

**MoPED: Modernization of Pedagogical Higher Education by Innovative
Teaching Instruments**

586098-EPP-1-2017-1-UA-EPPKA2-CBHE-JP

HANDBOOK

TITLE OF THE COURSE: Digital tools in lecturer's educational activities

SPECIALITY - «013 Primary education»,

HIGHER EDUCATION DEGREE: *Master*

Developers: Ph.D. in Pedagogical Sciences, Professor, Dean of the Faculty of Education **Ihnatenko Nataliia**, Ph.D. in Pedagogical Sciences, Associate Professor, Head of Department of International Relation **Kovtun Oksana**, Ph.D. in Historical Sciences, Associate Professor of the Department of Mathematics, Informatics and Learning Methods, Senior Lecturer of the Department of Pedagogy, Theory and Methods of Primary Education **Vasenko Oleksandr**

Higher Education Institution: SHEI “Pereiaslav-Khmelnytskyi Hryhorii Skovoroda State Pedagogical University”

Faculty: pedagogical

2019

The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



This work is licensed under a Creative Commons Attribution-NonCommercial- ShareAlike 4.0 International License (<https://creativecommons.org/licenses/by-nc-sa/4.0/>).

Abstract of academic discipline: (up to 200-250 words)

Theoretical issues of integrating the latest information digital tools into the educational process of training future teachers are considered within the discipline. In the course of training, students will receive knowledge and practical skills as far as possible to integrate digital tools in the educational process, in particular in the field of implementation of modern innovative pedagogical technologies of education (blended learning, problem learning, upside-down training, experiential learning, etc.) and STEAM-education, etc. The curriculum of the academic discipline is based on the competency approach, implementation of interdisciplinary links and continuity in learning according to the requirements of Nush and standards of higher education in Ukraine. Performance of problems of discipline allows to form an electronic portfolio of the teacher which will include own author's works realized on the basis of the previous kinds of educational activity.

Keywords: (7-10 words)

Digital tools, cloud technology, STEAM education, information and communication technologies, virtual laboratory, research environment, educational environment.

Content

1. Description of academic discipline

1.1 The scope of the discipline in ECTS credits and its distribution in hours according to the forms of educational process organization and types of classes

3,0 ECTS credits.

Quantity of content modules – 3

For daytime form: 6 hours of lectures, 24 hours of practical classes, 60 hours of independent work.

1.1. For part-time course : 4 hours of lectures, 6 hours of practical classes, 80 hours of independent work.

1.2. Language of study

Ukrainian

1.3. 1.3. Internet address of permanent placement of educational content of the discipline

<https://sites.google.com/view/digitaltools6>

1.4. Developer(s), working group(s)

Coordinator: Ph.D. in Pedagogical Sciences, Professor, Dean of the Faculty of Education
Ihnatenko Nataliia

Workgroup:

Ph.D. in Pedagogical Sciences, Associate Professor, Head of Department of International
Relation Kovtun Oksana

Ph.D. in Historical Sciences, Associate Professor of the Department of Mathematics,
Informatics and Learning Methods, Senior Lecturer of the Department of Pedagogy,
Theory and Methods of Primary Education Vasenko Oleksandr

1.5. The purpose of studying the discipline

The purpose of teaching discipline is to form a holistic view of the role and place of modern digital technology in the scientific and scientific-pedagogical activities of the teacher. Introduction of future teachers to modern information and communication technologies as a part of the educational process and their practical application in the realization of STEAM-education and the latest teaching approaches. Development of communication skills designed to increase the professional efficiency of future teachers in an open educational process.

1.5. Program competences which are formed in the course of the discipline study

Integral competence (IC) Ability to solve complex specialized tasks and practical problems in professional and pedagogical activities, which provide applications of theoretical provisions and pedagogical methods, psychology and individual teaching methods, particularly English language teaching methods are characterized by complexity and uncertainty in the conditions.

General competence (GC) 1. General education. Ability to learn and gain modern knowledge, in particular, innovative methodological approaches, modern systems, methods, technologies of education, development and upbringing of the young generation; effective normative support of education, etc.

GC 12. Information and communication. Ability to use modern means of information and computer technologies to solve communicative tasks in professional activity and in everyday life. Possession of modern information and communication technologies. Ability to use printed and electronic information sources, to process various types of information, to process it in accordance with the goals and objectives of the educational process.

GC 13. Scientific research. Production of research and innovation activities. Possession of modern methods of scientific research in the field of education. Ability to select, analyze, systematize and synthesize factual material. Formulate the innovation of scientific research.

Professional (Special) Competencies (PSC) 1. Ability to apply knowledge, skills and experience from the cycle of professional-scientific disciplines, is the theoretical basis for the construction of

the content of educational areas defined by the State Standard, to realize their implementation in the educational sector as a whole, and individual content lines in particular.

PSC 4. Organization of pedagogical and scientific-pedagogical activities in primary and higher education institutions.

1.6. Discipline results

Knowledge PKR1. Knowledge of the essence of learning and education processes in higher education, their psychological and pedagogical foundations. Knowledge of English.

PKR 2. Knowledge of the main legal documents concerning the educational system, rights and obligations of subjects of the educational process (teachers, leaders, students).

PKR 3. Knowledge of methods of forming skills of independent work and development of creative abilities and logical thinking of a person.

PKR 4. Knowledge of the basics of applying elements of theoretical and experimental research in professional activity.

Ability PRA 1. The ability to use critical worldview theories and absorbed theoretical knowledge in solving social and professional problems, to choose and use appropriate training tools to build learning technologies.

PRA 2. The ability to organize students' learning activities, manage their activities and evaluate their results.

PRA 3. Critical thinking skills, ability to socialize, analyze and synthesize in professional activities. Express ideas in English.

PRA 4. Accounting in pedagogical activity of individual features of students, including age and psychological ability to carry out pedagogical accompaniment of process of professionalization of students.

PRA 5. Possession of methods of scientific and pedagogical research, skills of conducting diagnostic measurements in individual development.

PRA 6. The ability to plan, design, construct, organize and analyze teaching activities.

Communication PCR 1. Ability to establish social-psychological communicative contact, individually oriented interaction that provides creative character of the learning process and high level of learning material.

PCR 2. The ability to present conclusions, knowledge and rationale to those who are learning.

PCR 3. The ability to form an ethical communication strategy with the subjects of interaction, to apply democratic technologies of collective decision-making, to take interests and needs of others into account, to use effective communication strategies depending on the situation.

Privacy and responsibility PAR 1. Be willing to make decisions under difficult and unpredictable conditions, which requires new approaches and predictions.

PAR 2. To determine the level of personal and professional development, to model the trajectory of personal self-improvement, to demonstrate the ability how to self-organize professional activity.

PAR 3. Show responsibility for the development of professional knowledge and practices, evaluation of strategic development of the team and group.

PAR 4. The ability to learn independently and autonomously throughout life.

1.8. Students' Knowledge Control

Means of diagnosing learning outcomes (current and final assessment) Current and final assessment

Final evaluation Final evaluation is conducted in the form of computer testing after the completion of the discipline which includes 30 questions.

Communication and feedback.

Students have access to all course materials. Students can consult with the instructor as well as their classmates through a forum attached to the electronic resource of the discipline.

Evaluation scale

Sum of points for all educational activities	ECTS evaluation	National scale score	
		For an exam, a project (work), practice	For credit
90 – 100	A	Excellent	Counted
82-89	B	Good	
74-81	C		
64-73	D	Fine	
60-63	E		
35-59	FX	Not good with possibility of rewriting	Not counted, with possibility of rewriting.
0-34	F	Not good with mandatory repetition of discipline	Not counted, with mandatory repetition of discipline.

2. Content and structure of the academic discipline

Names of modules and themes	Number of hours											
	full-time form						part-time form					
	total	including					total	including				
	L.	P.	La b.	Ind .	I. W.		L.	P.	La b.	Ind .	I. W.	
1	2	3	4	5	6	7	8	9	10	11	12	13
Module 1												
Substantial module 1. Digital tools and the introduction of web technologies in the teaching profession												
Theme 1. General writing, communication and messaging tools	16	2	4			10	11	2	1			8
Theme 2. Data collection and forming assessment tools	14		4			10	9		1			8
total	30	2	8			20	20	2	2			16
Substantial module 2. Creating an educational space for students with the help of digital tools												

Theme 1. Content Management Systems	16	2	4			10	11		1			10
Theme 2. Learning Management Systems	22		6			16	13		1			12
total	38	2	10			26	24		2			22
Substantial module 3. Using research environments to provide STEAM education												
Theme 1. General information about digital tools in STEAM education	8	2				6	15	2	1			12
Theme 2. Instruments for working with virtual laboratories and other media	14		6			8	31		1			30
total	22	2	6			14	44		2			42
together	90	6	24			60	90	4	6			80

2.1. Substantial module 1. *Digital tools and introduction of web technologies in the professional activity of the teacher*

2.1.1. Theme 1. *Common writing, communication and messaging tools*

2.1.2. Purpose and expected results: students familiarization with the goal and task of the discipline; formation of appropriate conceptual and categorical device for future teachers; development of practical skills and abilities in working with digital tools of general writing, communication and message exchange.

2.1.3. Criteria and forms of assessment of learning outcomes on the topic: methods of formative assessment of teacher's observation, student observation, questions for discussion, final assessment.

2.1.4. digital tools Google applications (disk, documents, presentations, etc.), social networks, messengers, etc.

2.1.5. Innovative learning technologies The training of the future teacher includes the integration of innovative educational technologies (blended learning, problem learning, rote learning, experiential learning, etc.) and the use of the ICR room.

2.1.6. Lecture 1. Use of digital tools and web technologies in the context of informatization of education by a higher education teacher.

Purpose: to introduce students to the goal, objectives and conceptual and categorical apparatus of the discipline. To outline the possibilities of digital tools and web technologies in the conditions of education informatization.

Plan

- 1) Current state of informatization of education

- 2) 2) Web technologies in ensuring the informatization of society
- 3) 3) Development of digital tools and their place in the educational process of the university
- 4) 4) The pedagogical basis for the real possibilities of digital tools in the lighting process.

2.1.7. Practice session 1, 2. Using Google Cloud Services for Collaboration and Teamwork on Projects

Students work within a form-based learning group to implement an integrated lesson project for junior high school students. Each group receives a lesson topic and a list of interdisciplinary connections, one for each participant.

Evaluation for the practical lesson (2 lessons):

A high school student has flexible knowledge within the requirements of the academic discipline, applies it argumentatively in different situations, can independently analyze, evaluate, summarize the material being processed, use different sources of information and tools for processing it, make decisions.

Average: The student's knowledge is sufficient. He is able to apply the studied material in standard situations, tries to analyze and establish essential links and dependencies between facts, phenomena, make conclusions, generally controls his activity. The answer and the results of the work should have a logical structure, although there are inaccuracies.

A low level student distinguishes between the object of study, reproduces part of the learning material, and does not have a clear understanding of the object of study.

60% of the grade is the presentation of the lesson and the correspondence of its structure to the proposed criteria;

20% of the grade is the result of the ongoing testing;

20% of the grade is the result of the evaluation by the participants of the formal study group.

2.1.8. Group tasks topics

Indicative themes of integrated lessons

№	Subjects	Themes that are being integrated
1.	Literary reading Ukrainian	Language is a priceless treasure of the people. The native language is the language of ancestors and motherland.
2.	Literature reading Art	Poetic paintings of autumn. Autumn is so lovely... Creating the image of an autumn girl.
3.	Ukrainian Health Basics	Definition of the type of adjectives. Natural health factors.
4.	Maths Health Basics	24 hours. An hour. One minute. One second. The student's performance and rest..
5.	Maths Labour training	Cube. Elements of the cube (edge, rib, top). The elements of technical graffiti (a cube assembly, a cone).
6.	Natural science Health Basics	Water in nature. Protection of water. Water as a natural factor that helps to preserve human health.

7.	Natural science Art	Animal habitats. Protection of animals. The sculpture of the beloved forest animal "Who lives in the forest?"
----	----------------------------	---

2.1.9. Student self-study assignments

Working as part of a formal training group for project implementation, preparation for ongoing testing.

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

2.1.11. Theme 2: Data collection and molding assessment tools

2.1.12. Purpose and expected results: familiarisation of students with the instruments of data collection and realization of their opportunities in the educational process; to form an idea of modern principles of assessment; to develop skills of using digital tools to ensure the process of data collection and molding assessment..

2.1.13. Criteria and forms of learning assessment on the topic: methods of formative assessment teacher observation, student observation, questions for discussion.

2.1.14. Google digital tools applications, other cloud resources for data collection and molding assessment (e.g. Kahoot !, Mentimeter, Learningapps, Formative, etc.)

2.1.15. Innovation learning technologies Training of the future teacher includes integration of innovative educational technologies (mixed learning, problem learning, upside-down learning, experiential learning, etc.) and use of ICR room capabilities.

2.1.16. Lecture

2.1.17. Practice session 3, 4. Interactive multimedia resources for data collection as part of teaching activities

The student's individual work on the task. The content of the task is to create a data collection form using one of the appropriate resources. The topic is chosen by the student independently based on the pre-graduate program.

Evaluation for practical training:

A high level student has flexible knowledge within the requirements of the academic discipline, can reasonably apply it in different situations, can independently analyze, evaluate, summarize the material being processed, use different sources of information and tools for its processing, and make decisions.

Average: The student's knowledge is sufficient. He is able to apply the studied material in standard situations, tries to analyze and establish essential links and dependencies between facts, phenomena, make conclusions, generally controls his activity. The answer and the results of the work should have a logical structure, although there are inaccuracies.

A low level student distinguishes between the object of study, reproduces part of the learning material, and does not have a clear understanding of the object of study.

60% of the grade is the presentation of the work results and the compliance of their structure with the proposed criteria;

20% of the grade is the result of current testing;

20% grade - the result is received as feedback from the students in the group.

2.1.18. Topics of individual tasks

Topics are selected by students on the basis of a pre-degree internship program approved by the graduating department.

2.1.19. Student self-study assignments

Individual independent work of the student on the set tasks, preparation for the current test.

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

2.2. Content module 2. Creating an educational space for students via digital tools

2.2.1. Topic 1: Content management systems

2.2.2. Purpose and expected results: to deepen students' knowledge about modern educational spaces and their role in the process of training future specialists; to improve students' skills in working with digital tools of site content management..

2.2.3. Criteria and forms of learning assessment on the topic: methods of formative assessment teacher observation, student observation, questions for discussion, final assessment.

2.2.4. Google digital tools applications (site, drive, documents, etc.)

2.2.5. Innovation learning technologies Training of the future teacher includes integration of innovative educational technologies (mixed learning, problem learning, upside-down learning, experiential learning, etc.) and use of ICR room capabilities.

2.2.6. Lecture 1. Application of modern web technologies in the educational activity of the teacher.

Objective: to acquaint students with general concepts of web technologies and ways of their realization in modern educational process; to develop students' skills while working with Google applications, web technologies etc.

Plan

1) *General characteristics and trends in web technologies;*

2) *Google applications - as an educational ecosystem.*

2.2.7. Practice session 5, 6. Creation and administration of the site using the Google Website service

Creating a site fragment of the course.

The course is selected in accordance with the practice program approved by the graduating department. The structure of the site must meet the criteria and contain all the listed elements: course business card, work program, training schedule, grade scale, printed and Internet sources, announcements, discussions and educational and methodical materials.

The didactic-methodic materials include only the lectures, seminar, practical, laboratory works, tasks for independent work, etc., developed personally by the student during the pre-degree practice.

Evaluation for practical lesson (2 lessons):

A high level student has flexible knowledge within the requirements of the academic discipline, can reasonably apply it in various situations, can independently analyze, evaluate, summarize the material being processed, use various sources of information and tools for its processing, make decisions.

Average: The student's knowledge is sufficient. He is able to apply the studied material in standard situations, tries to analyze and establish essential links and dependencies between facts, phenomena, make conclusions, generally controls his activity. The answer and the work results should have a logical structure, although there are inaccuracies.

The lower grade student distinguishes the subject of study, reproduces part of the learning material, has not clear ideas about the subject of study.

15% rating - the conformity of design and ergonomics of the site delivered;

15% grade - compliance of elements and sections of the site with the proposed criteria;

20% rating - the use of web technologies in the structure of the site;

10% ratings - the site's cross-platform design;

20% ratings - uniqueness of the site content;

20% ratings - the results of current testing;

2.2.8. Topics of individual tasks

Development of own Google site on the basis of the student's experience as a result of his pre-graduate teaching practice.

2.2.9. Student self-study assignments

Independent work done by a student to design, build and administer a website, prepare for ongoing testing.

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

2.2.11. Theme 2: Learning management systems

2.2.12. Purpose and expected results: To introduce students to learning management systems. Develop skills to use digital tools to ensure their integration into the educational process.

2.2.13. Criteria and assessment forms of learning outcomes on the topic: methods of formative evaluation teacher observation, student observation, questions for discussion, final evaluation.

2.2.14. Google digital tools applications (class, disk, documents, etc.).

2.2.15. Innovative learning technologies Training of future teacher includes integration of innovative educational technologies (mixed learning, problem learning, upside-down learning, experiential learning, etc.) and use of ICR room capabilities.

2.2.16. Practice session 7, 8, 9. Design and development of a learning management system on one of the platforms (Google Class).

The student's individual task work. The content of the task is to create a fragment of the course in accordance with the task of practice approved in the graduating department. The class should contain multimedia content, including graphic and video materials, as well as theoretical and practical part according to the conducted classes. At designing of a class use of tools for the organization of process of training, system of an estimation, the schedule of performance and delivery of tasks and so forth should be considered. To a class should be attached a minimum of 5 students who should execute provided tasks and write a short feedback on the created class.

Grading for practical lesson (3 lessons):

A high level student has flexible knowledge within the requirements of the course of study, can reasonably apply it in different situations, is able to analyze, evaluate, summarize the material being processed, use different sources of information and tools for processing it, and make decisions.

Average: The student's knowledge is sufficient. He is able to apply the studied material in standard situations, tries to analyze and establish essential links and dependencies between facts, phenomena, make conclusions, generally controls his activity. The answer and the results of the work should have a logical structure, although there are inaccuracies.

A low level student distinguishes between the object of study, reproduces part of the learning material, and does not have a clear understanding of the object of study.

40% - classroom design and administration;

25% - task fulfilment from colleagues' classes;

15% - writing a feedback on the work of colleagues;

20% - grades - the results of current testing.

2.2.17. Topics of individual tasks

Topics are selected by students on the basis of a pre-degree internship program approved at the graduate department.

Performance of student class tasks (minimum 3 grades)

2.2.18. Tasks for independent student work

Individual student's independent work on the set tasks, preparation for current testing.

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

2.3. Content module 3: Using research environments to provide STEAM education

2.3.1. Theme 1: General information about digital tools in STEAM education and research environments

2.3.2 Purpose and expected results: To introduce students to the specifics of using digital tools in STEAM education. To develop skills in working with information and communication technologies and applying the latest learning approaches in creating and designing research environments.

2.3.3. Criteria and forms of learning assessment on the topic: methods of formation assessment teacher observation, student observation, questions for discussion, final assessment.

2.3.4 Digital tools Graasp platform, Google Applications, virtual laboratories, etc.

2.3.5 Innovative learning technologies Training of the future teacher includes integration of innovative educational technologies (mixed learning, problem learning, upside-down learning, experiential learning, etc.) and use of ICR room capabilities.

2.3.6 Lecture 1: Using digital research environments in STEAM education settings.

Aim: to form students' understanding of virtual laboratories and research environments place in teacher's educational activity. Familiarisation of students with the newest approaches in preparation of competitive ability of a capable specialist and peculiarities of STEAM education implementation in conditions of modern school education.

Plan

1) *Key concepts of STEAM education;*

2) *STEAM approaches to learning in the transition to the New Ukrainian School;*

3) *Establishment and operation of STEAM laboratories and centers;*

4) *Virtualization of the research process.*

2.3.7. Practice session 10. Features of using virtual laboratories in educational practice of the future teacher.

Research of virtual laboratories on GO-LAB platform. Search and analyze the possibility of using virtual laboratories in your own professional activity. Selection of virtual laboratories that can be used in the implementation of your own research environment and its design. Development of a conceptual map of the future research environment based on the selected theme.

Evaluation for practical work:

A high level student has flexible knowledge within the requirements of the academic discipline, can reasonably apply it in different situations, can independently analyse, evaluate, summarise the material being processed, can use different sources of information and tools for its processing, make decisions.

Average: The student's knowledge is sufficient. He is able to apply the studied material in standard situations, tries to analyse and establish essential links and dependencies between facts, phenomena, make conclusions, generally controls his activity. The answer and the results of the work should have a logical structure, although there are inaccuracies.

A low level student distinguishes between the object of study, reproduces part of the learning material, and does not have a clear understanding of the object of study.

30% - expediency and compliance of the selected virtual laboratories with the tasks set;

50% - a conceptual map presentation of the research environment;

20% - assessments - the results of current testing.

2.3.18. Topics of individual tasks

Topics are selected by students on the basis of their own experience, e.g. development of laboratory work, integrated lessons, etc.

2.3.19. Tasks for students' independent work

Individual student independent work on the set tasks, preparation for the current test.

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

2.3.11. Theme 2: Virtual laboratory and research tools

2.3.12. Purpose and expected results: To introduce students to learning management systems. Develop skills to use digital tools to ensure their integration into the educational process.

2.3.13. Criteria and forms of assessment of learning outcomes on the topic: methods of formative assessment teacher's observation, student observation, questions for discussion, final assessment.

2.3.14. Google digital tools applications (class, disk, documents, etc.), Graasp platform.

2.3.15. Innovative learning technologies Training of the future teacher includes integration of innovative educational technologies (mixed learning, problem learning, upside-down learning, experiential learning, etc.) and use of ICR room capabilities.

2.3.16. Lecture

2.3.17. Practice session 11, 12. *Creation of research environment on one of the platforms (Graasp platform).*

Individual student work on implementation of designed research environment on Graasp platform. Inclusion of necessary digital tools in its structure, in particular virtual laboratories. In the course of the assignment, the student must implement the lab work using this platform. The designed environment must satisfy the criteria.

Collaboration with other students in terms of working together on individual parts of the environment.

Each student must perform assignments assigned by their peers in their own research environment (minimum 5).

Evaluation per practice (2 lessons):

A high level student has flexible knowledge within the requirements of the academic discipline, applies it argumentatively in different situations, is able to analyze, evaluate, summarize the material being processed, use different sources of information and tools for processing it, and make decisions.

Average: The student's knowledge is sufficient. He is able to apply the studied material in standard situations, tries to analyze and establish essential links and dependencies between facts, phenomena, make conclusions, generally controls his activity. The answer and the results of the work should have a logical structure, although there are inaccuracies.

A low level student distinguishes between the object of study, reproduces part of the learning material, and does not have a clear understanding of the object of study.

50% - design and administration of the research environment;

25% - performing tasks on research environments of colleagues;

5% - writing a feedback on the work of colleagues;

20% - the results of current testing.

2.3.18. Topics of individual tasks

The topic for the research environment is a preliminary conceptual map.

2.3.19. Tasks for students' independent work

Individual independent work of the student on the set tasks, preparation for current testing.

2.3.20. Methodological materials and instructions (if available)

3. Tasks for final certification

3.1. List of questions for final inspection.

The final control is provided by testing via the online platform of SHEI "Pereiaslav-Khmelnytskyi Hryhorii Skovoroda State Pedagogical University", and includes a test base with at least 400 test questions. In the process of testing, the student is randomly generated 30 questions from the proposed base.

3.2 Test tasks (if any).

3.3 Additional creative tasks (if any).

3.4. Procedure of final certification

Distribution of points that students receive

Ongoing testing and independent work			Toget her	Indep enden t work	Exam
Substantial module №1	Substantial module № 2	Substantial module № 3			
T1–T2	T3–T4	T5–6			
16,64	24,96	8,4	50	20	30

T1, T2 ... T6 – topics of content modules.

Indicative evaluation of different types of student learning activities (in points)

The grades for each topic and the practical and independent work of the students are described in detail in the sense of the specific topics and the respective classes.

The final test (exam) consists of 30 questions from a proposed base of at least 400 test assignments.

4. List of recommended literature (including electronic resources)

Alkhansa A. Shakeabubakor. Cloud Computing Services and Applications to Improve Productivity of University Researchers / Alkhansa A. Shakeabubakor, Elankovan Sundararajan, and Abdul Razak Hamdan // International Journal of Information and Electronics Engineering. – Vol. 5. – No. 2. – 2015. – p.153-157.

1. Hashmi S.I. Using the Cloud to Facilitate Global Software Development Challenges / S.I.Hashmi, V.Clerc, M.Razavian and others // 2011 Sixth IEEE International Conference on Global Software Engineering Workshops. – 2011.

2. ISO/IEC 17788:2014(E) Information technology – Cloud computing – Overview and vocabulary. – First edition 2014-10-15. – 2014. – 16 p.

3. Mell P. The NIST Definition of Cloud Computing. Recommendations of the National Institute of Standards and Technology / P.Mell, T.Grance. – NIST Special Publication 800-145. NIST, Gaithersburg, MD 20899-8930, September 2011.

4. Nosenko, Yu., Shyshkina, M., Oleksiuk, V.: Collaboration between Research Institutions and University Sector Using Cloud-based Environment. In: 12th Int. Conf. ICTERI, pp. 656-671. CEUR Workshop Proceedings, Kyiv (2016), http://ceur-ws.org/Vol-1614/paper_84.pdf

5. Vaquero L. M. EduCloud: PaaS versus IaaS cloud usage for an advanced computer science course / Vaquero Luis M. // IEEE Transactions on Education. – 54(4). – 2011. – pp. 590-598.

6. Bahashova V. Isak T.. STEM-education - from the lesson of innovation // Scientific notes of the Small Academy of Sciences of Ukraine: Proceedings. - M: Institute of a gifted child NAES of Ukraine, 2017. - Edition.10. – C. 183-196.

7. Bykov V. Y. Theoretical-methodological bases of cloud formation in the oriented environment of a higher education institution / V. Y. Bykov M. P. Shyshkina // Theoretical and methodological bases of cloud formation in oriented environment of a university. – 2016. – No 2. - C. 30-52.

8. Bykov V. Y. Open web-oriented monitoring systems for the implementation of scientific and pedagogical research results / V.Y. Bykov O.M. Spirin L.A. Luparenko // Theory and practice of managing social systems. – 2014. – No1. – C. 3-25.

9. Bykov V. Y. Open learning environment information networks / V.Y. Bykov V.V. Oliinyk // Postgraduate education in Ukraine. – 2008. – No1. – C. 54-63.

10. Bykov V. Y. Methodological and methodical bases of creation and use of electronic means of educational purpose / V.Y.Bykov V.V. Lapinskyi // Computer in school and family No2(98), 2012. – p.3-6.
11. Bykov V. Y. Models of organizational systems for open education / V.Y.Bykov. – Kyiv Atika, 2009. – 684 c.
12. Bykov V. Y. Cloud computing technologies, ICT outsourcing and new functions of the ICT units of educational and research institutions / Bykov V. Y. // Information technologies in education. - Issue 10. - Kherson: KSU, 2011. – No 10. – C. 8-23.
13. Vasylyashko I. Implementation of STEM-training - answer to the time calling / I. Vasylyashko, T. Bilyk // Education management. - K., 2017. - No 2 (386). C. 28-31.
14. Voitkiv H.V. P Development of pupils' creativity by means of STEM-education // Scientific notes of the Small Academy of Sciences of Ukraine: collected works. - Institute of Gifted Child NAES of Ukraine, 2016. – ed.8. – C. 223-231.
15. Glazunov, A.T. Pedagogical research: content, organization, results processing / A.T. Glazunov. - M: APO Publishing Centre, 2003. - – 41p.
16. Hnied L.I. Integration - one of the ways of solving the problems of science education // Integration of knowledge in the subjects of the natural-mathematical cycle: problems and ways of their solutions. Collection of materials on Internet conference. - Cherkassy, 2012.
17. Honcharenko S.U. Method *на* teaching and research in higher school / S.U.Honcharenko. - Kyiv: Higher School, 2003. – 323 p.
18. Honcharova N. Glossary of terms that define the essence of the concept of STEM-education // Information collection for headmaster and head of kindergarten, 2015 - Edition. 17-18 (41) C. 90-92.
19. Honcharova N.O. STEM - education: professional competence of a teacher / N.A. Honcharova // Proceedings of the II International Scientific and Practical Conference "Continuing education of the new century: achievements and prospects", 18-25 April 2016, city. Zaporizhzhia Honcharova N.A. Use of game technologies in STEM-education / N.A. Goncharova. - Problems of education. – K., 2016. – C. 160-164.
20. Honcharova N.O. Professional competence of a teacher in the STEM training system // Scientific Notes of the Junior Academy of Sciences of Ukraine: Proceedings. - Institute of Gifted Child NAES of Ukraine, 2015. – ed.7. – C. 141-148.
21. Horbenko S.L. Forms of control of pupils' learning activities in the implementation of STEM education / S. L. Horbenko // home school. – 2017.
22. Hryneva A. Tsunykova Y.. Transformation of information-educational environment in the context of implementation of STEM-training // Scientific notes of the Small Academy of Sciences of Ukraine: Proceedings. - Gifted Child Institute NAES of Ukraine, 2016. – ed.10. – C. 197-207.
23. Zhuk O.I. Structure and levels of teaching / O.I. Zhuk // Education management. – 2007. – No 11(155). – p.6-10.
24. Zahviazynskyi V.Y. Methodology and methods of psychological and pedagogical research / V.Y.Zahviazynskyi R.Atakhanov. - 2nd ed.: M.: Academy. – 2005. – 208 p.
25. 25. Integration - cloud base [Electronic resource] / L. Chernyak // Open systems. DBMS (September 16, 2011). - – 2011. - No. 07. - Mode of access to the publishing house: <http://www.osp.ru/os/2011/07/13010473/>
26. 26. Kukharenko V.N. Educational process in a mass open distance course. Theory and practice of social systems management. No 1, 2012. - p.40-50.

27. Lavrentieva H.P. Shyshkina M.P. Methodological recommendations for the organization and conduct of scientific and pedagogical experiment. - Kiev: IITZN, 2007. - 72 p.
28. Lypskiy Y.A. Technologies for implementing goals and value orientations in social and pedagogical activities. - Tambov: TSU, 2000. - 32 p.
29. Lytvynova S. H. Component Model of the Cloud of Educational Environment of General Education Institution / S.H. Lytvynova // Scientific bulletin. - Ep. 35. - Series: Pedagogy. Social work. - Uzhgorod: UzhNU, 2015 - p. 99-107.
30. Lytvynova S. H. Methods of Designing and Using the Cloud of Oriented Learning Environment of Higher Education: Methodological Recommendations / S.H. Lytvynova. - M: Comprint, 2015 – 280 p.
31. Lytvynova S. H. Designing a Cloud of Oriented Educational Environment of General Education Institution: Monograph / S.H. Lytvynova - M.: Compint, 2016. – 354 p.
32. Mykhailova O.V. Values paradigm in the educational space of the school: application of forms. Methods, technologies of STEM-education in primary school on the principle of "STEM LEARNING IS EVERYWHERE" // Scientific Notes of the Junior Academy of Sciences of Ukraine: Proceedings. - Institute of Gifted Child NAES of Ukraine, 2016. – ed.8. – C. 250-259.
33. Nikolai, G.Yu. Methodology and technology of scientific and pedagogical research / G.Y. - Sumy: SDPU named after A.S.Makarenko, 1999. – 106 p.
34. Nosenko Yu.G. Use of Google cloud services as a means to support management processes in preschool educational institutions / Nosenko Yu.G., Bogdan V.A. // New technologies of education: method. collection / Institute of innovative technologies and educational content of MES of Ukraine. - M., 2016. - Issue. 88. - Ч. 1. - C. 55-60.
35. Samples, P.I. Methods and methodology of the psychological and pedagogical research. - M., S.-P., Nizhny Novgorod, etc., 2004. - 272 c.
36. Patrikeev O ... Modern means of STEM-literacy formation / A. Patrykeev, in Chernomorets // Scientific notes of the Small Academy of Sciences of Ukraine: a collection of works. - Institute of Gifted Child of the Academy of Sciences of Ukraine, 2017. - VIP.10. - Pp. 8-16.
37. Patrikeev, A.A. Content and the problems of STEM-education / A.A. Patrikeev, N.A. Goncharova // STEM-education - problems and prospects: collection of materials of I International scientific-practical seminar., G.Kropivnitskiy, 28-29 October 2016 / Edited by A.S. Kuzmenko and V.V. Kropivnitskiy. Problems and prospects: collection of materials of I International scientific-practical seminar. - Kropivnitsky: NAU KLA, 2016. - C. 70-73. Patrikeeva, A.A.; Lozovaya, A.V.; Gorbenko, S.L. Modern state of the STEM-education implementation in Ukraine (in Russian) / A.A. Patrikeev, A.V. Lozovaya, S.L. Gorbenko // Problems of education. - 2016. - C. 152-155.
38. Postovaya, K. P. 152-155. 38. Prerequisites and prospects of STEM-education in Ukraine // Scientific notes of the Small Academy of Sciences of Ukraine: a collection of works. - M.: Institute of a gifted child APN Ukraine, 2017. - VIP.10. - P. 75-82.
39. Regechi D. European research networks / D. Regechi, M. Fyodinger. - Kyiv: "ADEF-Ukraine" LLC, 114 p.
40. Seydametova S. S. Cloud services in education / S. S. Seydametova, S. N. Seitvelieva // Information technologies in education. - 2011. - No. 9. - C. 105-111.
41. Spirin, O.M. Information and communication technologies for monitoring the implementation of the research results [Electron resource] / A.N. Spirin // Information

- technologies and training means. - 2013. - No. 4 (36). - C. 132-152. - Access mode to the journal .: <http://journal.iitta.gov.ua/index.php/itlt/article/view/890/655>.
42. Spirin, O.M. Design of the system of the electronic libraries of the scientific and educational institutions of Ukrainian Academy of Sciences [Electronic resource] (in Russian) / A.N. Spirin, V.M. Saukh, V.A. Reznichenko, A.V. Novitskiy // Information technologies and teaching means. - 2009. - No6 (14). - Access mode: <http://journal.iitta.gov.ua/index.php/itlt/article/view/213/199>.
43. Spirin, O.M.; Demianenko, V.N.; Shishkina, M.P.; Zaporozhchenko, Yu.G.; Demianenko, V.B. Models for the harmonization of the network instruments for information technology support of the educational and cognitive activity processes (in Russian) // Information technologies and teaching means, 2012. - No 6 (32). - Mode of access to the journal. : [Http://journal.iitta.gov.ua/index.php/itlt/issue/archive](http://journal.iitta.gov.ua/index.php/itlt/issue/archive).
44. Stuk, A.M. Cloud system of the oriented means of education as an element of information scientific-educational environment of university [Electronic resource] / A.N. Stuk, M.V. Rasovitska // Information technologies and means of education. - 2014. - No. 4 (42). - C. 150-158. - Mode of access to the journal. : <Http://journal.iitta.gov.ua/index.php/itlt/article/view/1087/829>.
45. Khalilova F.S. Information technologies in professional activity of primary school teacher. (in Russian) / Under edition of N.V. Apatov. - Simferopol, "SUDBA", 2009. - 240 p.
46. Chernetskyi I., Polikhun N., Slipukhina I. Pedagogical STEM technology as a means of reforming the educational system of Ukraine // Education and development of gifted personality: Monthly scientific and methodological journal. - Moscow: Gifted Child Institute, 2017. - No 3 (58) .- P. 05-09.
47. Shakotko V.V. Computer in primary school: tutorial / V.V. Shakotko. - M .: TOV Editorial Office "Computer", 2007. – 128 p.
48. Shakotko V.V. Methods of ICT usage in primary school: manual / V.V. Shakotko. - K .: Editorial Office "Computer", 2008. – 128 p.
49. Shyshkina M.P. Formation and development of a cloud of oriented educational and scientific environment of a higher education institution: a monograph / M.P. Shyshkina. – K .: UKR IHTEI, 2015. – 256 p.
50. Shyshkina M.P. Innovation models for organizing a cloud of oriented educational and scientific environment of a higher education institution / M.P. Shyshkina // The problems of modern teacher education. Series: Pedagogy and Psychology. Forty-third issue. Part 3. – 2014. – C.300-312.
51. Shyshkina M.P. Models for organizing software access in the cloud in a focused educational environment / M.P. Shyshkina // Information technologies in education. - ed.22. – 2015. – C. 120-129.
52. Shyshkina M.P. Problems of education informatization in Ukraine in the context of development of research on ICT quality assessment / M.P. Shyshkina O.M. Spirin Yu.H. Zaporozhchenko // Electronic Specialized Edition. Information technology and learning tools. 2012. No. 1 (27). - Magazine access mode: <http://journal.iitta.gov.ua/index.php/itlt/article/view/632/483>
53. Shyshkina M.P. Formation and development of ICT educational and scientific environment of higher education institutions based on the concept of cloud computing / Shyshkina M.P. // Humanitarian Journal of "SHEI "Pereiaslav-Khmelnytskyi Hryhorii Skovoroda State

Pedagogical University"- Annex 1 to Exhibit 5, Volume II (54). - Thematic issue "Higher Education of Ukraine in the context of integration into the European educational space" - Annex 1 issue 5, Vol. II (54). - Kyiv: Gnosis, 2014. – C.302-309.

54. Shyshkina M.P. Clouds oriented environment of an educational institution: current state and prospects of research development / M.P.Shyshkina M.V.Popel// Information technology and teaching tools [Electronic resource]. - 5 (37). - 2013. Access Mode: <http://journal.iitta.gov.ua/index.php/itlt/article/view/903/676>

5. Annexes (if required)

Internet resources

- 1) <http://www.chatzy.com/>
- 2) <https://www.triventy.com/>
- 3) <https://about.google/intl/ru/products/?tab=rh>
- 4) <https://animoto.com/>
- 5) <https://answergarden.ch/>
- 6) <https://app.edu.buncee.com/>
- 7) <https://app.wizer.me/>
- 8) <https://classroomscreen.com/>
- 9) <https://coggle.it/>
- 10) <https://conceptboard.com/>
- 11) <https://edulastic.com/>
- 12) <https://go.playposit.com/>
- 13) <https://goformative.com/>
- 14) <https://graasp.eu/>
- 15) <https://kahoot.com/>
- 16) <https://learningapps.org/>
- 17) <https://padlet.com/>
- 18) <https://piazza.com/>
- 19) <https://quizlet.com/latest>
- 20) <https://spiral.ac/>
- 21) <https://vocaroo.com/>
- 22) <https://wordart.com/>
- 23) <https://www.classtime.com/ru/>
- 24) <https://www.flippity.net/>
- 25) <https://www.golabz.eu/>
- 26) <https://www.liveworksheets.com/>
- 27) <https://www.mentimeter.com/>