CTE 2019 – When cloud technologies ruled the education

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Abstract. This is an introductory text to a collection of papers from the CTE 2019: The 7th Workshop on Cloud Technologies in Education, which was held in Kryvyi Rih, Ukraine, on the December 20, 2019. It consists of short introduction and some observations about the event and its future.

Keywords: cloud technologies in education, digital transformation of learning, cloud-based learning environment, scloud services for learning foreign language, cloud technologies in STEAM education.

1   CTE 2019 at a glance

Cloud Technologies in Education (CTE) is a peer-reviewed international Computer Science workshop focusing on research advances, applications of cloud technology in education.

The CTE Workshop occupies contributions in all aspects of educational technologies and cloud-based learning tools, platforms, paradigms and models, functioning programmes or papers relevant to modern engineering and technological decisions in the IT age. There is urgent general need for principled changes in education elicited by current e-learning tools, services and IT communication.

CTE topics of interest since 2018 [43]:

— Mobile and blended learning.
— Cloud-based e-learning platforms, tools and services.
— Cloud-based learning environments.
— Cloud technologies of open education.
— Cloud technologies of mobile learning.
— Cloud-based learning management systems.

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- ─ Cloud technologies for informatics learning.
- ─ Cloud technologies for mathematics learning.
- ─ Cloud technologies for physics learning.
- ─ Cloud-based and mobile learning technologies for teacher and VET.
- ─ Seamless learning and holistic education modelling and design.
- ─ Massive open online courses.
- ─ Open learning systems and virtual conferences for training professionals.
- ─ Methods of using cloud-based learning tools.

This volume represents the proceedings of the 7th Workshop on Cloud Technologies in Education (CTE 2019), held in Kryvyi Rih, Ukraine, in December 20, 2019 (Fig. 1, 2). It comprises 42 contributed papers that were carefully peer-reviewed and selected from 66 submissions. Each submission was reviewed by at least 3, and on the average 3.5, program committee members. The accepted papers present the state-of-the-art overview of successful cases and provides guidelines for future research.

Fig. 1. CTE 2019 opening

The volume is structured in five parts, each presenting the contributions for a particular workshop track.

2   Session 1: Digital transformation of learning

The article "Digital competence of pedagogical university student: definition, structure and didactical conditions of formation" (Fig. 3) of Mykhailo V. Moiseienko, Natalia V. Moiseienko, Iryna V. Kohut and Arnold E. Kiv [76] defines and substantiates didactic conditions of digital formation competences of students of pedagogical universities: actualization of motivational value training of students of pedagogical universities;

organization of interaction between students and teachers of pedagogical universities on the Internet through the creation of digital information educational environment; creation of individual educational trajectories of students.
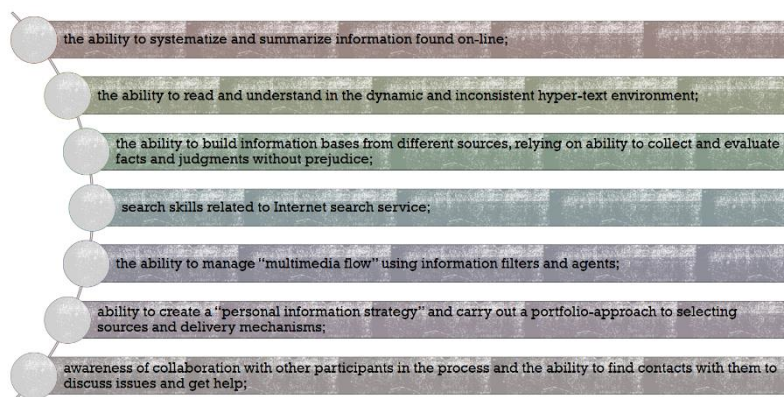

Fig. 2. At the beginning of CTE 2019

Fig. 3. Presentation of paper [76]

The article "The methodology of development of information and communication competence in teachers of the military education system applying the distance form of learning" (Fig. 4) of Vasyl V. Yahupov, Vladyslav Yu. Kyva and Vladimir I. Zaselskiy [159] theoretically substantiates the methodology of development of information and communication competence in teachers of the military education system applying the distance form of learning. Scientific approaches to the concepts of "methodology" have been analyzed and the author's vision of "the methodology of development of information and communication competence in the military education teachers" has been suggested. In particular, they determine the methodological approaches to the methodology of its development, as well as its main stages, purpose, tasks, content, methods, types of training sessions, tools and organizational forms of learning.

Teaching methods and types of lessons for the development of ICC in teachers applying the distance form of learning

Stage	Goal	Tasks	Method, technique, way	Type of a lesson
The value-motivational stage	to develop and enrich the values and motivation of ICC development	development of the value-motivational component of ICC	questioning, testing, stimulation, conversation, discussion etc.	all kinds of training in the high military school
The development stage	to develop theoretical and practical knowledge of the use of ICT in pedagogical activity, practical skills and ability to apply them in their activities	development of intellectual, praxeological, information-technological, subjective components of ICC	independent work with educational materials, educational conversation, educational discussion, method of exercises, method of oral control, self-control, method of written (test) knowledge control	all kinds of training in the high military school
The final stage	to implement successfully the previous stages of the methodology of ICC development; to perform the pedagogical evaluation of the ICC development levels of teachers	completing the ICC development in teachers of the military education system; determining the levels of ICC development in teachers	method of written (test) control of knowledge, practical skills, capacities and abilities of applying ICT in the pedagogical activity	practical and control lessons

Fig. 4. Presentation of paper [159]

The article "Technology of forming future journalists' social information competence in Iraq based on the use of a dynamic pedagogical site" (Fig. 5) of Alla A. Kharkivska, Liudmyla V. Shtefan, Muntasir Alsadoon and Aleksandr D. Uchitel [32] reveals scientific approaches to substantiating and developing technology to form social information competence of future Iraqi journalists based on using a dynamic pedagogical site. After pre-interviewing students of the Journalism Faculty at Al-Imam Al-Kadhim University College for Islamic Sciences in Baghdad, the authors came to the conclusion there are issues on defining the essence of social information competences. It is established that the majority of respondents do not feel satisfied with the conditions for forming these competences in the education institutions. At the same time, there were also positive trends as most future journalists recognized the importance of these professional competences for their professional development and had a desire to attend additional courses, including distance learning ones. Subsequently, the authors focused on social information competence of future

journalists, which is a key issue according to European requirements. The authors describe the essence of this competence as an integrative quality of personality, which characterizes an ability to select, transform information and allows to organize effective professional communication on the basis of the use of modern communicative technologies in the process of individual or team work. Based on the analysis of literary sources, its components are determined: motivational, cognitive, operational and personal. The researchers came to the conclusion that it is necessary to develop a technology for forming social information competence of future journalists based on the use of modern information technologies. The necessity of technology implementation through the preparatory, motivational, operational and diagnostic correction stages was substantiated and its model was developed. The authors found that the main means of technology implementation should be a dynamic pedagogical site, which, unlike static, allows to expand technical possibilities by using such applications as photo galleries, RSS modules, forums, etc. Technically, it can be created using Site builder. Further research will be aimed at improving the structure of the dynamic pedagogical site of the developed technology.
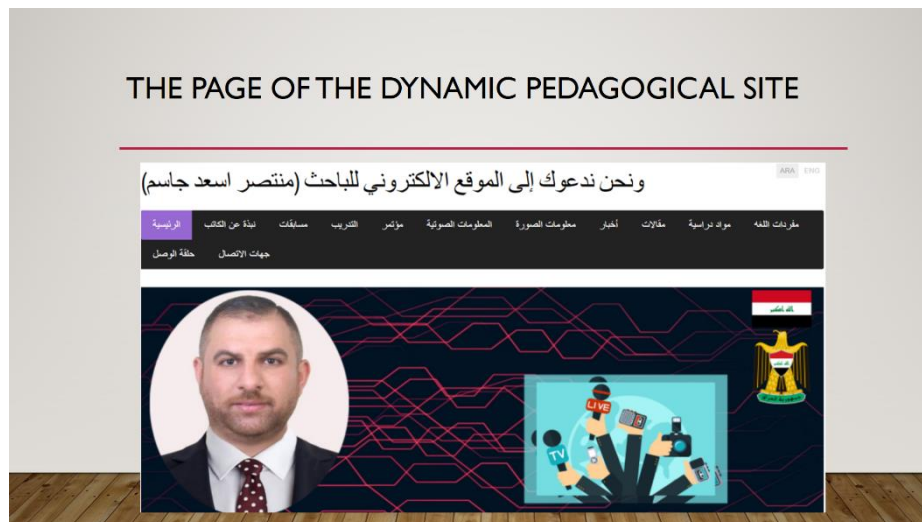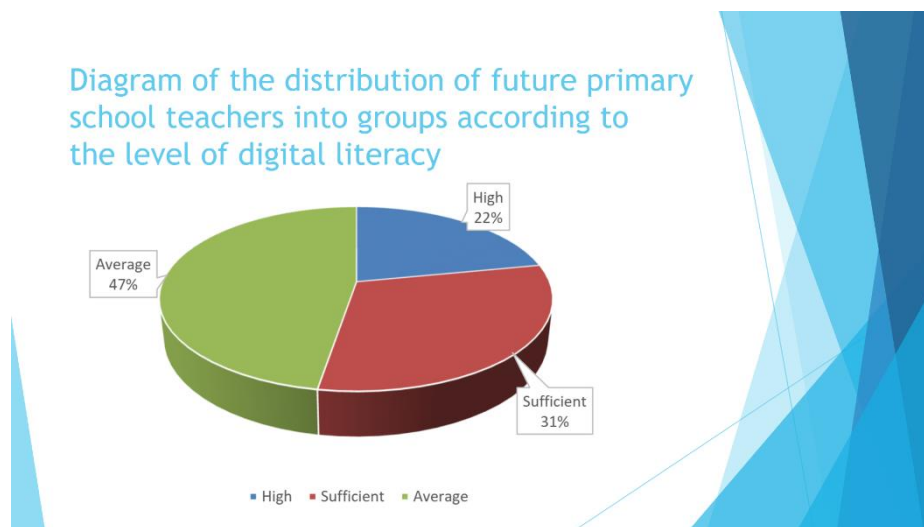

Fig. 5. Presentation of paper [32]

The article "An integrated approach to digital training of prospective primary school teachers" (Fig. 6) of Olga G. Yaroshenko, Olena D. Samborska and Arnold E. Kiv [160] emphasizes the importance of information and digital technologies in pre-service training of primary school teachers, substantiates the content and components of information and digital competence of prospective primary school teachers. It points out that the main purpose of information and digital training in the pedagogical higher educational institutions is to ensure the formation of digital competence of future primary school teachers, to prepare them for developing primary students' digital literacy in classes on various academic subjects, for active use of ICT in primary school

teachers' professional activities. An integrated approach to the modernization of information and digital training of pre-service primary school teachers, which covers the main forms of the educational process – training sessions, independent work, practical training, and control activities is justified. The article presents the results the pedagogical experiment aimed at testing the effectiveness of the integrated approach to the modernization of information and digital training of prospective primary school teachers. The results are determined by the level of digital literacy and the ability of students in the control and experimental groups to use information and digital technology in the educational process of primary school.
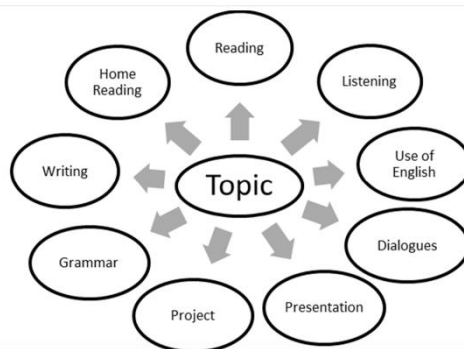

Fig. 6. Presentation of paper [160]

The article "Google cloud services as a way to enhance learning and teaching at university" (Fig. 7) of Tetiana I. Korobeinikova, Nataliia P. Volkova, Svitlana P. Kozhushko, Daryna O. Holub, Nataliia V. Zinukova, Tetyana L. Kozhushkina and Sergei B. Vakarchuk [46] highlights further research by the authors, begun in [99], [107], [139], [141], [142], [152] and [157]. This article is devoted to the issue of a cloud-based learning system implementation as a powerful strategy for future specialists' training at higher educational establishments. Using cloud computing in self-work management of the university courses is essential to equip students with a workload of appropriate educational materials and variable activities for professional training. Theoretical and empirical research methods were applied to select the appropriate services and tools for organizing students' self-work at university. Critical analysis of scientific literature, synthesis of the data, didactic observation of the educational process, designing of the skeleton for university courses, questionnaires enabled to facilitate the study of the issue. G Suite has been chosen to enhance the quality of training of prospective specialists at a higher educational establishment. This paper introduces the outcomes of the project on applying Google Classroom in the

management of students' self-work while studying university courses. The focus of the first stage of the project was on testing pilot versions of the courses with the aim to work out the requirements and recommendations for incorporation general blended learning model of university courses. Particular attention is drawn to the designed model of the university course based on the curriculum with the necessary components of blended learning in the G Suite virtual environment. Cloud-based higher education is considered as a prospective tool for design of university courses with the need for further research and implementation.

Components of the topic of English for Translators Course in GC

Fig. 7. Presentation of paper [46]

The article "The state of ICT implementation in institutions of general secondary education: a case of Ukraine" (Fig. 8) of Tetiana A. Vakaliuk, Dmytro S. Antoniuk and Vladimir N. Soloviev [147] highlights further research by the authors, begun in [109] and [102]. This article article presents the results of the analysis of the current state of implementation of ICT in the educational process of institutions of general secondary education in Ukraine. For this purpose, a survey was conducted among students of the first year of the Zhytomyr Polytechnic State University, within which 17 questions were asked to students related to the use of information and communication technologies in the educational process. As a result of the research, the introduction of the discipline "Educational technologies and digital education" into the training of future information technology specialists was substantiated, as well as the certification educational program "Information systems and cloud technologies in the educational process", designed for general education teachers, educators for higher education institutions, experts in the field of additional educational services, and other professionals.

The article "Application of augmented reality technologies for education projects preparation" (Fig. 9) of Anna V. Iatsyshyn, Valeriia O. Kovach, Volodymyr O. Lyubchak, Yurii O. Zuban, Andriy G. Piven, Oleksandra M. Sokolyuk, Andrii V. Iatsyshyn, Oleksandr O. Popov, Volodymyr O. Artemchuk and Mariya P. Shyshkina

[27] highlights further research by the authors, begun in [25], [26] and [28]. After analysis of scientific literature, authors defined that concept of "augmented reality" has following synonyms: "advanced reality", "improved reality", "enriched reality", "mixed reality" and "hybrid reality". Analysis of scientific literature and own practical experience of the use of augmented reality technologies application in educational practices allowed to state next: augmented reality technologies have a great potential for application in education; there are some cases of augmented reality use for school education; positive aspects of augmented reality technologies application in higher education institutions are confirmed by experiments (isolated cases); only few universities in Ukraine apply augmented reality technologies to educate students; only few universities in Ukraine have special subjects or modules in schedule to teach students to develop augmented reality technologies; various scientific events, mass events, competitions are held in Ukraine, and specialized training on the augmentation of augmented reality technologies is carried out, but this is non-systematic and does not have special state orientation and support. Features of introduction of virtual and augmented reality technologies at Sumy State University (Ukraine) are identified: "e-learning ecosystems" was created; in 2019, augmented and virtual reality research laboratory was established. Advantages and disadvantages of project activity in education are described: project activity is one of the most important components of educational process; it promotes creative self-development and self-realization of project implementers and forms various life competencies. It is determined that augmented reality application for implementation of educational projects will help: to increase students' interest for educational material; formation of new competences; increase of students' motivation for independent educational and cognitive activity; activation of educational activities; formation of positive motivation for personal and professional growth; conditions creation for development of personal qualities (creativity, teamwork, etc.). Current trends in implementation of educational projects were identified: most of the winner projects were implemented using augmented reality technology; augmented reality technologies were used in projects to teach different disciplines in higher education institutions. Augmented reality technology application for project activity has positive impact on learning outcomes and competitiveness of the national workforce; it will enhance the country's position in the global economic space.

The article "Methodological aspects of preparation of educational content on the basis of distance education platforms" (Fig. 10) of Alexander F. Tarasov, Irina A. Getman, Svetlana S. Turlakova, Ihor I. Stashkevych and Serhiy M. Kozmenko [138] describes the experience of using the free distance education platform Moodle within the framework of the higher educational institution Donbass State Engineering Academy. Methodical aspects of training content preparation on the basis of distance education platforms on the example of MoodleDDMA system are given in this article. The General structure of the distance course and an example of evaluation of test tasks of the distance course (module) on topics are considered. An example of the presentation of the course on the basis of distance education platform MoodleDDMA is given. Conclusions about the experience of using the Moodle distance education system at the Donbass State Engineering Academy from the point of view of teachers

and students are drawn. The perspective directions of researches and development of the Moodle distance education platform in completion and expansion of educational materials by multimedia elements and links, and also creation of the application for mobile devices for possibility of more effective use of the platform are allocated.
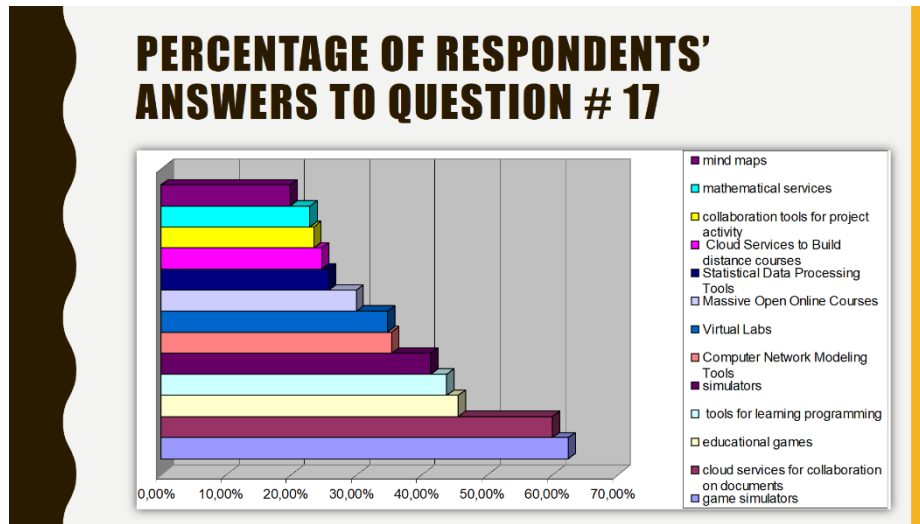

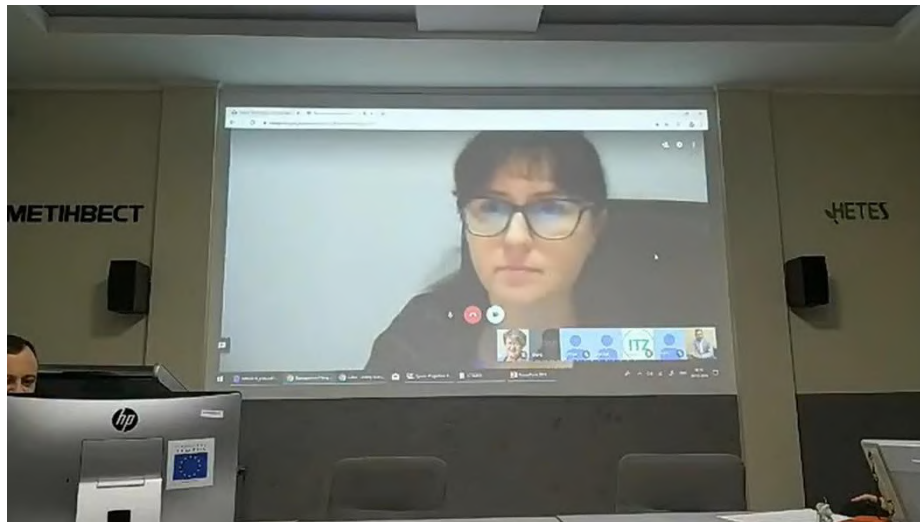**Fig. 8.** Presentation of paper [147]

Fig. 9. Presentation of paper [27]

The purpose of the article "MarkHub Cloud Online Editor as a modern web-based book creation tool" (Fig. 11) of Vitalina O. Babenko, Roman M. Yatsenko, Pavel D. Migunov and Abdel-Badeeh M. Salem [4] is to analyze modern editors to create

educational information content in the modern educational space and to present a modern tool for creating web books based on the latest IT technologies. Modern editors of web material creation have been analyzed, statistics of situations on mastering of knowledge by listeners, using interactive methods of information submission have been investigated. Using the WYSIWYG concept and analyzing modern information tools for presenting graphic material, an effective tool for teaching interactive web material was presented. An adapted version of the MarkHub online editor based on cloud technologies is presented. Using MarkHub cloud-based online editor for the unified development of educational content can significantly increase the author's productivity in the content creation process. At the same time, the effects of reducing the time spent on formatting the external presentation of the content, making synchronous changes to different versions of the content, tracking the versions of the content, organizing remote teamwork in the network environment are achieved.
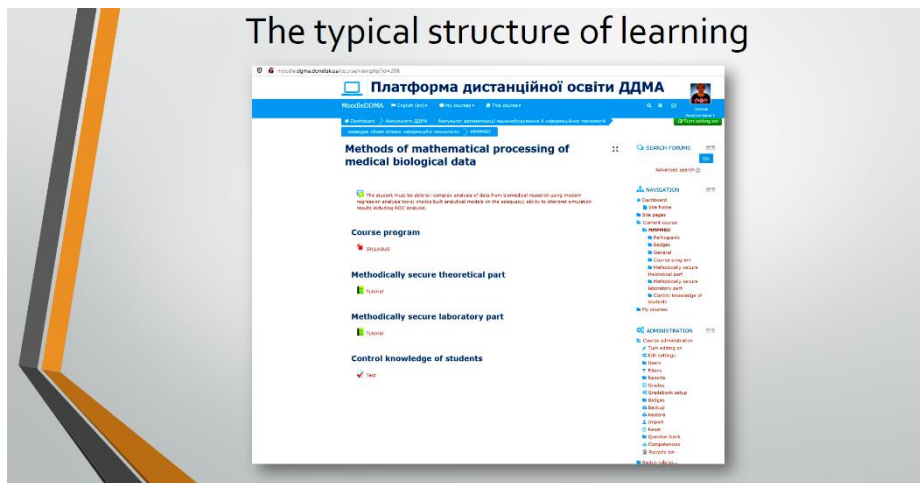

Fig. 10. Presentation of paper [138]

The article "The students' brainwork intensification via the computer visualization of study materials" (Fig. 12) of Halyna I. Ivanova, Olena O. Lavrentieva, Larysa F. Eivas, Iuliia O. Zenkovych and Aleksandr D. Uchitel [29] highlights further research by the authors, begun in [56], [57] and [94]. The paper the approaches to the intensification of the students' brainwork by means of computer visualization of study material have been disclosed. In general, the content of students' brainwork has been presented as a type of activity providing the cognitive process, mastering the techniques and ways of thinking, developing the capabilities and abilities of the individual, the product of which is a certain form of information, as a result of the brainwork the outlook of the subject of work is enriched. It is shown the visualization is the process of presenting data in the form of an image with the aim of maximum ease of understanding; the giving process of visual form to any mental object. In the paper the content, techniques, methods and software for creating visualization tools for study material has exposed. The essence and computer tools for creating such types of visualization of educational material like

mind maps, supporting notes and infographics have been illustrated; they have been concretized from the point of view of application in the course of studying the mathematical sciences. It is proved the use of visualization tools for study materials helps to increase the intensity and effectiveness of students' brainwork. Based on the results of an empirical study, it has been concluded the visualization of study materials contributes to the formation of students' key intellectual competencies and forming their brainwork culture.

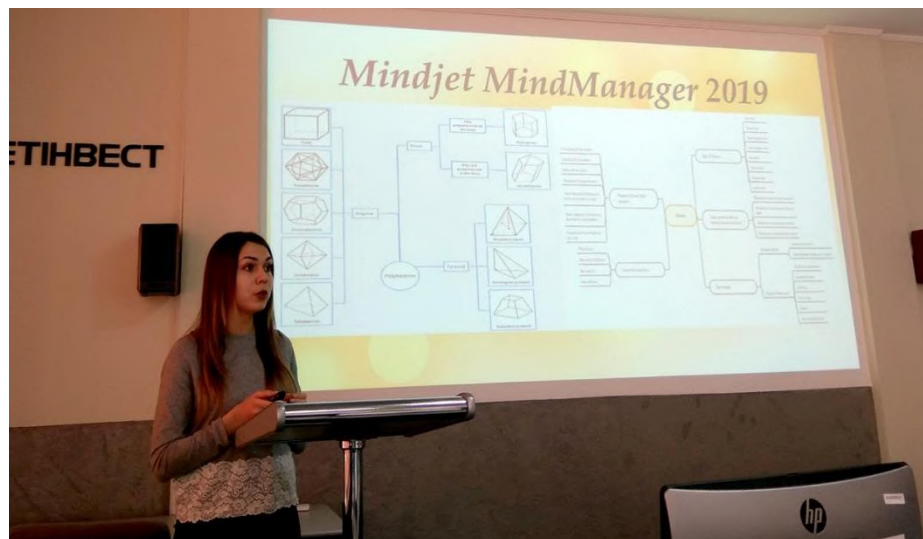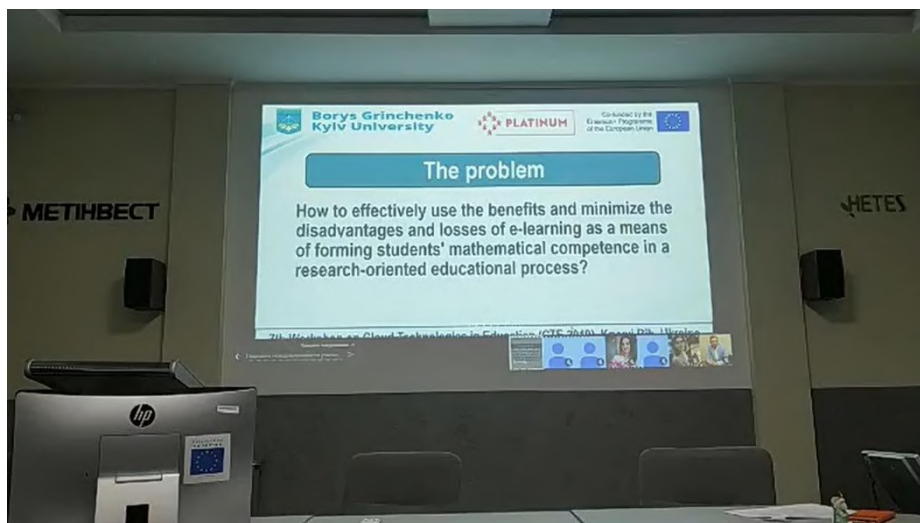**Fig. 11.** Presentation of paper [4]

Fig. 12. Presentation of paper [29]

Fig. 13. Presentation of paper [23]

The article "The usage of digital technologies in the university training of future bachelors (having been based on the data of mathematical subjects)" (Fig. 13) of Oksana M. Hlushak, Svetlana O. Semenyaka, Volodymyr V. Proshkin, Stanislav V. Sapozhnykov and Oksana S. Lytvyn [23] highlights further research by the authors, begun in [22] and [114]. This article demonstrates that mathematics in the system of higher education has outgrown the status of the general education subject and should become an integral part of the professional training of future bachelors, including economists, on the basis of intersubject connection with special subjects. Such aspects as the importance of improving the scientific and methodological support of mathematical training of students by means of digital technologies are revealed. It is specified that in order to implement the task of qualified training of students learning econometrics and economic and mathematical modeling, it is necessary to use digital technologies in two directions: for the organization of electronic educational space and in the process of solving applied problems at the junction of the branches of economics and mathematics. The advantages of using e-learning courses in the educational process are presented (such as providing individualization of the educational process in accordance with the needs, characteristics and capabilities of students; improving the quality and efficiency of the educational process; ensuring systematic monitoring of the educational quality). The unified structures of "Econometrics", "Economic and mathematical modeling" based on the Moodle platform are the following ones. The article presents the results of the pedagogical experiment on the attitude of students to the use of e-learning course (ELC) in the educational process of Borys Grinchenko Kyiv University and Alfred Nobel University (Dnipro city). We found that the following metrics need improvement: availability of time-appropriate mathematical materials; individual approach in training; students' self-expression and the development of their creativity in the e-

learning process. The following opportunities are brought to light the possibilities of digital technologies for the construction and research of econometric models (based on the problem of dependence of the level of the Ukrainian population employment). Various stages of building and testing of the econometric model are characterized: identification of variables, specification of the model, parameterization and verification of the statistical significance of the obtained results.

Fig. 14. Presentation of paper [131]

The article "Cloud technologies for enhancing communication of IT-professionals" (Fig. 14) of Svitlana V. Symonenko, Viacheslav V. Osadchyi, Svitlana O. Sysoieva, Kateryna P. Osadcha and Albert A. Azaryan [131] highlights further research by the authors, begun in [45], [88], [130] and [132]. This paper deals with the urgent problem of enabling better communication of IT-specialists in their business and interpersonal interaction using information and communication technologies, including cloud technologies. It is emphasized, that effective communication is an integral part of the successful professional work of IT-professionals, but in recent years it has undergone significant transformations, which have been expressed in new forms and means of communication, its content changes, its complications and volume increases, the need to improve its accuracy, and the level of understanding for a wide range of people. Certain peculiarities of communication in the IT-environment have been discussed. It is noted that typical forms of communication in the IT-environment are synchronous and asynchronous ones. The authors insist that during their professional career IT-specialists communicate in the professional community from a variety of positions and common types of task formulation can be expressed through verbal or symbolic communication means. Due to the specifics of their professional activities, IT-professionals often need to communicate using synchronous communication (chats, video chats, audio chats, instant messaging) and asynchronous communication (email,

forums, comments) tools, hence there is a demand to teach corresponding communication skills at universities. Certain practical examples of teaching communication skills using modern technologies are given. Advantages of cloud technologies for better communication within a company or an educational institution are presented. Microsoft Office 365 services, which can be successfully used to enable better communication and collaboration within a company or an educational institution are analyzed.

The article "Modeling the training system of masters of public service using Web 2.0" (Fig. 15) of Yevhen M. Khrykov, Alla A. Kharkivska, Halyna F. Ponomarova and Aleksandr D. Uchitel [37] highlights further research by the authors, begun in [14], [59], [67] and [81]. This article concerns grounding the technology of training masters of public service with the use of Web 2.0. This technology is based on the concept of sign-contextual learning, the positions of the laboratory-brigade method, the concept of Web 2.0, case technology, project method, problem learning. The main features of this technology are changes in the correlation between theoretical and practical training, in-class and individual studying; changing teachers' functions; extensive use of information technology capabilities in learning.
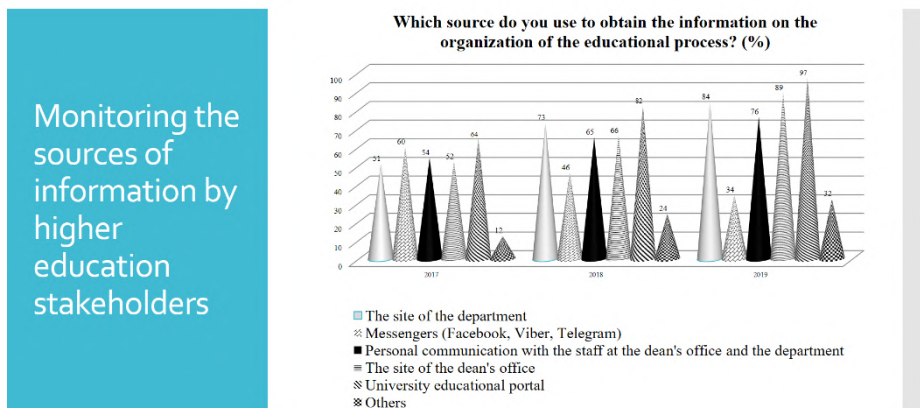
Fig. 15. Presentation of paper [37]

The article "Using Twitter in Ukrainian sociology majors training" (Fig. 16) of Liubov F. Panchenko, Andrii O. Khomiak and Andrey V. Pikilnyak [91] highlights further research by the authors, begun in [90], [92] and [93]. This article deals with the problem of using cloud technologies in the training of sociology students in Ukraine. The popularity of Twitter in Ukraine is analyzed. The possibilities of using Twitter as a learning tool in classroom are discussed. List of recommended tweeters, including Ukrainian resources as well as resources related to population censuses is proposed. The article offers examples of student activities for Social Statistics and Demographics

courses. The article demonstrates that new forms of student's activity related to data analysis introduced by academics and practitioners (building art objects and storytelling based on data; shared data collection by citizens through mobile devices, "play with data" modern data visualization services) can be realized with Twitter resources and can help overcome the barriers that arise while studying quantitative methods.

Fig. 16. Presentation of paper [91]

The article "Technology of presentation of literature on the Emoji Maker platform: pedagogical function of graphic mimesis" (Fig. 17) of Rusudan K. Makhachashvili, Svetlana I. Kovpik, Anna O. Bakhtina and Ekaterina O. Shmeltser [49] deals with the technology of visualizing fictional text (poetry) with the help of emoji symbols in the Emoji Maker platform that not only activates students' thinking, but also develops creative attention, makes it possible to reproduce the meaning of poetry in a succinct way. The application of this technology has yielded the significance of introducing a computer being emoji in the study and mastering of literature is absolutely logical: an emoji, phenomenologically, logically and eidologically installed in the digital continuum, is separated from the natural language provided by (ethno)logy, and is implicitly embedded into (cosmo)logy. The technology application object is the text of the twentieth century Cuban poet José Ángel Buesa. The choice of poetry was dictated by the appeal to the most important function of emoji – the expression of feelings, emotions, and mood. It has been discovered that sensuality can reconstructed with the help of this type of meta-linguistic digital continuum. It is noted that during the emoji design in the Emoji Maker program, due to the technical limitations of the platform, it is possible to phenomenologize one's own essential-empirical reconstruction of the lyrical image. Creating the image of the lyrical protagonist sign, it was sensible to apply knowledge in linguistics, philosophy of language, psychology, psycholinguistics, literary criticism. By constructing the sign, a special emphasis was placed on the facial

emogram, which also plays an essential role in the transmission of a wide range of emotions, moods, feelings of the lyrical protagonist. Consequently, the Emoji Maker digital platform allowed to create a new model of digital presentation of fiction, especially considering the psychophysiological characteristics of the lyrical protagonist. Thus, the interpreting reader, using a specific digital toolkit – a visual iconic sign (smile) – reproduces the polylateral metalinguistic multimodality of the sign meaning in fiction. The effectiveness of this approach is verified by the poly-functional emoji ousia, tested on texts of fiction.
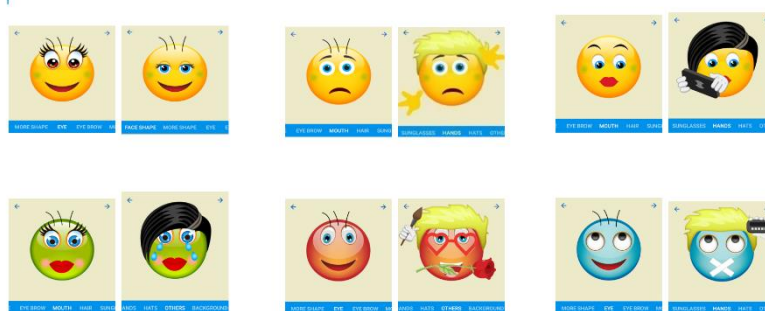

Fig. 17. Presentation of paper [49]

## 3   Session 2: Cloud-based learning environments

The article "Model of using cloud-based environment in training databases of future IT specialists" (Fig. 18) of Olha V. Korotun, Tetiana A. Vakaliuk and Vladimir N. Soloviev [48] highlights further research by the authors, begun in [40], [41], [47], [69], [108], [145], [146] and [148]. The authors substantiates and develops the model of using cloud-based environment (CBE) in the training of databases of future information technology (IT) specialists, which consists of interrelated units: target (purpose, task of using CBE), conceptual (pedagogical approaches, didactic principles), organizational and semantic (characteristics of CBE, basic requirements for CBE, subjects of training, CBE of the teacher, CBE of the student, curricula of institution of higher education, educational-methodical complex of discipline "Databases", installation and configuration of database management system, development of educational material from the database in electronic form, selection of cloud-based systems of distance learning, introduction of cloud-based systems of distance learning in the training of students' databases, selection of CBE in database training (databases, forms, methods, tools), evaluative (criteria, indicators, levels of professional and practical competence of future IT specialists on the use of CBE in database training), effective (increased formation of the information and communication technologies of future IT specialists on the use of CBE in database training).
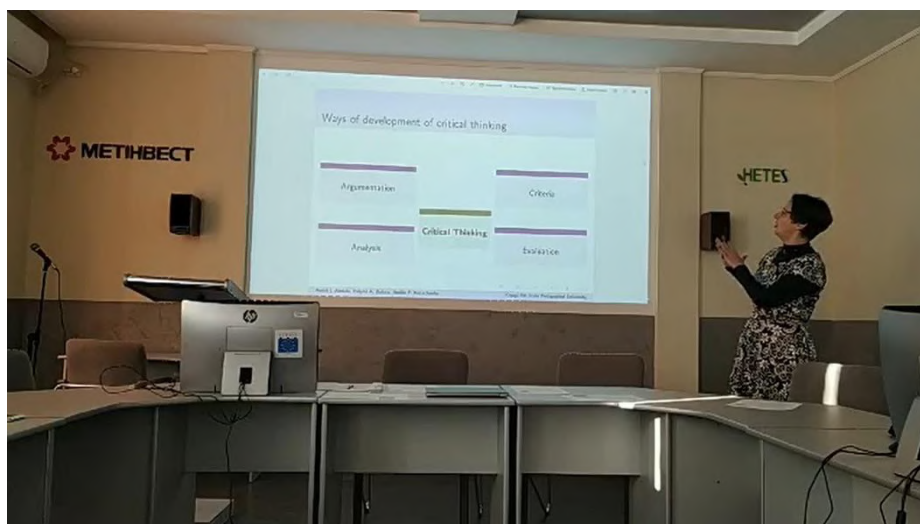
Fig. 18. Presentation of paper [48]

The article "Using Learning Content Management System Moodle in Kryvyi Rih State Pedagogical University educational process" (Fig. 19) of Iryna S. Mintii [70] highlights further research by the author, begun in [68], [101] and [144]. Author analyzes the results of the survey of 75 lecturers on using learning content management system (LCMS) Moodle in the educational process. It is defined that more than 75% of the respondents use LCMS Moodle. The lecturers up to 30 or over 60 years old, with up to 3-year-work experience in Universities need methodic assistance. Textual e-learning resources are widely used in developed courses while video and audio are not used enough. LCMS Moodle is mostly used during exams or tests and student work, and using LCMS Moodle should be intensified in lectures, laboratory and practical classes. Among the most demanded resources are label, page, file, URL, book, assignment, attendance, glossary, quiz. Thus, the popularization of other resources is identified as one of the most important. An action plan how to improve LCMS Moodle usage: increasing the IT competencies of both teachers and students – planned long-term courses "IT in full-time (blended) learning"; seminars, consultations, (group and individual forms) both on general issues, and according to the specificity of the specialties; methodic handouts and recommendations; improving logistics; improving logistical support – ensuring constant access to the Internet, updating and equipping computer classrooms; creating of transparent, predictable and attractive for authors content of the regulatory framework.
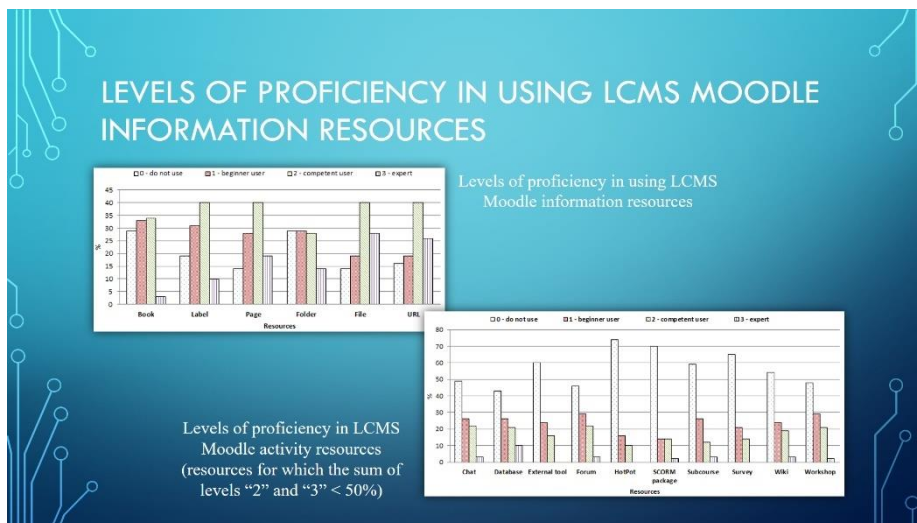
Fig. 19. Presentation of paper [70]

The article "Peculiarities of using of the Moodle test tools in philosophy teaching" (Fig. 20) of Andrii I. Abdula, Halyna A. Baluta, Nadiia P. Kozachenko and Darja A. Kassim [1] highlights further research by the authors, begun in [19], [50] and [95]. This paper considers the role of philosophy and philosophical disciplines as the means of forming general cultural competences, in particular, in the development of critical thinking. The article emphasizes that the process of forming over-subject and soft skills, which, as a rule, include also critical thinking, gets much more complicated under the conditions of the reduction in the volume of philosophical courses. The paper grounds that one of the ways to "return" philosophy to educational programmes can be the implementation of training, using the e-learning environment, especially Moodle. In addition, authors point to the expediency of using this system and, in general, e-learning as an instrument for collaborating students to the world's educational community and for developing their lifelong learning skills. The article specifies the features of providing electronic support in philosophy teaching, to which the following belongs: the difficulty of parametrizing the learning outcomes; plurality of approaches; communicative philosophy. The paper highlights the types of activities that can be implemented by tools of Moodle. The use of the following Moodle test tasks is considered as an example: test control in the flipped class, control of work with primary sources, control of self-study, test implementation of interim thematic control. The authors conclude that the Moodle system can be used as a tools of online support for the philosophy course, but it is impossible to transfer to the virtual space all the study of this discipline, because it has a significant worldview load. Forms of training, directly related to communication, are integral part of the methodology of teaching philosophy as philosophy itself is discursive, dialogical, communicative and pluralistic. Nevertheless, taking into account features of the discipline, it is possible to provide not only the evaluation function of the test control, but also to realize a number of

educational functions: updating the basic knowledge, memorization, activating the cognitive interest, developing the ability to reason and the simpler ones but not less important, – the skill of getting information and familiarization with it.

Fig. 20. Presentation of paper [1]

The article "The technique of the use of Virtual Learning Environment in the process of organizing the future teachers' terminological work by specialty" (Fig. 21) of Victoria V. Pererva, Olena O. Lavrentieva, Olena I. Lakomova, Olena S. Zavalniuk and Stanislav T. Tolmachev [96] highlights further research by the authors, begun in [55]. This paper studies the concept related to E-learning and the Virtual Learning Environment (VLE) and their role in organizing future teachers' terminological work by specialty. It is shown the creation and use of the VLE is a promising approach in qualitative restructuring of future specialists' vocation training, a suitable complement rather than a complete replacement of traditional learning. The concept of VLE has been disclosed; its structure has been presented as a set of components, such as: the Data-based component, the Communication-based, the Management-and-Guiding ones, and the virtual environments. Some VLE's potential contributions to the organization of terminological work of future biology teachers' throughout a traditional classroom teaching, an independent work, and during the field practices has been considered. The content of professionally oriented e-courses "Botany with Basis of Geobotany" and "Latin. Botany Terminology" has been revealed; the ways of working with online definer (guide), with UkrBIN National Biodiversity Information Network, with mobile apps for determining the plant species, with digital virtual herbarium, with free software have been shown. The content of students' activity in virtual biological laboratories and during virtual tours into natural environment has been demonstrated. The explanations about the potential of biological societies in social networks in view of students' terminology work have been given. According to the results of empirical

research, the expediency of using VLEs in the study of professional terminology by future biology teachers has been confirmed.

Fig. 21. Presentation of paper [96]

The article "The use of digital escape room in educational electronic environment of maritime higher education institutions" (Fig. 22) of Serhii A. Voloshynov, Halyna V. Popova, Alona Y. Yurzhenko and Ekaterina O. Shmeltser [158] highlights further research by the authors, begun in [15], [30], [44], [60] and [82]. This paper is tended to investigate the gamification activities use in educational electronic environment of maritime higher education institutions. Gamification methods with examples are described (gamification testing, QR Code quest, storytelling and escape room). Comparative characteristic of traditional learning and learning using gamification in educational electronic environment is given in the article according to different criteria: the place and role of teacher or students in the learning process; type of information communication; methods of training; equipment; level of freedom of the actions; presence of the problems in educational process; level of its control and learning outcomes. The paper also presents examples of gamification activities based on escape room quest to form communicative competency of future maritime professionals. Escape room activity presented in the article contains storytelling element, crossword and electronic testing questions of different types. Question types listed in the paper are Drag and drop to the text, Short answer and Multiple choice. Escape room activity was done by second year cadets of Kherson State Maritime Academy. According to the received results, knowledge quality increased by 10% and success by 20%. Further

investigation of gamification activities can also be done for learning system of maritime higher education institutions using simulation technologies of virtual, augmented and mixed realities.

Fig. 22. Presentation of paper [158]

4   Session 3: Cloud services for learning foreign language

The article "Improving the content of training future translators in the aspect of studying modern CAT tools" (Fig. 23) of Rostyslav O. Tarasenko, Svitlana M. Amelina and Albert A. Azaryan [136] highlights further research by the authors, begun in [134] and [135]. This article deals with the search for improving the content of training for future translators, taking into account the expansion of the use of information technologies in the field of translation. The results of a study of curriculums for translators at the universities of Europe, America and Asia are presented. The use of CAT systems in the work of translation agencies is shown. The presentation of various CAT systems in training programs for translators and their use in the market of translation services is analyzed. It has been established that both university curricula and translation agencies are oriented, as a rule, not to one, but to several CAT systems. The results of a student survey based on their practice in translation agencies are presented. Recommendations have been developed regarding the inclusion of the most common CAT systems in the training program for translators. The expediency of studying not just one, but several CAT systems is substantiated. The necessity of studying both desktop and cloud CAT systems is indicated.

The article "Integrated testing system of information competence components of future translators" of Rostyslav O. Tarasenko, Svitlana M. Amelina and Albert A. Azaryan [137] (Fig. 24) highlights further research by the authors, begun in [2]. This article deals with the diagnosis of the formation of the information competence

components of translators through testing. The use of testing to determine the level of formation of the information-thematic component of the information competence of translators is demonstrated. It has been established that one of the ways to form the information-thematic component of information competence in the aspect of studying terminology can be the use of thematic networks. The development of a thematic network is shown on the example of the thematic network "Electrical equipment". The stages of test control, which are consistent with the logic of the organization of the educational process and the process of forming the information competence of the future translator according to the scheme of the developed thematic network, have been determined. These stages are the current, thematic, modular, final testing. The main types of test tasks are defined, the combination of which allows diagnosing the level of formation of the information-thematic component of students' information competence. Criteria and principles for the selection of test tasks for each of the testing stages are proposed. The ratio of test tasks of different types and complexity at the determined testing stages has been developed. The results of an experimental study on the diagnosis of the formation of the information-thematic component of the information competence of future translators by applying the developed integrative testing system using the Moodle platform are presented.

Fig. 23. Presentation of paper [136]

The article "The use of mobile applications and Web 2.0 interactive tools for students' German-language lexical competence improvement" (Fig. 25) of Yuliya M. Kazhan, Vita A. Hamaniuk, Svitlana M. Amelina, Rostyslav O. Tarasenko and Stanislav T. Tolmachev [31] focuses on the use of mobile applications and Web 2.0 interactive tools to improve students' German-language lexical competence. The composition and structure of lexical competence are described, the order of exercises for lexical competence formation is given, the didactic possibilities of using mobile applications,

blogging technologies and other interactive tools to improve lexical skills are found out, examples of using mobile applications and Web 2.0 interactive tools in the learning process that prove their effectiveness are given. It is proved that the use of mobile applications and Web 2.0 interactive tools helps to organize students' work in and outside classrooms effectively for the formation and improvement of their lexical competence.
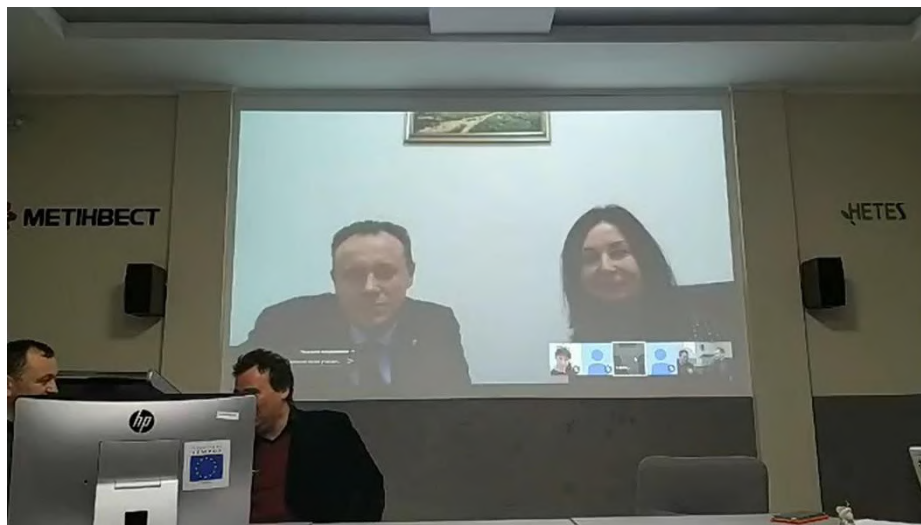
Fig. 24. Presentation of paper [137]

Fig. 25. Presentation of paper [31]

The article "Moodle course in teaching English language for specific purposes for masters in mechanical engineering" (Fig. 26) of Hanna M. Shalatska, Olena Yu. Zotova-Sadylo and Ivan O. Muzyka [113] highlights further research by the authors, begun in [54], [64] and [110]. The central thesis of this paper is that e-learning courses can have a significant impact on English language for specific purposes (ESP) proficiency of mining mechanical engineering students. The purpose of this study is to assess the effectiveness of ESP Moodle-based course "English for Mining Mechanical Engineers" and to reveal the results of its experimental approbation. In order to identify the lectures' and learners' needs we have applied the survey research. The survey confirmed the greatest demand for Moodle courses that include all the elements of a coherent training manual to provide self-development of engineering students. The interview results contributed to design of author's ESP course syllabus. The importance and originality of this study are that to approbate the course materials' effectiveness two approaches have been adopted simultaneously. The first is blended learning method based on e-learning platform applied in the experimental group and the second one is classic in-class instructor-led studying used in a control group. Students' progress in ESP proficiency has been assessed using the cross assessment method. The experiment has validated the initial hypothesis that the special online courses focused on honing foreign language skills and integrated in the domain of specific professional knowledge have a beneficial effect on students' communicative competencies in general. There were identified the advantages of self-tuition based on Moodle platform. The Moodle course lets the teachers save considerable in-class time to focus more on communicative assignments. The findings of this study have a number of practical implications in ESP online courses development.
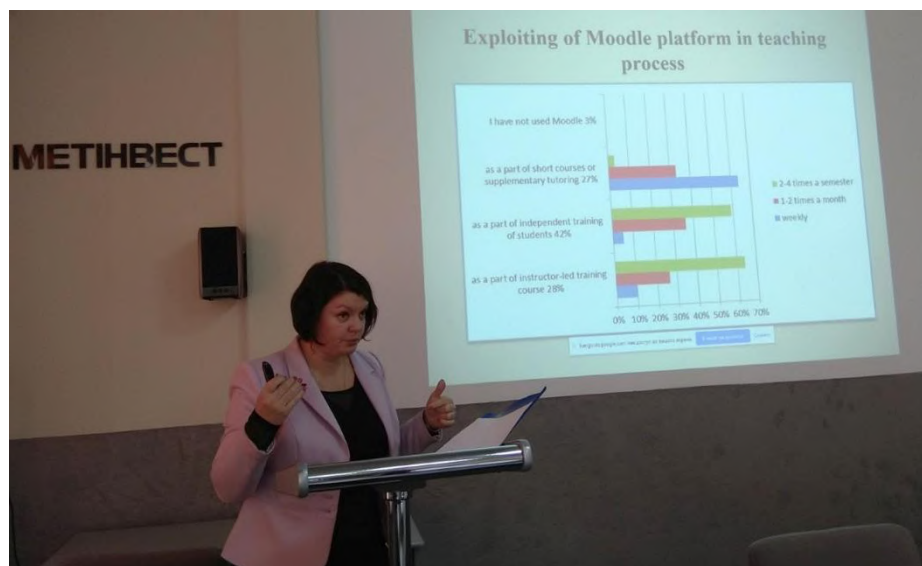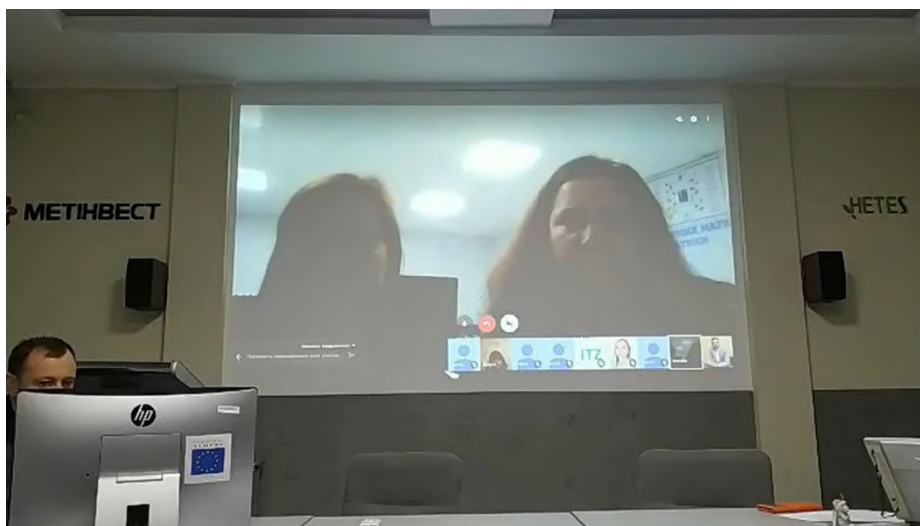

Fig. 26. Presentation of paper [113]

## 5   Session 4: Cloud technologies in STEAM education

The article "Cloud technologies for STEM education" (Fig. 27) of Nataliia V. Valko, Nataliya O. Kushnir and Viacheslav V. Osadchyi [150] highlights further research by the authors, begun in [149]. Cloud technologies being used in STEM education for providing robotics studying are highlighted in this article. Developing cloud robotic systems have not been used to their fullest degree in education but are applied by limited specialists' number. Advantages given by cloud robotics (an access to big data, open systems, open environments development) lead to work with mentioned systems interfaces improving and having them more accessible. The potential represented by these technologies make them worth being shown to the majority of teachers. Benefits of cloud technologies for robotics and automatization systems are defined. An integrated approach to knowledge assimilation is STEM education basis. The demanded stages for robotics system development are shown and cloud sources which could be possibly used are analyzed in this article.

Fig. 27. Presentation of paper [150]

The article "Analyzing of main trends of STEM education in Ukraine using stemua.science statistics" (Fig. 28) of Yevhenii B. Shapovalov, Viktor B. Shapovalov, Fabian Andruszkiewicz and Nataliia P. Volkova [119] highlights further research by the authors, begun in [115], [116], [117], [118] and [120]. Authors propose to analyses it by using SEO analysis of one of the most popular STEM-oriented cloud environment in Ukraine stemua.science. It is proposed to use the cycle for cloud-based educational environments (publishing/SEO analysis/team's brainstorm/prediction/creation of further plan) to improve their efficiency. It is found, that STEM-based and traditional publications are characterized by similar demand of educational process stakeholders. However, the way how teachers and students found the publication proves that

traditional keywords (47.99 %) used significantly more common than STEM keywords (2.67 %). Therefore, it is proved that STEM-methods are less in demand than traditional ones. However, considering the huge positive effect of the STEM method, stemua.science cloud educational environment provides a positive effect on the educational process by including the STEM-aspects during finding traditional approaches of education by stakeholders of the educational process.
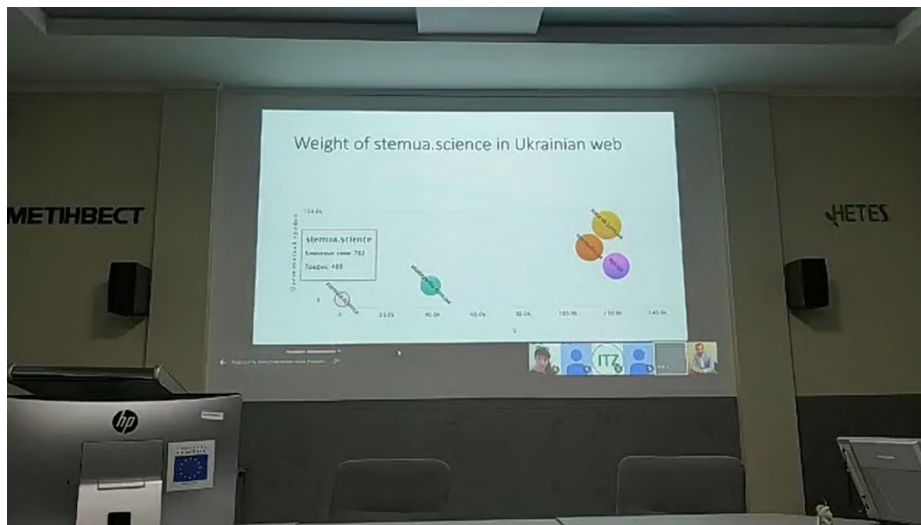
Fig. 28. Presentation of paper [119]

The article "Educational electronic platforms for STEAM-oriented learning environment at general education school" (Fig. 29) of Nataliia V. Soroko, Lorena A. Mykhailenko, Olena G. Rokoman and Vladimir I. Zaselskiy [128] highlights further research by the authors, begun in [12], [89], [51] and [156]. This article is devoted to the problem of the use of educational electronic platform for the organization of a STEAM-oriented environment of the general school. The purpose of the article is to analyze the use of educational electronic platforms for organizing the STEAM-oriented school learning environment and to identify the basic requirements for supporting the implementation and development of STEAM education in Ukraine. One of the main trends of education modernization is the STEAM education, which involves the integration between the natural sciences, the technological sciences, engineering, mathematics and art in the learning process of educational institutions, in particular, general school. The main components of electronic platform for education of the organization STEAM-oriented educational environment should be open e-learning and educational resources that include resources for students and resources for teachers; information and communication technologies that provide communication and collaboration among students; between teachers; between students and teachers; between specialists, employers, students, and teachers; information and communication technologies that promote the development of STEAM education and its

implementation in the educational process of the school; online assessment and self-assessment of skills and competences in STEAM education and information and communication technologies fields; STEAM education labs that may include simulators, games, imitation models, etc.; STEAM-oriented educational environment profiles that reflect unconfirmed participants' data, their contributions to projects and STEAM education, plans, ideas, personal forums, and more. Prospects for further research are the design of an educational electronic platform for the organization of the STEAM-oriented learning environment in accordance with the requirements specified in the paper.

THE RESULTS OF TEACHERS' SURVEY

Functions to be provided by the STEAM-oriented educational environment for supporting the implementation of the STEAM approach in the general school teaching process	Mean
ensuring student learning mobility	4.9
ensuring teachers academic mobility	4.4
carrying out Olympiads, Competitions	3.2
carrying out distance courses	2.9
providing tools for STEAM research	4.7
conducting experiments within STEAM disciplines	3.8
students' algorithmic thinking development	3.5
developing students' skills to creatively solve STEM learning problems	3.8
ensuring communication and collaboration between students; between teachers; between students, teachers, professionals and employers	3.2
providing tools for students' STEAM knowledge, skills and competences self-assessment and validation	4.5
support for student and teacher collaboration within STEAM learning projects	4.2
Total ($N = 47$)	

Fig. 29. Presentation of paper [128]

The article "Cloud technologies as a tool of creating Earth Remote Sensing educational resources" (Fig. 30) of Ihor V. Kholoshyn, Olga V. Bondarenko, Olena V. Hanchuk and Iryna M. Varfolomyeyeva [35] highlights further research by the authors, begun in [10], [11], [18], [33], [34] and [36]. This article is dedicated to the Earth Remote Sensing (ERS), which the authors believe is a great way to teach geography and allows forming an idea of the actual geographic features and phenomena. One of the major problems that now constrains the active introduction of remote sensing data in the educational process is the low availability of training aerospace pictures, which meet didactic requirements. The article analyzes the main sources of ERS as a basis for educational resources formation with aerospace images: paper, various individual sources (personal stations receiving satellite information, drones, balloons, kites and balls) and Internet sources (mainstream sites, sites of scientific-technical organizations and distributors, interactive Internet geoservices, cloud platforms of geospatial analysis). The authors point out that their geospatial analysis platforms (Google Earth Engine, Land Viewer, EOS Platform, etc.), due to their unique features, are the basis for the creation of information thematic databases of ERS. The article presents an

example of such a database, covering more than 800 aerospace images and dynamic models, which are combined according to such didactic principles as high information load and clarity.
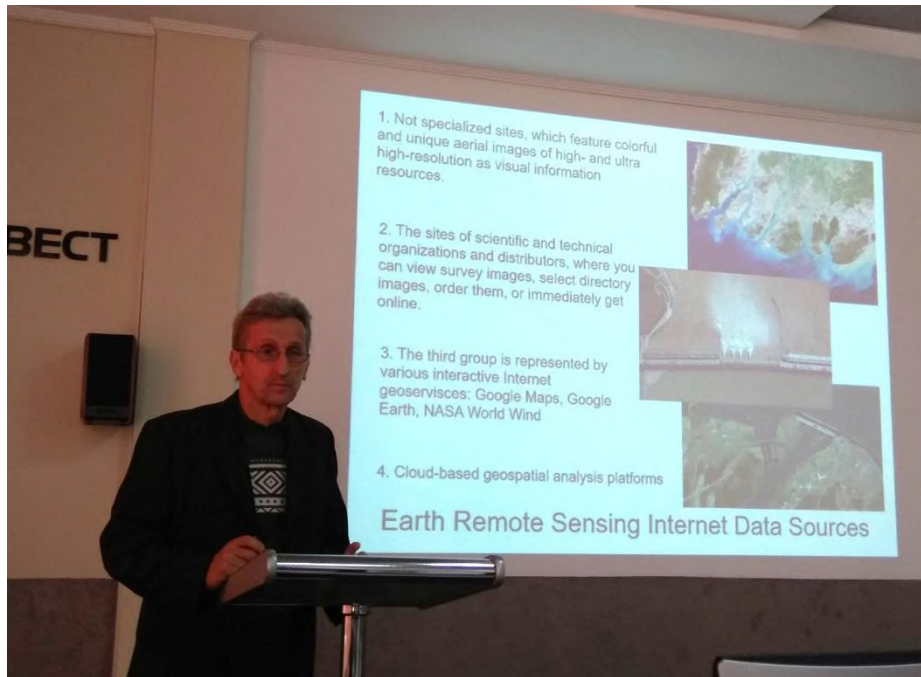
Fig. 30. Presentation of paper [35]

The article "Learning free software using cloud services" (Fig. 31) of Elena H. Fedorenko, Vladyslav Ye. Velychko, Svitlana O. Omelchenko and Vladimir I. Zaselskiy [16] highlights further research by the authors, begun in [17] and [151]. This article deals with the use of cloud technology services in the study of free software. Free software is a social phenomenon based on the philosophy of freedom and the right to intellectual creative activity. To date, a significant number of software products have been created that are licensed under free software and not used in educational activities. The conducted research revealed the factors promoting and hindering the use of free software in educational activities. Conducted questionnaires, analysis of open data, research of scientists made it possible to conclude on the expediency of using free software in educational activities. Cloud technology is not only a modern trend of effective use of information and communication technologies in professional activity, but also a proven tool for educational activities. To get acquainted with the free software, the use of cloud technologies has been helpful, which is the goal of our research.

The article "Methods of using mobile Internet devices in the formation of the general professional component of bachelor in electromechanics competency in modeling of technical objects" (Fig. 32) of Yevhenii O. Modlo, Serhiy O. Semerikov, Ruslan P.

Shajda, Stanislav T. Tolmachev, Oksana M. Markova, Pavlo P. Nechypurenko and Tetiana V. Selivanova [73] highlights further research by the authors, begun in [21], [38], [39], [42], [63], [65], [71], [72], [74], [75], [77], [78], [79], [80], [111], [112], [133] and [140]. This article describes the components of methods of using mobile Internet devices in the formation of the general professional component of bachelor in electromechanics competency in modeling of technical objects: using various methods of representing models; solving professional problems using ICT; competence in electric machines and critical thinking. On the content of learning academic disciplines "Higher mathematics", "Automatic control theory", "Modeling of electromechanical systems", "Electrical machines" features of use are disclosed for Scilab, SageCell, Google Sheets, Xcos on Cloud in the formation of the general professional component of bachelor in electromechanics competency in modeling of technical objects. It is concluded that it is advisable to use the following software for mobile Internet devices: a cloud-based spreadsheets as modeling tools (including neural networks), a visual modeling systems as a means of structural modeling of technical objects; a mobile computer mathematical system used at all stages of modeling; a mobile communication tools for organizing joint modeling activities.
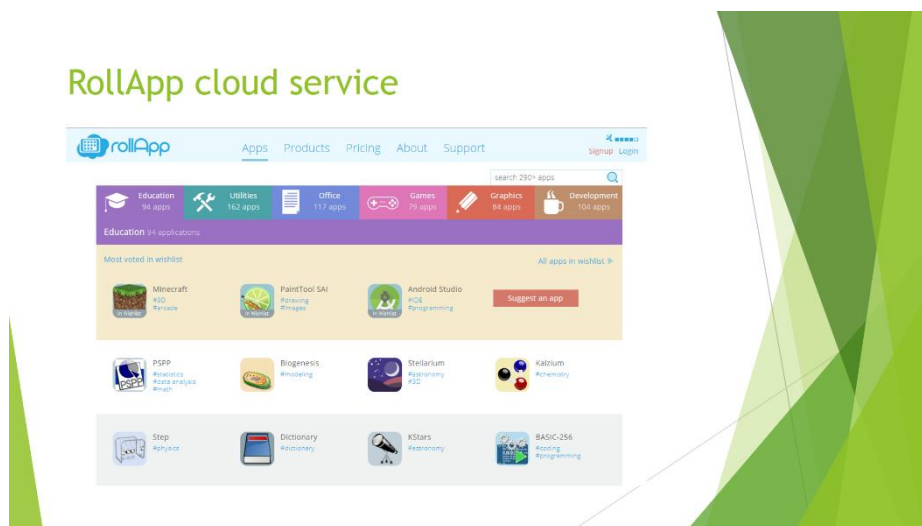
Fig. 31. Presentation of paper [16]

The article "Methodology of using mobile Internet devices in the process of biology school course studying" (Fig. 33) of Alla V. Stepanyuk, Liudmyla P. Mironets, Tetiana M. Olendr, Ivan M. Tsidylo and Oksana B. Stoliar [129] highlights further research by the authors, begun in [13], [20] and [143]. This paper considers the problem of using mobile Internet devices in the process of biology studying in secondary schools. It has been examined how well the scientific problem is developed in pedagogical theory and educational practice. The methodology of using mobile Internet devices in the process of biology studying in a basic school, which involves the use of the Play Market server

applications, Smart technologies and a website, has been created. After the analyses of the Play Market server content, there have been found several free of charge applications, which can be used while studying biology in a basic school. Among them are the following: Anatomy 4D, Animal 4D+, Augmented Reality Dinosaurs – my ARgalaxy, BioInc – Biomedical Plague, Plan+Net. Their choice is caused by the specifics of the object of biological cognition (life in all its manifestations) and the concept of bio(eco)centrism, which recognizes the life of any living system as the highest value. The paper suggests the original approach for homework checking, which involves besides computer control of students' learning outcomes, the use of Miracast wireless technology. This demands the owning of a smartphone, a multimedia projector, and a Google Chromecast type adapter. The methodology of conducting a mobile front-line survey at the lesson on the learned or current material in biology in the test form, with the help of the free Plickers application, has been presented. The expediency of using the website builder Ucoz.ua for creation of a training website in biology has been substantiated. The methodology of organizing the educational process in biology in a basic school using the training website has been developed. Recommendations for using a biology training website have been summarized. According to the results of the forming experiment, the effectiveness of the proposed methodology of using mobile Internet devices in the process of biology studying in a basic school has been substantiated.
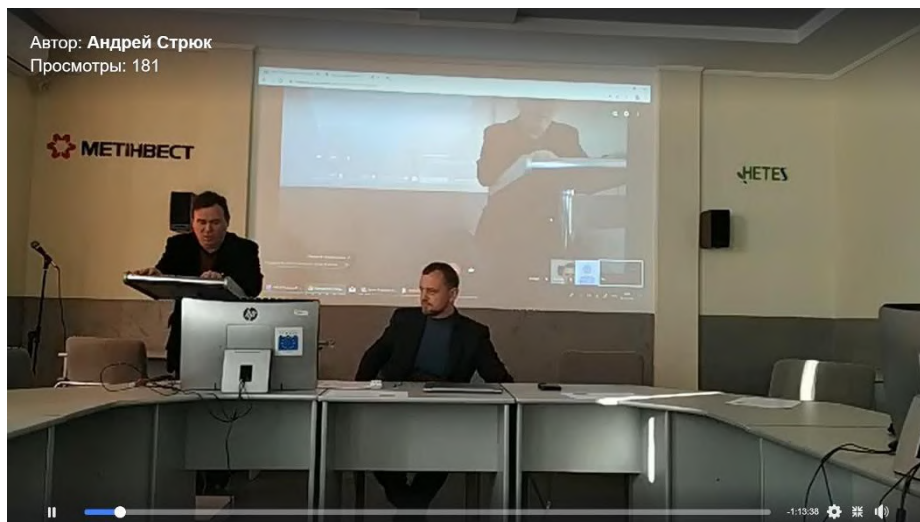
Fig. 32. Presentation of paper [73]

The article "Technologies of distance learning for programming basics lessons on the principles of integrated development of key competences" (Fig. 34) of Svitlana V. Shokaliuk, Yelyzaveta Yu. Bohunenko, Iryna V. Lovianova and Mariya P. Shyshkina [121] highlights further research by the authors, begun in [58], [66], [100], [103], [122], [123], [126], [127], [153] and [154]. The purpose of this article is to investigate the
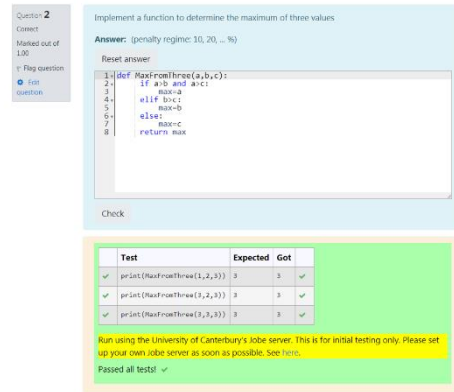
content of key competences of a secondary school student and to develop a method of teaching for the integrated development of multilingual and mathematical competences in the process of teaching Programming Basics with the help of distant technologies. The objectives of the research include generalizing and systematizing theoretical data on the structure and the content of key competences and the potential of informatics lessons for the development of separate components of multilingual and mathematical competences; generalizing and systematizing theoretical data on the ways of arranging distant support for informatics learning, Programming Basics in particular; to investigate the content and the methods of teaching Programming Basics in 7th-11th grades; to develop the e-learning Moodle course using Python for Programming Basics on the principles of integrated approach to developing separate components of multilingual and mathematical competence with determining some methodical special features while using it.

Fig. 33. Presentation of paper [129]

The article "Informatics teacher's training for design of innovative learning aids" (Fig. 35) of Liudmyla I. Bilousova, Liudmyla E. Gryzun, Julia O. Rakusa and Ekaterina O. Shmeltser [7] highlights further research by the authors, begun in [8], [9] and [84]. This paper covers practical aspects and experience of Informatics teachers' preparation for the design of innovative learning aids as one of the important components of the renewed model of teachers' training. Theoretical background of the research includes holistic educational approach and functional basics of electronic didactic aids development. The specific example of such an experience (students' project activity on the design of English multimedia tutorial for schoolchildren) is depicted in details. The prospects of further research are outlined.

Fig. 34. Presentation of paper [121]

Fig. 35. Presentation of paper [7]

The purpose of the article "Training elementary school teachers-to-be at Computer Science lessons to evaluate e-tools" (Fig. 36) of Nadiia V. Olefirenko, Ilona I. Kostikova, Nataliia O. Ponomarova, Kateryna O. Lebedieva, Vira M. Andriievska and Andrey V. Pikilnyak [85] is to develop methodological support for students' training for evaluation e-tools for young learners and to check its effectiveness experimentally. The module "Expert evaluation of the quality of e-tools for young learners" is offered for teachers-to-be. The determination of the weighting factor of each criterion by expert evaluations was organized. Educational principles, correlation e-tool content with the

curriculum, interactivity, multimedia, assistance system, ergonomic requirements are mentioned. On the basis of the criterion rank, the significance of each criterion was calculated. The indicators to determine the level of preliminary expert evaluations of e-tools are proposed. The results are calculated with nonparametric methods of mathematical statistics, in particular, Pearson's criterion χ^2. The conclusion is the expert evaluation has different activity stages, gradually becoming a common phenomenon. Training teachers-to-be for e-tool expert evaluation at Computer Science, Mathematics, English is a complex process.
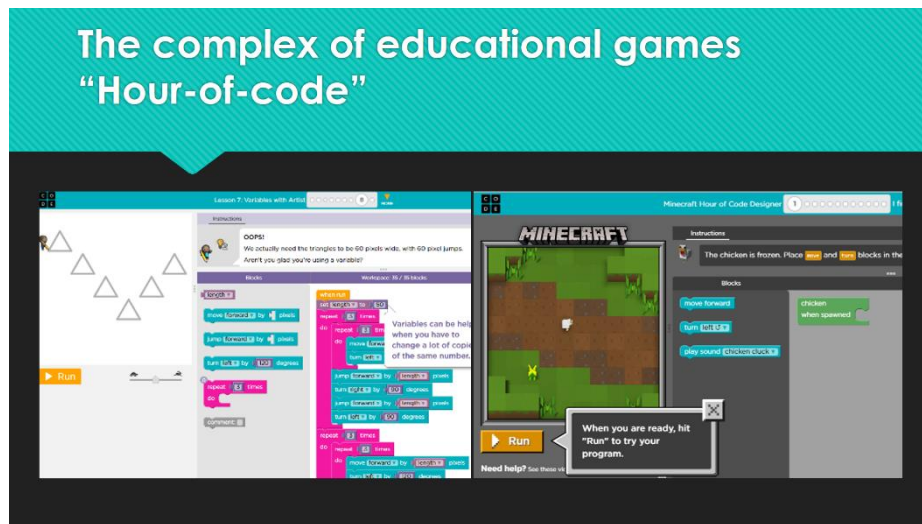
Fig. 36. Presentation of paper [85]

The article "Methodology of teaching cloud technologies to future computer science teachers" (Fig. 37) of Vasyl P. Oleksiuk and Olesia R. Oleksiuk [86] highlights further research by the authors, begun in [5], [6] and [87]. This article deals with the problem of training future computer science teachers for the use of cloud technologies. The authors analyzed courses from leading universities to study cloud technologies. On this basis the model of application and studying of cloud technologies in the process of training of future teachers of informatics was developed. The basic principles of this model are proposed: systematic, gradual, continuous. It contains target, content, operating and effective component. Therefore, the stages of using cloud computing technology were proposed: as a means of organizing learning activities, as an object of study, as a means of development. The article summarizes the experience of designing a cloud-based learning environment. The model is based on such philosophical and pedagogical approaches as systemic, competent, activity, personality-oriented, synergistic. Hybrid cloud is the most appropriate model for this environment. It combines public and private cloud platforms. Cloud-based learning environment also requires the integration of cloud and traditional learning tools. The authors described the most appropriate teaching methods for cloud technologies such as classroom

learning, interactive and e-learning, practical methods. The article contains many examples of how to apply the proposed methodology in a real learning process.
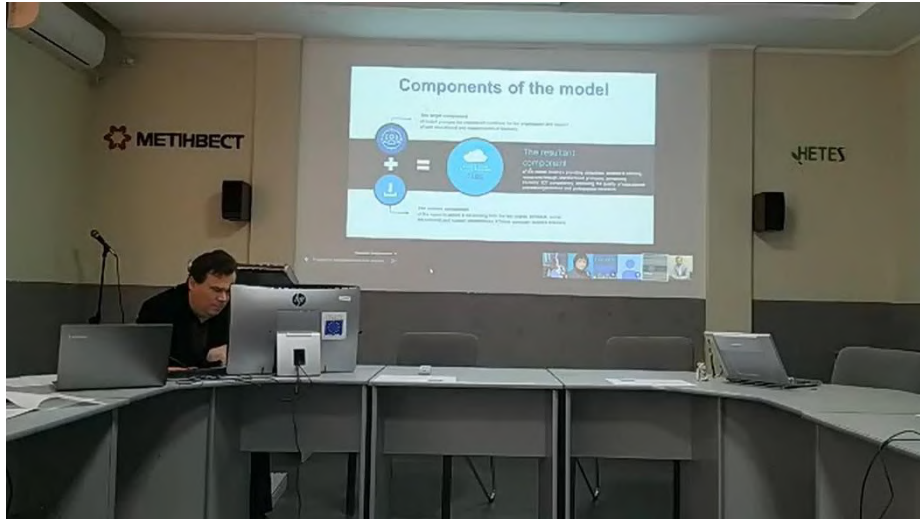
Fig. 37. Presentation of paper [86]

The article "The approaches to Web-based education of computer science bachelors in higher education institutions" (Fig. 38) of Svitlana L. Proskura and Svitlana H. Lytvynova [106] highlights further research by the authors, begun in [61]. This article is devoted to the problem of organizing of Web-based education of bachelors, and the bachelors of computer science in particular. The IT industry puts forward new requirements for future IT professionals training. This, in its turn, requires the educational process modernization: content specification, updating of forms, methods and means of training to meet the demands of socio-economic development of the society in general and bachelors of computer science in particular. The article analyzes and clarifies the notion of Web-based education of bachelors; as well as a line of approaches, such as approaches to the organization of Web-based learning for A La Carte, Station Rotation, Lab Rotation, Individual Rotation, Flipped Learning scenario; the necessity of cloud computing and virtual classroom use as a component of Web-based learning is substantiated. It is established that with the advent of a large number of cloud-based services, augmented and virtual realities, new conditions are created for the development of skills to work with innovative systems. It is noted that the implementation of the approaches to the organization of student Web-based education is carried out on international level, in such projects as Erasmus+ "Curriculum for Blended Learning" and "Blended learning courses for teacher educators between Asia and Europe". The article features the results of programming students survey on the use of Web-based technologies while learning, namely the results of a new approach to learning organization according to the formula – traditional (30%), distance (50%) and project (20%) training.

Fig. 38. Presentation of paper [106]

The article "Motivation readiness of future software engineer's professional self-improvement and prospects of its formation in college cloud environment" (Fig. 39) of Larisa M. Petrenko, Iryna P. Varava and Andrey V. Pikilnyak [98] highlights further research by the authors, begun in [24], [97] and [162]. The main article purpose is to analyze the state of the form of motivational readiness for future programmer's professional self-improvement, to identify problems of its formation in colleges and to determine the ways of its increase as one of the main factors of quality improvement. To achieve it, a complex of theoretical and empirical methods was used, with help of which a number of problems were revealed which slow down the process of improving the quality of future programmers professional training. To eliminate them, a system of phased motivation for future specialists professional self-improvement has been developed on the basis of general secondary education, which can be integrated into the teaching of both general education and professionally-oriented disciplines; ways of improving the quality of the educational process through the creation of a cloud of oriented environment, the introduction of innovative teaching technologies, special training of teachers in the system of professional development.

The article "Web-based online course training higher school mathematics teachers" (Fig. 40) of Kateryna V. Vlasenko, Sergei V. Volkov, Daria A. Kovalenko, Iryna V. Sitak, Olena O. Chumak and Alexander A. Kostikov [155] looks into the problem of theoretical aspects of using Web 2.0 technology in higher education. This paper describes answers of 87 respondents who have helped to identify the most required types of educational content for the integration to pages of the online course training higher school mathematics teachers. The authors carry out a theoretical analysis of researches and resources that consider the development of theoretical aspects of using web tools in higher education. The research presents the characteristics common to online courses, principles of providing a functioning and physical placement of online

systems in webspace. The paper discusses the approaches of creating and using animated content in online systems. The authors describe the methods of publishing video content in web systems, in particular, the creation and use of video lectures, animation, presentations. This paper also discusses several of the existing options of integrating presentations on web pages and methods of integrating mathematical expressions in web content. It is reasonable to make a conclusion about the expediency of promoting online courses, the purpose of which is to get mathematics teachers acquainted with the technical capabilities of creating educational content developed on Web 2.0 technology.

Fig. 39. Presentation of paper [98]

The article "Auto Checker of Higher Mathematics – an element of mobile cloud education" (Fig. 41) of Tetyana I. Zhylenko, Nataliia S. Martynova, Irina A. Shuda, Yevhenii A. Chykalov, Danyla A. Kuzmuk [161] presents the author's development from the field of mobile cloud education in higher mathematics. The design architecture of this application is described in detail: QR generator and scanner, authorization, sending tasks. Block diagrams and images are presented that clearly demonstrate the operation of the application. Authors showed an example of solving the integral from the section of integral calculus for higher mathematics and showed how to download the answer in the form of a QR code and find out whether it is correct or incorrect (this can be seen by the color on the smart phone screen). It is shown how this technology helps the teacher save time for checking assignments completed by students. This

confirms its effectiveness. Such an application provides students and teachers with the ability to store and process data on a cloud computing platform.
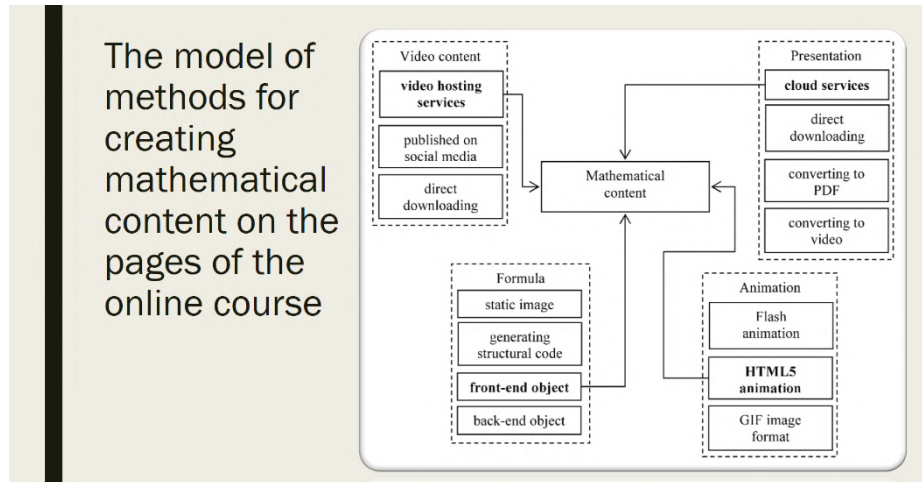
Fig. 40. Presentation of paper [155]

Fig. 41. Presentation of paper [161]

The article "E-learning as a mean of forming students' mathematical competence in a research-oriented educational process" (Fig. 42) of Mariia M. Astafieva, Oleksii B. Zhyltsov, Volodymyr V. Proshkin and Oksana S. Lytvyn [3] is devoted to the substantiation of approaches to the effective use of advantages and minimization of disadvantages and losses of e-learning as a mean of forming mathematical competence

of students in the conditions of research-oriented educational process. As a result of the ascertaining experiment, e-learning has certain disadvantages besides its obvious advantages (adaptability, possibility of individualization, absence of geographical barriers, ensuring social equality, unlimited number of listeners, etc.). However, the nature of these drawbacks lies not as much in the plane of opportunity itself as in the ability to use them effectively. On the example of the e-learning course (ELC) "Mathematical Analysis" (Calculus) of Borys Grinchenko Kyiv University, which is developed on the basis of the Moodle platform, didactic and methodical approaches to content preparation and organization of activities in the ELC in mathematics are offered. Given the specifics of mathematics as a discipline, the possibility of using ELCs to support the traditional learning process with full-time learning is revealed, introducing a partially mixed (combined) model. It is emphasized that effective formation of mathematical competence of students by means of e-learning is possible only in the conditions of research-oriented educational environment with active and concerned participation of students and partnership interaction. The prospect of further research in the analysis of e-learning opportunities for the formation of students' mathematical competence, in particular, research and investigation tools, and the development of recommendations for the advanced training programs of teachers of mathematical disciplines of universities are outlined.
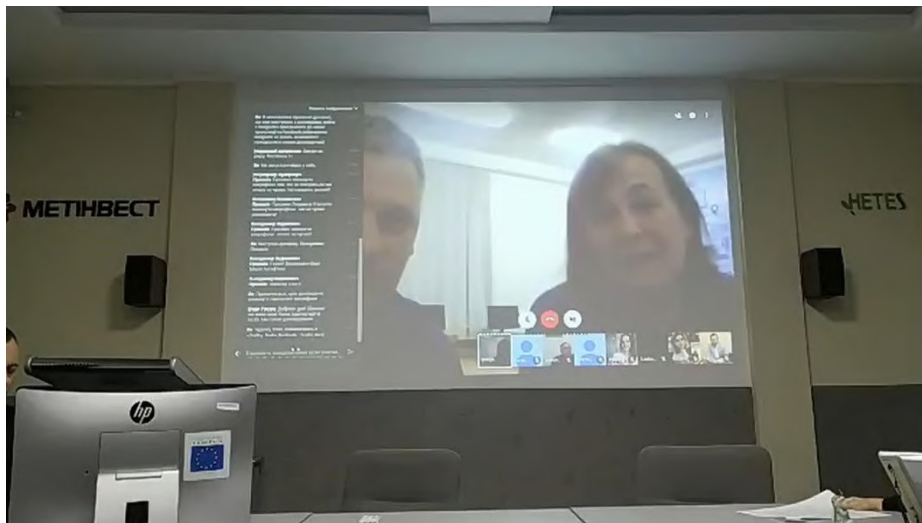
Fig. 42. Presentation of paper [3]

The article "The use of the cloud services to support the math teachers training" (Fig. 43) of Mariya P. Shyshkina and Maiia V. Marienko [125] highlights further research by the authors, begun in [62], [83], [104], [105] and [124]. The development of the information society and technological progress are significantly influenced by the learning tools. Therefore, to the variety of tools that could be used to support the study of any discipline new ones emerging lately are continuously being added. Along

with the great deal of systems of computer mathematics (SCM), web-oriented versions of SCM mathematical applications and other math learning tools the cloud-based versions of mathematical software such as MapleNet, MATLAB web-server, WebMathematica and others are now being used. These tools accomplishment becomes the essential part of training mathematics teachers. Domestic and foreign experiences of using cloud services for forming professional competences of mathematics teachers are analyzed. The place of the CoCalc within the system of mathematical disciplines learning tools is investigated. The task of improving the math teachers' ICT competence by means of cloud services use in the process of training is considered. Among the new forms of learning rising along with the cloud services dissemination are such as collaborative learning, inquiry-based learning, person-oriented learning. At the same time, the use of the appropriate cloud service in the study of some mathematical discipline improves the assimilation of the learning material and improves the knowledge acquisition process on most topics. The analysis of current research of Ukrainian scientists on the problem in question shows that the progress is underway as for further elaboration and implementation of new learning methods and techniques of using cloud services in the higher education institutions.

Fig. 43. Presentation of paper [125]

The article "Application of GeoGebra in Stereometry teaching" (Fig. 44) of Tetiana H. Kramarenko, Olha S. Pylypenko and Ivan O. Muzyka [52] highlights further research by the authors, begun in [53]. The purpose of this study is improving of the methodology of teaching Mathematics using cloud technology. The task of the study is identifying the problems that require a theoretical and experimental solution. The object of the study is the educational process in the higher education institution, the subject of the study is modern information and communication technologies. The result of the study is the teaching aids of pedagogically considered and appropriate combination of

traditional and modern teaching medium implemented into the educational process. The possibilities of using cloud technologies and Dynamic Mathematics system GeoGebra in the educational process on the example of Stereometry profile training are revealed. The use of GeoGebra Dynamic Mathematics in Stereometry teaching will assist the forming of students' STEM competencies. In order to orient Mathematics and Computer Science teachers to introduce the elements of STEM education, it is advisable to use cloud-based learning tools, such as GeoGebra, in their learning.
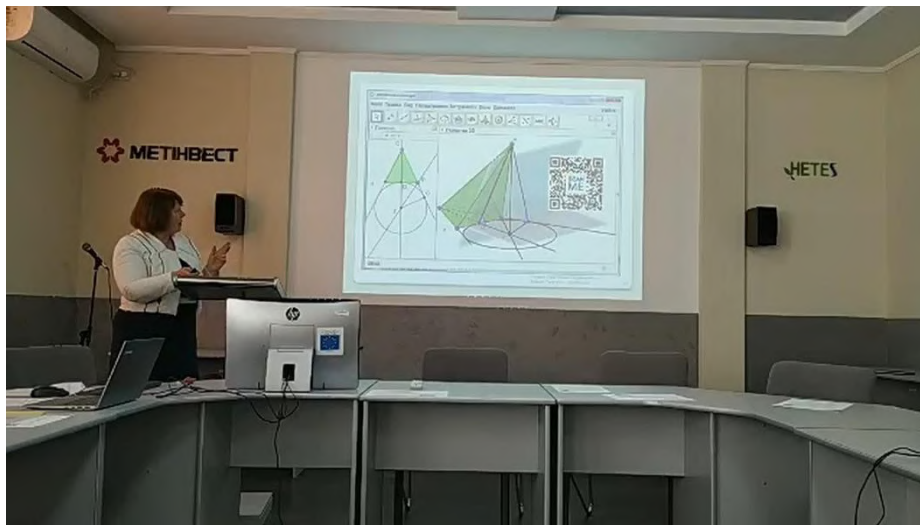
Fig. 44. Presentation of paper [52]

6   Conclusion

The vision of the CTE 2019 is provides a premier interdisciplinary platform for researchers, practitioners and educators to present and discuss the most recent innovations, trends, and concerns as well as practical challenges encountered and solutions adopted in the fields of educational technology.

The workshop has successfully performing forum to transferring and discussing research result among the researcher, students, government, private sector or industries. Participants and presenters from several countries such as Egypt, Iraq, Israel, Poland, Ukraine have attended the workshop to share their significant contribution in research related to Cloud Technologies in Education.

The seventh instalment of CTE was organised by Kryvyi Rih National University, Ukraine (with support of the rector Mykola I. Stupnik) in collaboration with Kryvyi Rih State Pedagogical University, Ukraine (with support of the rector Yaroslav V. Shramko), Institute of Information Technologies and Learning Tools of the NAES of Ukraine (with support of the director Valeriy Yu. Bykov) and Ben-Gurion University of the Negev, Israel (with support of the rector Chaim J. Hames).

We are thankful to all the authors who submitted papers and the delegates for their participation and their interest in CTE as a platform to share their ideas and innovation. Also, we are also thankful to all the program committee members for providing continuous guidance and efforts taken by peer reviewers contributed to improve the quality of papers provided constructive critical comments, improvements and corrections to the authors are gratefully appreciated for their contribution to the success of the workshop.

We hope you enjoy this workshop and meet again in more friendly, hilarious, and happiness of further CTE 2020.

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