but doing some minor inaccuracies</i>	<i>the task was completed partially or with gross errors: the student, with the help of a teacher, develops test tasks using mobile devices and creates educational products for teaching Mathematics using mobile and cloud technologies</i>

2.3.20. Methodological materials and instructions *(if available)*

The summary and presentation of lectures №7-8 are available here: <https://moodle.dls.udpu.edu.ua/course/view.php?id=4811>. Login password: 123456.

2.4. Content Unit 4. Innovative approaches to STEM-education implementation.

2.4.1. Theme 1. Implementation of STEM-education elements in the conditions of current educational process.

2.4.2. Objectives and anticipated outcomes

Objectives: *to introduce students to innovative approaches to the implementation of STEM education, in particular making, case technology, to show the beauty and practical application of Mathematics in unity with art and making, to teach to use elements of making and create educational "cases" in the educational process in mathematics, to form the ability to model life situations, and those solutions that the case participant will find, to develop creativity, creative and research abilities, positive motivation for pedagogical activities.*

Anticipated outcomes:

- 1) Possess traditional and innovative methods and techniques of teaching Mathematics in institutions of general secondary education (GC 1, GC 2, PsC 2, PsC 4).
- 2) Demonstrate knowledge of the actual material of the school course of Mathematics and master the modern methodology of its teaching (PsC 2, PsC 3).
- 3) Illustrate the ability to form a communication strategy with all the participants of the educational process (PsC 4).
- 4) Possess the skills of self-education and professional self-improvement (GC 1, GC 2, PsC 2, PsC 3).

2.4.3. Criteria and forms for evaluating learning outcomes on the topic (*formative and sumative evaluation*).

Table 2.4.1. Criteria for evaluating learning outcomes

Evaluation criteria	Quantitative and/or qualitative characteristics
Knowledge and understanding of the content, purpose, advantages and difficulties of STEM education, innovative approaches to its implementation in the educational process in Mathematics.	High Level (4 points) – the student knows and understands the content and the aim of STEM-education, determines its advantages and difficulties, names and characterizes innovative approaches to its implementation into the educational process in Mathematics.
	Intermediate Level (3 points) – the student knows and partially

	<p>understands the content and the aim of STEM-education, determines its advantages and difficulties, names innovative approaches to its implementation into the educational process in Mathematics and is slightly inaccurate in their characterization.</p> <p>Low level (1-2 points)– the student knows and partially understands the content and the aim of STEM-education, experiences significant difficulties in determining its advantages and difficulties, names innovative approaches to its implementation into the educational process in Mathematics, but cannot characterize them.</p>
<p>Ability to independently implement elements of making and case technologies into the educational process in Mathematics.</p>	<p>High level (9-10 points) – the student is able to: plan the educational process using elements of making, case technologies, and is ready to form and develop students' mathematical competence.</p> <p>Intermediate level (7-8 points) – the student experiences minor difficulties in planning the educational process using elements of making, case technologies, and is partially ready to form and develop students' mathematical competence.</p> <p>Low level (1-6 points) – the student experiences significant difficulties in planning the educational process using elements of making, and is partially ready to form and develop students' mathematical competence.</p>

2.4.4. Digital tools

Visualization tools

2.4.5. Innovative Training Technologies

Technologies for developing critical thinking, problem-based learning technology, research learning technology.

Innovation class spaces: study, research, and creative areas.

2.4.6. **Lecture 9. Implementation of elements of STEM-education under the conditions of the modern educational process.**

Objectives: *to acquaint students with the main types of innovations and their essence, conceptual apparatus; to determine the role of innovative technologies in the educational process in institutions of general secondary education.*

Plan:

1. STEM-education: nature, am, advantages and difficulties.
2. Innovative approaches to implementing STEM education into the educational process in Mathematics.

2.4.7. Seminar/ practical / laboratory lesson 1. *(brief description, if there are different types of activities of the student, specify the methods and criteria for their evaluation)*

Practical lesson 9.

Topic: Making in teaching Mathematics.

Task 1 (work in groups).

- a) Build a dynamic model and demonstrate a certain property of geometric shapes:

Group 1. – “Tangent property to a circle”;

Group 2. – "Property of the angles of a quadrilateral described around a circle".

Materials: cardboard containers for making panels, colored cardboard, plain white A4 paper, folders for files from which you can cut out transparent and plastic details, stationery knife, scissors, PVA glue, brush, fishing line for pivoting fixing moving parts, small buttons for pivoting fixing moving parts that play the role of dots, a felt-tip pen, a marker.

- b) Solve the problem analytically and demonstrate it visually using a dynamic model.

Group 1. From this point M, two tangents are drawn to the circle. Prove that the tangent segments MP and MQ are equal.

Group 2. Prove that in a quadrilateral described around a circle, the sums of opposite sides are the same.

Algorithm for working on models

Group 1. – “Tangent property to a circle”

- 1) Make a cardboard panel.
- 2) Cover it with colored paper.
- 3) Attach a colored circle centered at Point O and two colored tangents KM and KN drawn to the circle from one point K to the cardboard model.
- 4) Cut out a plastic bar with the length equal to the length of the segments KM and KN. One end of which is pivotally attached to the panel at point K.

Group 2. – "Property of the angles of a quadrilateral described around a circle".

- 1) Make a cardboard panel.
- 2) Cover the panel with light paper.
- 3) Build a circle.
- 4) Use strips of colored paper to draw the described quadrilateral ABCD.
- 5) From thick cardboard of bright color (or plastic), cut out two slats that have the same dimensions as the dimensions of the strips that represent the opposite sides of the described quadrilateral.
- 6) Fix both ends of each of these slats pivotally at the corresponding vertices of the Quadrilateral and cut at the points of their contact with the circle.

Task 2 (work in groups).

- a) Choose a task from the school course of Stereometry.
- b) Create a dynamic polyhedron model from the provided materials, the use of which will help in solving the problem.

Materials: plain white A4 paper, colored paper, cardboard, foam sheet, elastic band, wooden sticks, stationery knife, thread, PVA glue, plasticine, etc..

- c) Solve the task analytically and demonstrate it visually using a dynamic model.

Task 3 (work in groups).

- a) Create combinations of shapes in 3-D printing programs for one of the school course of Mathematics tasks.
- b) Print the model on a 3-D printer.
- c) Indicate the possibilities and expediency of using the manufactured 3-D models when teaching Mathematics for school learners.

Practical lesson 10.

Topic: Case technology in teaching Mathematics.

Task 1 (work in groups).

a) Determine in which class and on which topic of the school course of Mathematics you should use the case technology for the given problem.
Group 1. In which of the banks of the city of Uman it is profitable to invest a deposit in the amount of 10 000 UAH for a period of 6 months. How to invest profitably: with interest capitalization (compound interest) or without interest capitalization (simple interest).

b) Prepare the case block "Information part", where students should get acquainted with the given information and, based on it, choose the most profitable investment of a deposit in a bank and justify their choice.

Instructions for students:

The case block "Information part" must contain:

- information about deposits;
- information about accrual of complex and simple interest;
- information about interest accrual in Oshchadbank, Avalbank, PrivatBank, Ukrsibbank in Uman;
- information about consumer credit;
- images - of percentages.

c) prepare the case block "Case tasks".

Group 2. Which of the cellular operators operating in the region and the tariff plan is the most profitable for usage.

b) prepare the case block "Information part", where students should get acquainted with the given information and, based on it, choose the most profitable operator for using and justify their choice.

Instructions for students:

The case block "Information part" must contain:

- information about what a "cellular operator" or "tariff plan" is;
- information about the operators operating in the region "Kyivstar", "Lifecell", "Vodafone", etc.;
- information about the tariff plans of each of the cellular operators "Kyivstar", "Lifecell", "Vodafone", etc.;
- images - labels of operators.

c) Prepare the case block "Case tasks".

2.4.8. Topics of individual and / or group tasks *are not provided*

2.4.9. Tasks for independent work of students:

Task 1.

a) Build a dynamic model: "Adjacent angles".

b) Select a problem from the school Geometry course and demonstrate the use of a dynamic model while solving it.

Instructions for students:

- 1) Stick the image of a student protractor on a sheet of colored paper of rectangular shape.
- 2) Stick a colored paper strip AB.

- 3) Cut out a slot along the segment AB.
- 4) Cut out a circle, the radius of which is selected according to the size of the radius of the protractor.
- 5) Stick two colored semicircles on it, dividing it in half.
- 6) Insert the circle into the section and align the center of the circle with the point O.
- 7) At point O, pivotally attach the circle with buttons and fishing line to the sheet of cardboard on which the protractor is stuck.

Task 2.

- a) Build a dynamic model: "Vertical angles".
- b) Select a problem from the school Geometry course and demonstrate the use of a dynamic model while solving it.

Instructions for students:

- 1) Make a cardboard panel.
- 2) Cover it with colored paper.
- 3) Stick two protractor scales on the panel.
- 4) Cut out a piece of colored paper slightly longer than the inner diameter of the protractor, the ends of which are pointed.
- 5) Stick the ends of this bar to the panel so that its edges are against the 0° and 180° divisions. The second bar, made of plastic, should be pivotally fixed in the center of the circle, so that it rotates freely around the attachment point.

Task 3. Using online tools, create educational puzzles in jpg format for using when studying the following topics of the school course of Mathematics:

- 1) "Function";
- 2) "Graphs of elementary functions";
- 3) "Geometric transformations of function graphs";
- 4) "Triangles";
- 5) "Quadrilaterals";
- 6) "Polyhedra".

Task 4. Create a "case" for one of the topics of the school course of Mathematics: a) formulate the problem; b) prepare the case block "Information Part"; c) prepare the case block "case tasks":

- "Division with remainder" (Grade 5);
- "Percentages" (Grade 5);
- "Arithmetic mean" (Grade 6);
- "Scale" (Grade 6);
- "Circle length and Circle area" (Grade 6);
- "Equation" (Grade 7);
- "Functional dependence between quantities as a mathematical model of real processes" (Grade 7);

- "Polygon areas" (Grade 8);
- "Solving problems using the Pythagorean theorem" (Grade 8).
Instructions for creating a "case":
- the educational problem should be connected with the material being studied;
- problems should have cognitive significance;
- problematic questions should be based on the previous experience and knowledge of students;
- the main content of the problem should give direction to cognitive search, indicate the direction to its solution.

Table 2.4.2. Criteria for evaluating students' independent work

Evaluation criteria	High level (9-10 points)	Intermediate level (7-8 points)	Low level (1-6 points)
Ability to create training tools and educational "cases" on school Mathematics course and use them in the educational process	<p><i>the task was completed correctly;</i></p> <p><i>the student created a dynamic model, independently selected an appropriate task from the school Mathematics course, using the example of which he demonstrated the possibilities and effectiveness of using the model;</i></p> <p><i>the student independently formulated a problem to one</i></p>	<p><i>the task was completed, but the student experienced some difficulties and needed the teacher's help:</i></p> <p><i>the student created a dynamic model, independently selected a problem from the school course of Mathematics, using the example of which he demonstrated the possibilities and effectiveness of using the model, doing</i></p>	<p><i>the task is partially completed:</i></p> <p><i>the student created a dynamic model, but did not select an appropriate task from the school course of Mathematics, which can be used to demonstrate the possibilities and effectiveness of using the model;</i></p> <p><i>the student, with the help of a teacher, formulated a problem to one of the topics of the school course of</i></p>

	<p>of the topics of the school course of Mathematics, using the example of which he demonstrated the content of such blocks of the educational case as "Information part" and "Case tasks".</p>	<p>some minor inaccuracies; created formulated a problem to one of the topics of the school course of Mathematics on the example of which he demonstrated the content of such blocks of the educational case as the "Information part" and "Case tasks".</p>	<p>Mathematics, using the example of which he demonstrated partially (or one of) the content of such blocks of the educational case as the "Information part" and "Case tasks".</p>
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2.4.10. Methodological materials and instructions (if available)
The summary and presentation of lecture №9 are available *here*:
<https://moodle.dls.udpu.edu.ua/course/view.php?id=4811>. Login
password: 123456.

2.4.11. **Theme 2. Project technology as an element of innovative pedagogical technologies**

2.4.12. Objectives and anticipated outcomes

Objectives: *to introduce students to project technology as one of the varieties of innovative pedagogical technologies for teaching students mathematics, to form students' practical skills in planning and developing educational projects, to develop creative abilities, activity, independence, creativity, flexibility of students' thinking.*

Anticipated outcomes:

1. Apply innovative technologies for organizing educational and cognitive activities (PsC 4).
2. Be aware of the techniques of collecting, systematizing, summarizing and using information, methods of analyzing and processing information and use these results in professional activities (GC1-2, PsC 1, PsC 4).
3. Show readiness to form and develop mathematical and digital competence of students (GC2, PsC 2).

4. Keep to ethical standards, form a communication strategy with all participants of the educational process (PsC 1).

2.4.13. Criteria and forms for evaluating learning outcomes on topic (formative and sumative evaluation).

Table 2.4.3. Criteria for evaluating learning outcomes

Evaluation criteria	Quantitative and/or qualitative characteristics
<p>Knowledge and understanding of theoretical aspects of creating and applying project technology in the process of teaching students Mathematics</p>	<p>High Level (4 points) – the student knows and understands the content, aim and significance of project technology in teaching students Mathematics, is aware of the necessary conceptual apparatus, knows the features of organizing project activities in the educational process in Mathematics.</p> <p>Intermediate Level (3 points) – the student partially knows and understands the content, aim and significance of project technology in teaching students Mathematics, is aware of the necessary conceptual apparatus, does minor inaccuracies in revealing the features of organizing project activities in the educational process in Mathematics.</p> <p>Low level (1-2 points) – the student partially knows and understands the content, aim and significance of project technology in teaching students Mathematics, is not aware of the necessary conceptual apparatus, and cannot characterize the features of organizing project activities in the educational process in Mathematics.</p>
<p>Ability to independently plan the educational process in Mathematics using project</p>	<p>High Level (5 points) – the student independently determines the topics from school Mathematics course,</p>

<p>technology, independently develop educational projects in Mathematics for students.</p>	<p>while study of which it is advisable to use project technology, is ready to form and develop Mathematical and digital competence of students during project activities in Mathematics.</p> <p>Intermediate level (3-4 points) – the student experiences minor difficulties in determining the topics from school Mathematics course, while study of which it is advisable to use project technology, and is ready to form and develop the mathematical competence of students.</p> <p>Low level (1-2 points) – the student experiences significant difficulties in determining the topics from school Mathematics course, while study of which it is advisable to use project technology, and is partially ready to form and develop students' mathematical competence.</p>
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2.4.14. Digital tools

Tools for work: in a network environment; with electronic documents; with mobile devices for learning; with visualization tools.

2.4.15. Innovative Training Technologies

Technologies for the development of critical thinking, problem-based learning technology, research learning technology.

Innovation class spaces: study, research, and creative areas.

2.4.16. Lecture 10. Project technology as a type of innovative pedagogical technologies.

Objectives: *to introduce students to project technology as one of the varieties of innovative pedagogical technologies for teaching students Mathematics, to form students' practical skills in planning and developing educational projects, to develop creative abilities, activity, independence, creativity, flexibility of students' thinking.*

Plan:

1. Project method: historical aspect.
2. Types of training projects.
3. Peculiarities of organizing project activities in teaching students Mathematics.

2.4.17. Seminar/ practical/ laboratory lesson 1. *(brief description, if there are different types of activities of the student, specify the methods and criteria for their evaluation)*

Practical lesson 11-12.

Topic: Project technology as a type of innovative pedagogical technologies in teaching Mathematics.

Task 1. (Work in groups).

Think of the topic of an educational project from the school course of Mathematics and justify its appropriateness.

Group 1. Mathematics Grades 5-6.

Group 2. Algebra Grades 7-9.

Task 2 (work in groups). Create a methodological passport of an educational project on the selected topic, based on the program requirements for the knowledge, skills and abilities of students in Mathematics of a general secondary education institution.

Instructions for students № 1:

The project passport must contain the following components:

- 1) project name;
- 2) project type;
- 3) academic subjects, knowledge of which will be needed to solve the project task;
- 4) grade;
- 5) main issues of the project-key, thematic, content;
- 6) project objectives (practical, developmental ,educational);
- 7) anticipated outcomes of the educational project (a list of knowledge, skills and abilities that students will have upon completion of the project);
- 8) input knowledge and skills that students need to successfully complete project tasks; tasks for small groups that students must complete while working on the project;
- 9) research tasks for each small group; expected final product of project activities;
- 10) form of presentation of the final product.

Instructions for students №2:

1. The main issues of the project have to:
 - reflect the main concept of the training topic;
 - lead to the core, essence(s) of the academic subject;
 - appear again and again during the study of the topic;
 - not to have an obvious, "correct" answer;

- be formulated in such a way as to provoke the interest of school learners.
- 2. The main issues of the project are needed so that:
 - to promote the development of high-level thinking skills;
 - student projects were creative and real;
 - we could focus students' attention on the main important issues.
- 3. Key questions should be broad-based, be connected between academic subjects, between individual lesson topics;
- 4. Thematic questions should be connected with a specific topic of the lesson, support, specify, and deepen key ones.

Task 3. Create a teacher's input presentation for a training project in the school course of Mathematics (the topic of which was defined and developed by the methodological passport in practical lesson № 11), using tools for creating infographics Canva, PowToon, tools for searching for an educational video (YouTube) and editing it (Video Editor).

Instructions for students:

The components of a presentation can be as follows:

- project abstract;
 - project plan and requirements (terms of project implementation; photos of students in those classes who have already worked on the project; resources that students can use; various recommendations for students; forms and evaluation criteria);
 - a brief overview of a new idea, concept, or topic;
 - description of daily activities or the process before the project is implemented;
 - links to relevant websites and their descriptions;
 - a description of the project, which indicates the purpose of its creation, lists the materials used, and tells about the activities of students;
 - selection of illustrations, computer graphics;
 - photos, drawings, animations;
 - list of information sources.
- 2.4.18. Topics of individual and / or group tasks are not provided
- 2.4.19. Tasks for independent work of students:
- Tasks. Develop an educational project for one of the topics of the school course of Mathematics: a) think of the topic individually; b) create a passport of the educational project for the selected topic; C) create an incoming teacher's presentation using the tools for creating infographics Canva, PowToon, tools for searching the educational video (YouTube) and editing it (Video Editor).
- Evaluation methods: creative work (students' presentation of the results of their activity, discussion).

Table 2.4.4. Criteria for evaluating students' independent work

Evaluation criteria	High level (5 points)	Intermediate level (3-4 points)	Low level (1-2 points)
<i>Ability to independently develop educational projects in Mathematics for students</i>	<i>the task was completed completely: the student independently selected the topic from the school course of Mathematics; developed the passport of the educational project; created the input presentation</i>	<i>the task was completed, but some minor inaccuracies were made: the student independently selected the topic from the school course of Mathematics; developed the passport of the educational project, but made some minor mistakes; created the input presentation.</i>	<i>the task was completed partially or with gross errors: the student independently selected the topic from the school course of Mathematics; partially developed the passport of the educational project/developed the passport of the educational project, but made gross mistakes; did not create the input presentation/partially created the input presentation.</i>

2.4.20. Methodological materials and instructions (if available)

The summary and presentation of lecture №10 are available *here*:
<https://moodle.dls.udpu.edu.ua/course/view.php?id=4811>. Login
password: 123456.

3. Tasks for final control

3.1. List of questions for final control.

1. Describe the history of the concept of “innovation” in education.
2. Describe the concepts of “innovation”, “novation”, “novelty”. What are the views in pedagogical science on the interrelation of these concepts?
3. Reveal the essence of innovative processes in education, their basis and components.
4. Name the types of innovations in education. Illustrate them with examples of innovation in Mathematics education.
5. Characterize the peculiarities of interactive learning.

6. Formulate the aim of interactive learning.
7. Name the features of interactive learning.
8. Identify the benefits of interactive learning.
9. Name the scientists who researched an interactive learning
10. Name the classification criteria for interactive learning technologies.
11. Give a description of the classification of interactive learning technologies according to O.I. Pometun, L.V. Pyrozhenko
12. Reveal the essence, aim and objectives of implementing STEM-education in the educational process in Mathematics.
13. Characterize the STEM-education model.
14. Characterize the levels of implementating STEM-education in Ukraine.
15. Characterize innovative approaches to implementing STEM-education in the educational process in Mathematics. Illustrate them with the specific examples from the school course of Mathematics.
16. Reveal the historical aspects of appearing project-based learning technology.
17. Characterize the levels of implementating STEM-education in Ukraine.
18. Characterize innovative approaches to implementing STEM-education in the educational process in Mathematics. Illustrate them with the specific examples from the school course of Mathematics.
19. Give the definition of e-learning.
20. Name the specific quality properties of e-learning.
21. Name the elements of the e-learning system.
22. What are the advantages and disadvantages of e-learning.

3.2. Test tasks (if available).

3.3. Additional creative tasks:

- 1) Carry out a comparative analysis of traditional and innovative training
- 2) Carry out systematization of innovative training in accordance with the forms of Organization of the educational process in epy general secondary education institution.

3.4. Procedure for conducting final certification

The percentage of the total number of points was reallocated. 15% were allocated for the final control and criteria for its evaluation were developed.

Distribution of points that students get

Module I	Total	Exam
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C.M. 1	C.M.2	C.M.3	C.M.4		
T.1	T. 1-3	T. 1-2	T. 1-2		
3	31	28	23	85	15

C.M. – content modules

T.1, T.2 – topics of content modules

Approximate evaluation of various types of educational activities of students (in points)

Types of activities	Points* quantity
tasks completed by the student in practical classes	2*12
doing independent work	3*2
doing independent creative work	5*11
Total	85
Exam	15
Total	100

4. List of recommended literature

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