

# ICT for disaster-resilient education and training

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## Abstract

The 3L-Person 2022 workshop was held in Kryvyi Rih, Ukraine, on October 25, 2022. The workshop aimed to provide a platform for researchers and practitioners from different domains and regions, who are interested in exploring the opportunities and challenges of information and communication technologies (ICT) for lifelong learning and professional development. The workshop addressed various topics related to the design, development, evaluation, and application of ICT for education and training, such as personal learning environment design, advanced ICT for professional retraining and training in the workplace, blended and remote learning/teaching with emerging ICT, educational robots, databases and language technologies for open learning and research, ICT in education of a person with special needs, ICT in education safety and security, ICT-support of STEM education and professional career, and synthetic learning environment. The workshop featured 13 papers selected by a diverse and qualified program committee. The workshop also facilitated the discussion and networking among the participants, who shared their experiences and insights on the emerging trends and issues in this interdisciplinary field. This paper presents the theme, aims, topics of interest, program committee, accepted papers, and outcomes of the workshop.

## Keywords

ICT, education, training, learning, workshop

## 1. Introduction

### 1.1. 3L-Person in a glance

The **International Workshop on Professional Retraining and Life-Long Learning using ICT: Person-oriented Approach** (3L-Person) is a peer-reviewed workshop. The work-

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*3L-Person 2022: VII International Workshop on Professional Retraining and Life-Long Learning using ICT: Person-oriented Approach, October 25, 2022, Kryvyi Rih (Virtual), Ukraine*

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shop's goal is to bring together researchers and practitioners from the areas of Information/Communication Technologies (ICT) and Education/Training (E/T), to support the bridging process between ICT opportunities and education/training needs. ICT have a profound impact on education and training, offering new opportunities and challenges for learners, educators, and researchers. However, there is a need for a better understanding of the potential and limitations of these technologies, as well as the best practices and methodologies for their design and implementation. The workshop is cover such topics as ICT tools' design for: remote learning, adaptive learning, day-to-day support for individual's learning, synthetic learning environment, life-long learning of individuals, learning in the workplace, learning/training process of individuals with special needs, teaching/learning safety and security, vocational training and carrier guiding, etc.

The workshop is also address the issues of time, space, and cultural differences of learners and teachers, and how ICT can help to overcome them. The specific goal of this activity is to facilitate a broader understanding of the promise and pitfalls of these technologies and working (learning/teaching) environments in global education/development settings, with special regard to the human as subject in the system and to the integration of humans with the technical, didactic, and organizational subsystems.



Figure 1: 3L-Person logo.

## 1.2. 3L-Person aims

The workshop aims to achieve the following objectives:

1. The identification of needs and opportunities in which coordinated research efforts are required to expand and understand the emerging technologies in education (such as cloud computing, mobile tools and services, network infrastructures, systems of computer modeling, simulation, AR/VR/MR etc.), their effectiveness, the potential risks, and the potential benefits of new ways to educate, learn and collaborate.
2. The presentation and discussion of novel ICT solutions in E/T that can support and enhance lifelong learning and professional development of individuals and organizations.
3. The dissemination of information and experiences about the current trends and future prospects of global education in the near future, and how ICT can facilitate them.

## 1.3. 3L-Person topics of interest

3L-Person topics of interest since 2019 [1, 2]:

- **Personal Learning Environment Design:** person-oriented tools, adaptive and intuitive learning, cloud-based learning environment, social networking, etc.
- **Advanced ICT for Professional Retraining and Training in the Workplace:** cloud-based learning tools, mobile-based learning, learning networking tools, etc.

- **Blended and Remote Learning/Teaching with Emerging ICT:** remote learning and virtual classroom, flipped classroom, network-oriented collaborative learning, home-schooling, etc.
- **Educational Robots, Databases and Language Technologies for Open Learning and Research:** innovative and intelligence tools for data analysis; network labs, robotics learning tools; augmented cognition; machine learning; open learning and research platforms etc.
- **ICT in Education of a Person with Special Needs:** openness and accessibility of education, e-inclusion; using ICT in educating gifted, underachieved, disabled individuals; ICT for a human development, etc.
- **ICT in Education Safety and Security:** human-system integration, human factors, quality evaluation of electronic learning resources, etc.
- **ICT-support of STEM Education and Professional Career:** network labs, robust intelligence, synthetic environment, augmented cognition, 3D technology, systems of computer modeling and simulation, etc.
- **Synthetic learning environment:** AR/VR/MR, AI in education, computer modeling in teaching process etc.

This volume contains the papers presented at the VII International Workshop on Professional Retraining and Life-Long Learning using ICT: Person-oriented Approach (3L-Person 2022) held on October 25, 2022 in Ukraine.

The workshop received 19 submissions. Each submission was reviewed by at least 3 program committee members. On average, each submission was reviewed by 3.2 program committee members. Based on the reviews, 13 papers were accepted for this volume as regular papers, 11 as full papers, and 2 as short papers.

## 2. Program committee

- *Marc Baaden*, CNRS, France [3]
- *Liudmyla Bilousova*, Academy of Cognitive and Natural Sciences, Ukraine & Israel [4]
- *Pablo Garcia Bringas*, University of Deusto, Spain [5]
- *Oleksandr Burov*, Institute for Digitalisation of Education of the NAES of Ukraine, Ukraine & University of Vienna, Austria [6]
- *Nadire Cavus*, Near East University, North Cyprus [7]
- *El-Sayed M. El-Horbaty*, Ain Shams University, Egypt [8]
- *Ramón Fabregat*, University of Girona, Spain [9]
- *Irina Georgescu*, Bucharest University of Economics, Romania [10]
- *Mustansar Ali Ghazanfar*, University of East London, United Kingdom [11]
- *Anita Goel*, University of Delhi, India [12]
- *Carina S. Gonzalez*, Universidad de La Laguna, Spain [13]
- *Sven Hartmann*, Clausthal University of Technology, Germany [14]
- *Michail Kalogiannakis*, University of Crete, Greece [15]

- *Arnold Kiv*, Ben-Gurion University of the Negev, Israel [16]
- *Hennadiy Kravtsov*, Kherson State University, Ukraine [17]
- *Olena Kuzminska*, National University of Life and Environmental Sciences of Ukraine, Ukraine [18]
- *Francesco Lelli*, Tilburg University, Netherlands [19]
- *Chung-Sheng Li*, PwC, United States [20]
- *Piotr Lipiński*, Technical University of Lodz, Poland [21]
- *Alessandra Lumini*, University of Bologna, Italy [22]
- *Svitlana Lytvynova*, Institute for Digitalisation of Education of the NAES of Ukraine, Ukraine [23]
- *Maiia Marienko*, Institute for Digitalisation of Education of the NAES of Ukraine, Ukraine [24]
- *Rashid Mehmood*, King Abdulaziz University, Saudi Arabia [25]
- *Iryna Mintii*, Institute for Digitalisation of Education of the NAES of Ukraine, Ukraine [26]
- *Natalia Morze*, Borys Grinchenko Kyiv University, Ukraine [27]
- *Vincenzo Moscato*, University of Naples “Federico II”, Italia [28]
- *Thomas Moser*, St. Pölten University of Applied Sciences, Austria [29]
- *Ranesh Kumar Naha*, University of Tasmania, Australia [30]
- *Viacheslav Osadchyi*, Borys Grinchenko Kyiv University, Ukraine [31]
- *Liubov Panchenko*, Igor Sikorsky Kyiv Polytechnic Institute, Ukraine [32]
- *Stamatios Papadakis*, University of Crete, Greece [33]
- *Olha Pinchuk*, Institute for Digitalisation of Education of the NAES of Ukraine, Ukraine [34]
- *Michael M. Resch*, HLRS, University of Stuttgart, Germany [35]
- *Nina Rizun*, Gdańsk University of Technology, Poland [36]
- *Abdel-Badeeh M. Salem*, Ain Shams University, Egypt [37]
- *Demetrios G. Sampson*, University of Piraeus, Greece [38]
- *Antonio Sarasa Cabezuelo*, Universidad Complutense de Madrid, Spain [39]
- *Olena Semenikhina*, Sumy State A.S.Makarenko Pedagogical University, Ukraine [40]
- *Serhiy Semerikov*, Kryvyi Rih State Pedagogical University, Ukraine [41]
- *Liyang Shen*, Anhui University, China [42]
- *Prem Kumar Singh*, Gandhi Institute of Technology and Management, India [43]
- *Mariya Shyshkina*, Institute for Digitalisation of Education of the NAES of Ukraine, Ukraine [44]
- *Oleg Spirin*, Institute for Digitalisation of Education of the NAES of Ukraine, Ukraine [45]
- *Andrii Striuk*, Kryvyi Rih National University, Ukraine [46]
- *Daniel Thalmann*, Swiss Federal Institute of Technology in Lausanne, Switzerland [47]
- *Tetiana Vakaliuk*, Zhytomyr Polytechnic State University, Ukraine [48]
- *Vladyslav Velychko*, Donbas State Pedagogical University, Ukraine [49]
- *Kateryna Vlasenko*, National University of Kyiv Mohyla Academy, Ukraine [50]
- *Longkai Wu*, National Institute of Education, Singapore [51]
- *Eftim Zdravevski*, University Ss Cyril and Methodius, Macedonia [52]

### 3. Articles overview

The paper “Online training of youth volunteers for projecting socially significant actions in the COVID-19 pandemic” [53] by Oleksandr G. Kucheryaviy and Dmytro G. Gryshchuk addresses the challenge of engaging youth volunteers in meaningful social projects during the COVID-19 pandemic, which has disrupted many aspects of life and increased the demand for humanitarian assistance. The paper proposes a novel online training program that aims to equip youth volunteers with the necessary competences and skills to design and implement socially significant projects in the context of the global health crisis.

The paper presents the theoretical and practical foundations of the program, which is based on several principles, such as: online dominance, ICT literacy, project-based learning, gerontological and psychotherapeutic knowledge, self-preservation and self-organization skills, emotional and personal support. The paper also describes the content and methods of the program, which include: motivational and organizational techniques, stimulation of project activity, humanistic and interactive approaches.

The paper reports on the experimental testing of the program and the assessment of its effectiveness using the criteria of readiness for volunteer project action. The paper shows that the program has a positive impact on the participants’ knowledge, skills, attitudes, and values related to volunteer projects. The paper concludes with some implications and recommendations for further research and practice.

The paper “CoCalc: an integrated environment for open science education in informatics and mathematics” [54] by Pavlo V. Merzlykin, Maiia V. Marienko, and Svitlana V. Shokaliuk, delves into the exploration of CoCalc, a cloud-based platform designed to facilitate open science education. CoCalc serves as an integrated environment offering a wide array of services and tools that empower users to create, share, and collaborate on computational documents supporting various programming languages and frameworks.

In this comprehensive analysis, the authors aim to identify the structural components of CoCalc ideally suited for educational purposes within the domains of informatics and mathematics. They investigate the potential use cases and benefits of CoCalc for these disciplines while scrutinizing the inner workings of the CoCalc kernel. The paper illuminates the features within CoCalc that can enhance diverse learning activities, including interactive coding, data analysis, visualization, simulation, testing, and assessment.

Furthermore, the authors delve into the challenges and opportunities presented by the integration of CoCalc into open science education. These considerations encompass accessibility, reproducibility, transparency, and ethical aspects. The paper concludes by asserting that CoCalc stands as a promising and versatile environment capable of elevating the quality and effectiveness of informatics and mathematical education. It accomplishes this by providing a comprehensive and adaptable suite of services and tools tailored to the unique requirements of these disciplines.

The paper “Internet resources for foreign language education in primary school: challenges and opportunities” [55] by Inna A. Kravtsova, Alina O. Mankuta, Vita A. Hamaniuk, Olga S. Bilozir and Andrei V. Voznyak aims to examine how Internet resources can be used to improve the quality and effectiveness of foreign language education in primary school in Ukraine. The paper is based on the premise that foreign language education is a key component of the New Ukrainian School concept, which is a reform initiative that seeks to create a school that is

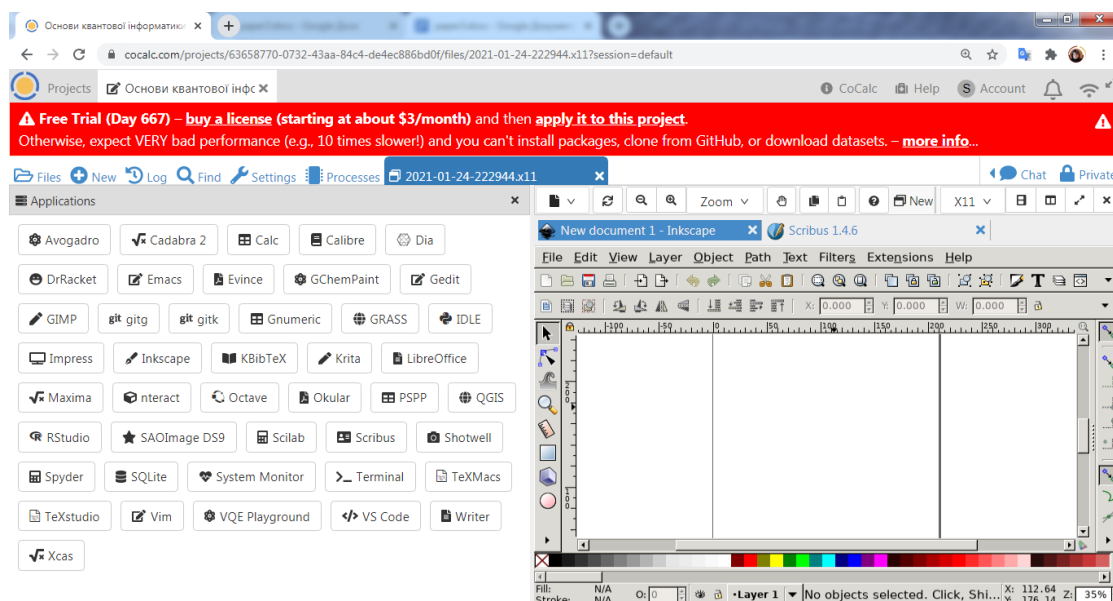


Figure 2: Presentation of paper [54].

pleasant, modern, and relevant for students. The paper identifies the main challenges and opportunities of developing professional competence of primary school teachers in teaching foreign languages, such as the need for updating the curriculum, enhancing teacher training, and reducing bureaucracy. The paper also provides a comprehensive overview of various Internet resources that can support foreign language learning in primary school, such as online platforms, games, videos, podcasts, blogs, and social networks. The paper evaluates the advantages and disadvantages of these resources in terms of accessibility, usability, interactivity, motivation, and feedback. The paper concludes that Internet resources can help modernize foreign language education in primary school and align it with the New Ukrainian School concept, but they also require careful selection, adaptation, and integration into the teaching process.

The paper “Digital resources for developing key competencies in Ukrainian education: teachers’ experience and challenges” [56] by Oksana V. Ovcharuk, Iryna V. Ivaniuk, Oleksandr Yu. Burov, Maiia V. Marienko, Nataliia V. Soroko, Olena O. Gritsenchuk and Oksana Y. Kravchyna investigates how Ukrainian teachers use various digital resources in their classroom activities to develop key competencies in their students, such as digital, civic, and entrepreneurship skills. The paper focuses on three key subject areas that are aligned with the European trends and the UN ‘2030 Agenda for Sustainable Development’: STEM education, education for democratic citizenship, and entrepreneurship education. The paper presents and evaluates different online tools and digital resources that support these subject areas, such as online platforms, games, videos, podcasts, blogs, and social networks. The paper also showcases the national online resources that promote a sustainable, multicultural, and democratic learning environment for teachers and students. The paper analyses the teachers’ experience and challenges of using digital resources in their teaching practice, such as how they integrate digital technologies into their curriculum, how they identify and address the needs and didactic approaches of their



Figure 3: Presentation of paper [55].

students, how they solve technical problems, and how they assess the gaps in their own and their students' digital and civic competencies. The paper highlights the benefits and challenges of using digital resources for teachers, such as improving and updating their digital competence, creating and maintaining a creative and sustainable digital environment in their schools, seeking opportunities for self-development and digital transformation, and organising distance learning in response to the COVID-19 pandemic. The paper aims to share the examples and the experience of Ukrainian educators who use digital educational resources to build a digital environment and develop key competencies in their students. The paper suggests that the presented experience can be applied in other schools and help to address the existing gaps in the teachers' use of digital learning tools.

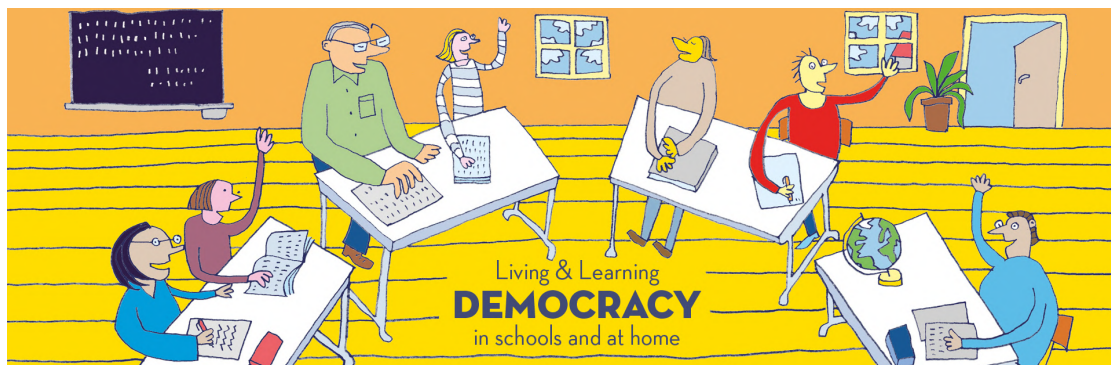


Figure 4: Presentation of paper [56].

The paper “YouTube as an open resource for foreign language learning: a case study of German” [57] by Olha V. Chorna, Vita A. Hamaniuk, Oksana Y. Markheva and Andrei V. Voznyak examines how YouTube can be used as an open resource for learning German as a foreign language in higher education, especially at a pedagogical university. The paper is divided into three main parts:

- The first part provides the theoretical background and context of the paper, explaining the importance and benefits of using information and communication technologies (ICT) and online resources for foreign language learning, especially in the context of distance learning. The paper also reviews the literature on the use of YouTube for language learning and identifies the criteria for selecting and evaluating YouTube video materials for teaching German.
- The second part presents the results of a practical analysis of several YouTube channels that offer video materials for learning German, such as Easy German, Deutsch für Euch, Learn German with Anja, and Deutsch mit Marija. The paper provides a brief didactic analysis of their products and suggests how to transform them into methodological material for the practical course of German language for future teachers. The paper also explores the potential of using alternative YouTube resources for distance learning, such as videos with subtitles, videos with interactive quizzes, videos with role-playing scenarios, and videos with mediation tasks. The paper explains how these resources

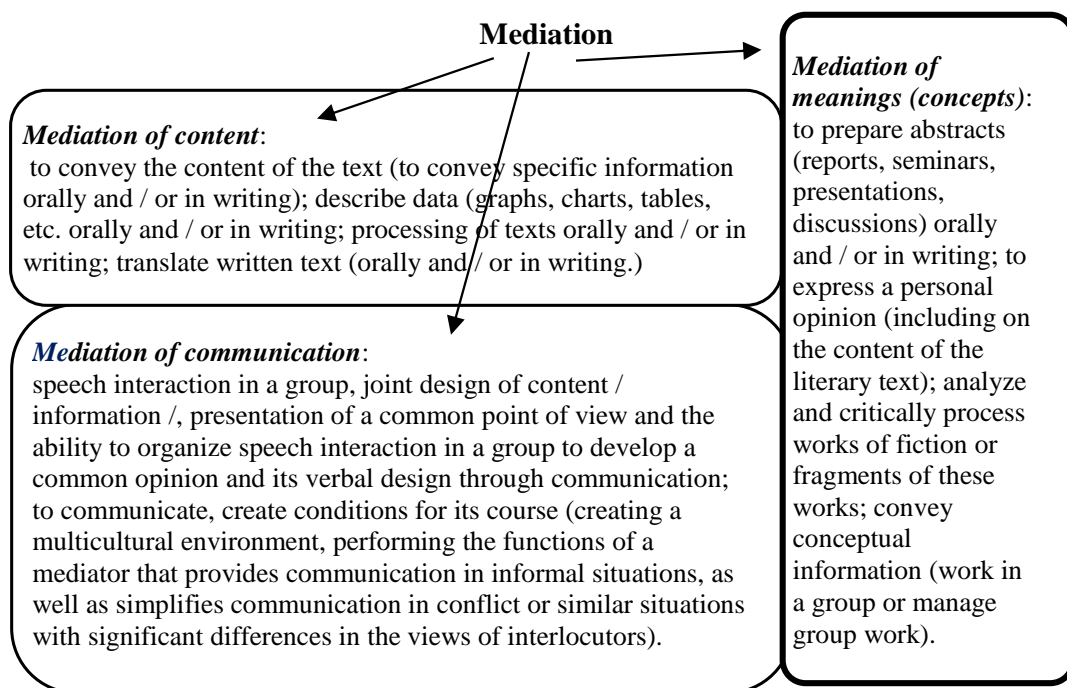


Figure 5: Presentation of paper [57].



can help develop mediation skills as defined by the CEFR Companion Volume with New Descriptors.

- The third part discusses the open resources ONCOO and TWINE, which can be used to foster the autonomy of future foreign language teachers. ONCOO is an online platform that allows teachers to create interactive learning scenarios with videos, texts, images, and audio files. TWINE is an online tool that allows teachers to create interactive stories with branching paths and choices. The paper describes the features and advantages of these resources and provides some examples of their use for teaching German.

The paper concludes that YouTube can be used as an open resource for foreign language learning, especially for teaching German as a first or second foreign language in higher education. The paper argues that YouTube can offer authentic, diverse, and engaging video materials that can support the development of various linguistic and ICT competencies, as well as mediation skills. The paper also suggests that YouTube can be combined with other open resources, such as ONCOO and TWINE, to create interactive and autonomous learning environments for future foreign language teachers.

The paper “Developing digital learning aids for pre-service IT specialists using the functional approach in holistic vocational training” [58] by Liudmyla I. Bilousova and Liudmyla E. Gryzun is a research article that aims to demonstrate how the functional approach can be used to design and implement digital learning aids for pre-service IT specialists in a holistic educational setting. The paper is based on the authors’ practical experience of conducting project-based activities with IT students at a university in Ukraine.

The paper begins with an introduction that explains the importance and challenges of developing digital learning aids for IT education, especially in the context of the rapid changes

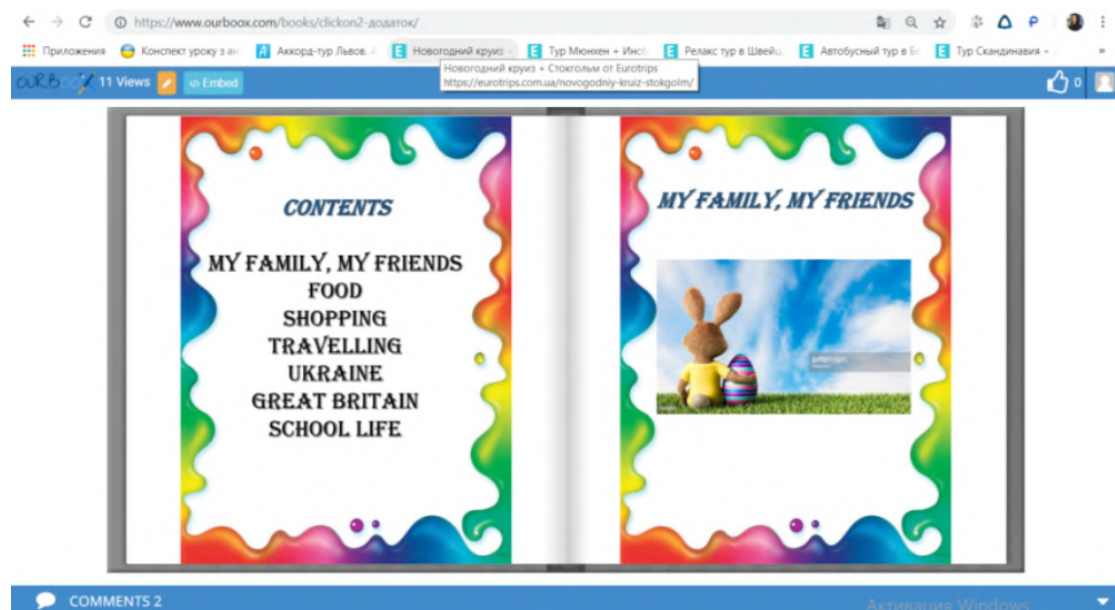


Figure 6: Presentation of paper [58].

and demands of the modern world. The paper then reviews the theoretical background of the holistic educational paradigm and the functional approach to digital didactic aids design, which are the main frameworks that guide the authors' work. The paper also defines some key concepts and terms related to digital learning aids, such as didactic functions, digital didactic design, and digital laboratory centre.

The paper then presents two case studies of students' project work on creating digital learning aids using the functional approach. The first case study describes the design of a multimedia tutorial for teaching English to schoolchildren, which aims to develop their linguistic, communicative, and intercultural competencies. The second case study describes the design of an e-guide on the basics of cryptography for university students, which aims to develop their mathematical, logical, and analytical skills. The paper provides detailed descriptions of the steps and procedures involved in each project, such as needs analysis, content selection, didactic functions determination, digital tools choice, design principles application, implementation, and evaluation.

The paper then discusses the results and benefits of applying the functional approach to the development of digital learning aids for pre-service IT specialists. The paper highlights how the functional approach enables the creation of digital learning aids that are relevant, contextualized, tailored, integrated, interactive, and adaptive to the learners' needs and goals. The paper also emphasizes how the functional approach fosters holistic learning outcomes that encompass cognitive, affective, social, and professional domains. The paper also identifies some challenges and limitations of applying the functional approach, such as time constraints, technical difficulties, and ethical issues.

The paper concludes with some suggestions for future research and practice in the field of digital learning aids development for IT education. The paper proposes some directions for further exploration and improvement of the functional approach, such as incorporating more feedback mechanisms, developing more criteria and indicators for evaluation, and expanding the scope and diversity of digital learning aids. The paper also calls for more collaboration and communication among researchers, teachers, students, and other stakeholders in the process of digital learning aids development.

The paper "Developing professional stability of future socio-economic specialists using cloud technologies in blended learning" by Hanna B. Varina, Kateryna P. Osadcha, Svetlana V. Shevchenko, and Valentyna V. Voloshyna is a research article that investigates how cloud technologies can be used to foster the professional stability of future socio-economic specialists in blended learning settings. Socio-economic specialists are professionals who work with people and social issues, such as social workers, psychologists, educators, and healthcare workers. Professional stability is defined as the ability to cope with the challenges and changes in the professional environment and to maintain a high level of performance and satisfaction.

The paper starts with an introduction that explains the relevance and importance of developing professional stability among future socio-economic specialists, who face high demands and expectations in their work. The paper then reviews the literature on blended learning, cloud technologies, and professional stability, highlighting the advantages and challenges of using cloud services, such as Google Workspace for Education and Moodle, to support the learning and development of students. The paper also defines the main concepts and terms related to professional stability, such as its components (cognitive, motivational, behavioral, emo-

**COMPONENTS OF THE FUTURE SPECIALIST'S PROFESSIONAL STABILITY**

<b>Motivational component</b>	<b>Cognitive component</b>	<b>Connotative component</b>	<b>Reflexive-valuable component</b>	<b>Regulatory-volitional component</b>
Motives related to the attitude to the future professional activities	Awareness of the patterns of future professional activity in the field of practical psychology	Skills of organizing and finding a creative solution of problems in future professional activity	Ability for reflection	Volitional regulation of future activities
	Awareness of the principles, directions, technologies of professional activity		Value orientations in future professional activity	Ability for self-regulation
Motives related to the development of professionally significant personal traits	Subject-specific knowledge	Skills and abilities of professionally stable behavior	Readiness for productive communication and establishment of trusting relationships (level of development of communication sphere and empathy)	Volitional regulation at the stage of self-development
Motives of achievement	Knowledge about oneself	Ability to restructure behavior and activities in changing conditions (adaptive capabilities of the individual)		The level of emotional regulation development

**Figure 7:** Presentation of paper [59].

tional and volitional), indicators (empathy, emotional self-regulation, vitality), and conditions (psychological and pedagogical).

The paper then presents the methodological framework for designing the process of professional stability development based on cloud technologies. The paper describes the principles, stages, methods, and tools of the cloud-based program, which aims to enhance the ICT competence and the mental capacity of the students through various learning activities and assessments. The paper also provides examples of how cloud services can be used to develop different components and indicators of professional stability.

The paper then reports the results of an empirical study that evaluated the effectiveness of the cloud-based program on the development of professional stability among students in blended learning. The study used a quasi-experimental design with pre-test and post-test measurements of professional stability components and indicators among two groups of students: experimental (who participated in the cloud-based program) and control (who did not). The study found

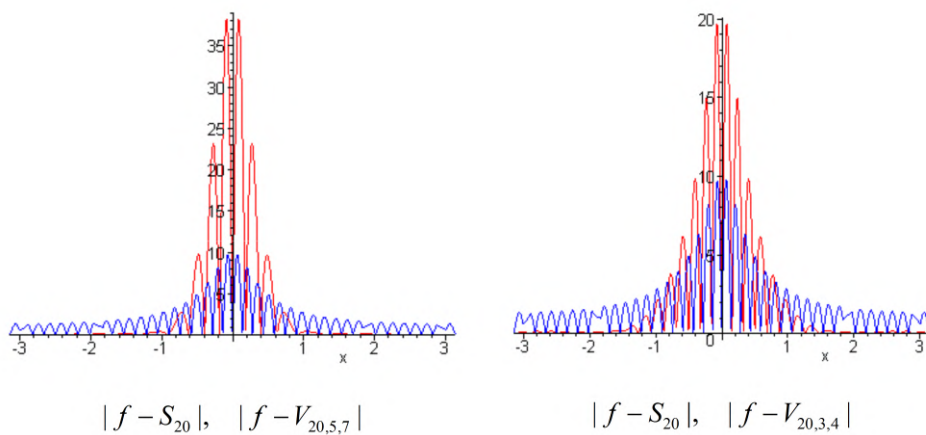
significant positive changes in the experimental group compared to the control group in terms of cognitive, motivational, behavioral, emotional and volitional components and empathy, emotional self-regulation, vitality indicators of professional stability.

The paper concludes with some implications and recommendations for further research and practice in the field of professional stability development using cloud technologies. The paper suggests some ways to improve and optimize the cloud-based program, such as incorporating more feedback mechanisms, developing more criteria and indicators for evaluation, and expanding the scope and diversity of cloud services. The paper also calls for more collaboration and communication among researchers, teachers, students, and other stakeholders in the process of professional stability development.

The paper “Inquiry-based learning for enhancing students’ interest in mathematical research: a case study on approximation theory and Fourier series” by Kateryna V. Vlasenko, Olha H. Rovenska, Iryna V. Lovianova, Oksana M. Kondratyeva, Vitaliy V. Achkan, and Yana M. Tkachenko is a research article that explores how inquiry-based learning (IBL) can be used to stimulate students’ interest in mathematical research. The paper focuses on the case study of using IBL to teach approximation theory and Fourier series, which are fundamental concepts in mathematics and computer science.

The paper begins with an introduction that explains the rationale and objectives of the study, as well as the main concepts and terms related to IBL, approximation theory, and Fourier series. The paper then reviews the literature on the benefits and challenges of using IBL in mathematics education, as well as the existing methods and tools for teaching approximation theory and Fourier series.

The paper then describes the methodology of the case study, which involved designing and implementing IBL workshops for undergraduate students majoring in mathematics and computer science. The paper explains the structure and content of the workshops, which consisted of four stages: posing an essential question, conducting an inquiry, presenting and discussing the results, and reflecting on the learning process. The paper also describes the



**Figure 8:** Presentation of paper [60].

instruments and procedures for collecting and analyzing the data, which included a survey questionnaire and the Differential Emotion Scale (DES) by Izard to measure the students' emotional state before and after the workshops.

The paper then reports and discusses the findings of the data analysis, which showed that the IBL workshops had a positive impact on the students' interest in mathematical research. The paper reveals that the students' negative emotions, such as anger, fear, sadness, disgust, contempt, and shame, decreased significantly after participating in the workshops, while their positive emotions, such as joy, surprise, interest, love, pride, and gratitude, increased significantly. The paper also shows that the students' engagement and motivation in the mathematical research activities improved after experiencing IBL.

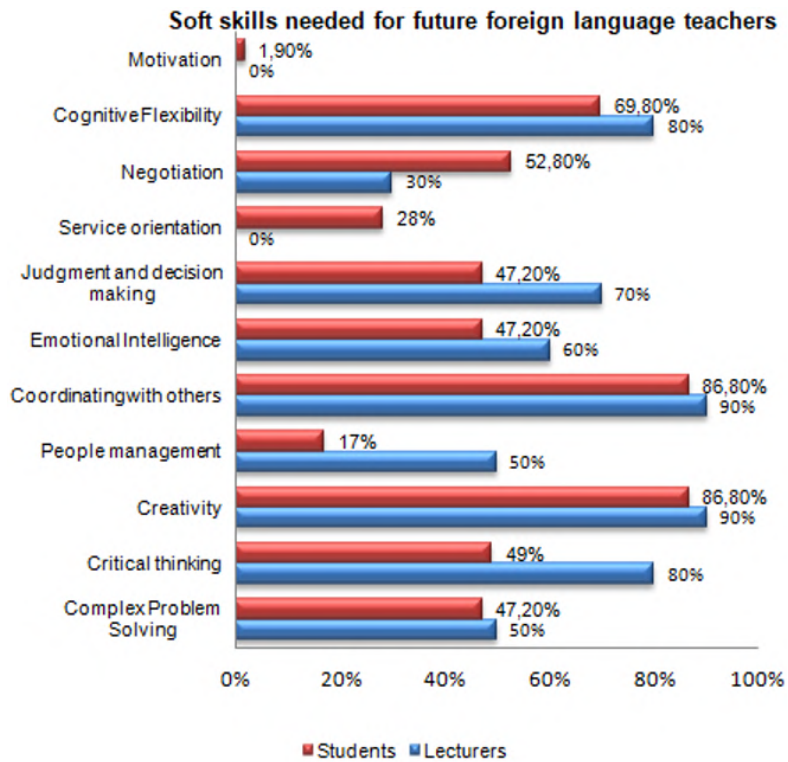
The paper concludes with some implications and recommendations for future practice and research in the field of mathematics education using IBL. The paper suggests some ways to improve the design and implementation of IBL workshops, such as providing more guidance and feedback to the students, using more diverse and interactive digital tools, and integrating more interdisciplinary and real-world problems. The paper also calls for more studies on the effects of IBL on other aspects of mathematical learning outcomes, such as conceptual understanding, problem-solving skills, creativity, and collaboration.

The paper "Developing digital and ICT literacy skills for future foreign language teachers: a comparative and action research approach" by Tetiana V. Konovalenko, Yuliia A. Nadolska, Tamara B. Poyasok, and Andrii M. Striuk examines how to enhance the digital and ICT literacy skills of future foreign language teachers in Ukraine and the USA. The paper is based on an action research project that involved both quantitative and qualitative data collection and analysis, as well as several interventions to improve the digital and ICT literacy skills of the participants.

The paper starts with an introduction that explains the importance and challenges of developing digital and ICT literacy skills for foreign language teachers in the 21st century, as well as the main concepts and terms related to digital and ICT literacy, action research, and comparative education. The paper then reviews the literature on the current state of pre-service teacher training programmes in Ukraine and the USA, as well as the existing frameworks and models for defining and assessing digital and ICT literacy skills.

The paper then describes the methodology of the action research project, which involved three phases: (1) a baseline survey of students and teachers in Ukraine and the USA to measure their digital and ICT literacy skills; (2) an implementation phase of several interventions based on the courses of Methodology of foreign language teaching and Practical course of foreign language, which aimed to improve the digital and ICT literacy skills of the students in Ukraine; and (3) a post-intervention survey of students and teachers in Ukraine and the USA to evaluate the impact of the interventions. The paper explains the instruments, procedures, and data analysis methods used in each phase, as well as the ethical considerations and limitations of the project.

The paper then reports and discusses the findings of the data analysis, which showed that: (1) there were significant differences between the students and teachers in Ukraine and the USA in terms of their digital and ICT literacy skills at the baseline level; (2) the interventions had a positive effect on improving the digital and ICT literacy skills of the students in Ukraine; (3) there were still some gaps and challenges in developing digital and ICT literacy skills among the

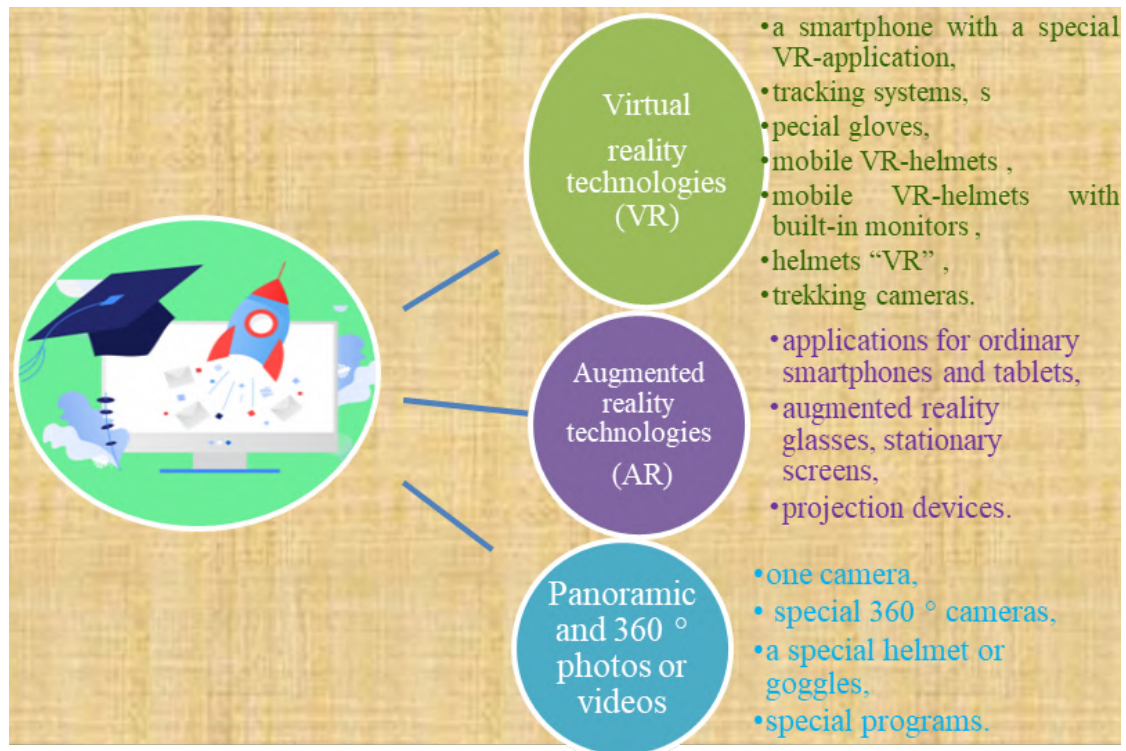


**Figure 9:** Presentation of paper [61].

participants, especially in relation to critical thinking, creativity, collaboration, communication, and digital citizenship; and (4) there were some positive practices and projects that emerged from the project, such as creating digital portfolios, using online platforms for learning and teaching, participating in online conferences and webinars<sup>123</sup>, etc.

The paper concludes with some implications and recommendations for future practice and research in the field of digital and ICT literacy development for foreign language teachers. The paper suggests some ways to improve the pre-service teacher training programmes in both countries, such as integrating more digital and ICT literacy components into the curriculum, providing more guidance and feedback to the students, using more diverse and interactive digital tools, fostering more collaboration among students and teachers, etc. The paper also calls for more action research projects that involve cross-cultural comparisons, longitudinal studies, mixed methods approaches, etc.

The paper “Exploring the potential of immersive technologies in university education worldwide” by Kateryna M. Binytska, Olha O. Bilyakovska, Oleksandra I. Yankovych, Galyna V. Buchkivska, Olena P. Binytska, Valentyna V. Greskova, and Inna P. Ocheretna is a research article that examines how immersive technologies can be used to enhance the learning and teaching experiences of university students and teachers across different disciplines and contexts. The paper defines immersive technologies as those that integrate technology with traditional methods of education, providing a more realistic and stimulating environment for growth<sup>1</sup>.



**Figure 10:** Presentation of paper [62].

The paper begins with an introduction that explains the importance and challenges of using immersive technologies in university education, as well as the main concepts and terms related to immersive technologies, such as virtual reality, augmented reality, mixed reality, and extended reality. The paper then reviews the literature on the advantages and disadvantages of using immersive technologies in university education, such as increasing engagement, motivation, creativity, collaboration, and accessibility, as well as raising ethical, technical, and pedagogical issues.

The paper then presents the main part of the analysis, which is divided into two sections: (1) the use of immersive technologies in professional training for various fields of study, such as archaeology, architecture, engineering, aviation, rescue, and medicine; and (2) the use of immersive technologies in creating inclusive learning environments for students with special educational needs. The paper provides examples and evidence of how immersive technologies can facilitate the acquisition of knowledge and skills, as well as the development of attitudes and values, among students and teachers in these fields and contexts.

The paper then discusses the global experiences with immersive technologies in university education, highlighting some innovative and impactful examples of their use in distance learning, empathy training for social issues such as homelessness, and environmental education on topics such as ocean oxidation and coral reefs. The paper shows how immersive technologies can be used not only for professional training but also for gaining social and emotional experiences

and raising awareness of environmental issues.

The paper concludes with some implications and recommendations for future research and practice in the field of immersive technologies in university education. The paper suggests some ways to improve the design and implementation of immersive technologies in university education, such as involving more stakeholders, conducting more evaluation studies, addressing more ethical and technical challenges, and exploring more interdisciplinary and cross-cultural applications.

The paper “Designing a cloud-oriented methodological system for training science and mathematics teachers in scientific lyceums” by Maiia V. Marienko proposes and evaluates a cloud-based system for preparing teachers of natural and mathematical subjects to work in scientific lyceums. A scientific lyceum is a new type of secondary school in Ukraine that focuses on mathematics, physics, chemistry, biology, and other sciences.

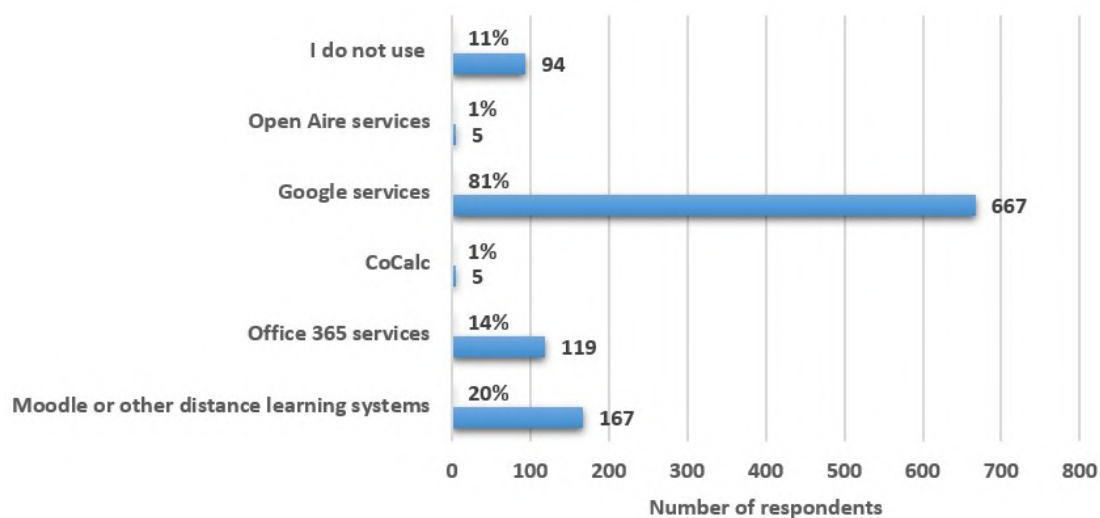


Figure 11: Presentation of paper [63].

The paper starts with an introduction that explains the importance and challenges of reforming teacher training in the context of the rapid development of science and technology, as well as the main concepts and terms related to cloud-oriented systems, open science systems, and scientific lyceums. The paper then reviews the literature on the current state of teacher training programmes in different countries, as well as the existing frameworks and models for designing and implementing cloud-based systems of open science.

The paper then describes the methodology of the pedagogical experiment, which involved designing, modelling, and testing a cloud-oriented methodological system for training teachers of natural and mathematical subjects to work in a scientific lyceum. The paper explains the structure and content of the system, which consists of three levels: basic, intermediate, and advanced. The paper also describes the instruments and procedures for collecting and analyzing the data, which included a survey questionnaire and a test of open science competencies among teachers.



The paper then reports and discusses the findings of the data analysis, which showed that: (1) there was a significant increase in the use of open science services by teachers after participating in the system; (2) there was a significant improvement in the readiness and skills of teachers to conduct research after participating in the system; (3) there was a significant increase in the awareness and understanding of teachers about the functions and requirements of scientific lyceums after participating in the system; and (4) there were some positive practices and projects that emerged from the system, such as creating digital portfolios, using online platforms for learning and teaching, participating in online conferences and webinars, etc.

The paper concludes with some implications and recommendations for future research and practice in the field of cloud-oriented systems for teacher training. The paper suggests some ways to improve and optimize the system, such as involving more stakeholders, conducting more evaluation studies, addressing more ethical and technical challenges, and exploring more interdisciplinary and cross-cultural applications.

The paper “Serverless computing for data processing in open learning and research environments” by Ihor A. Bezverbnyi and Mariya P. Shyshkina investigates how serverless computing can be used to facilitate data processing in open learning and research environments. Serverless computing is a paradigm that allows the execution of code without provisioning or managing servers, which reduces the cost and complexity of cloud-based applications.

The paper begins with an introduction that explains the importance and challenges of data processing in open learning and research environments, as well as the main concepts and terms related to serverless computing, such as lambda functions, cloud services, and hybrid clouds. The paper then reviews the literature on the advantages and disadvantages of serverless computing, as well as the existing applications and frameworks for data processing using serverless technologies.

The paper then presents the main contribution of the paper, which is the proposal of a concept of a hybrid serverless cloud, which combines different types of cloud services to provide access to various tools and resources for learners and researchers. The paper explains the architecture and components of the hybrid serverless cloud, which includes a cloud storage service, a cloud computing service, a cloud database service, a cloud messaging service, and a cloud orchestration service. The paper also describes the functions and features of the hybrid serverless cloud, such as scalability, cost-efficiency, ease of development, security, and interoperability.

The paper then demonstrates the feasibility and effectiveness of the hybrid serverless cloud by presenting a case study of wave files processing using a lambda function. The paper describes the steps and procedures involved in the case study, such as uploading wave files to the cloud storage service, invoking the lambda function to process the wave files, storing the results in the cloud database service, sending notifications to the users via the cloud messaging service, and managing the workflow via the cloud orchestration service. The paper also provides some screenshots and graphs to illustrate the results and performance of the case study.

The paper then discusses the challenges and opportunities of integrating serverless components within open systems of learning and research. The paper identifies some issues and limitations of serverless computing, such as cold start latency, vendor lock-in, debugging difficulties, and security risks. The paper also highlights some potential benefits and applications of serverless computing, such as supporting data-intensive tasks, enabling real-time collaboration, enhancing accessibility and mobility, and fostering innovation and creativity.

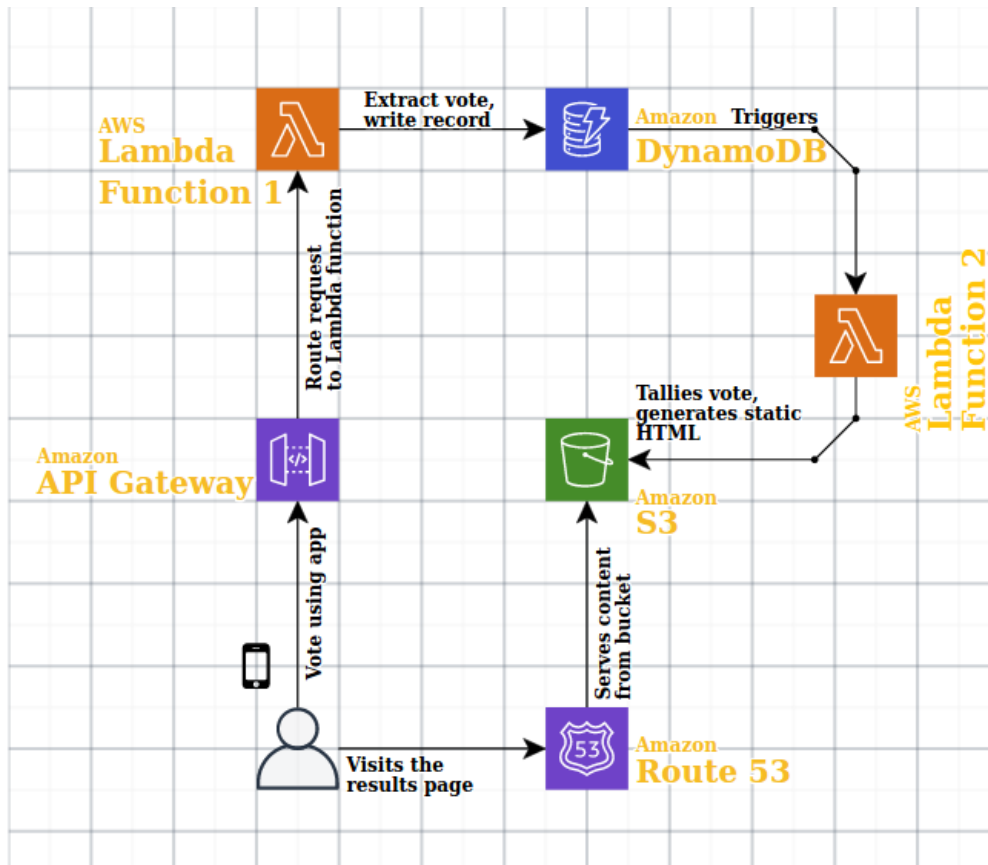
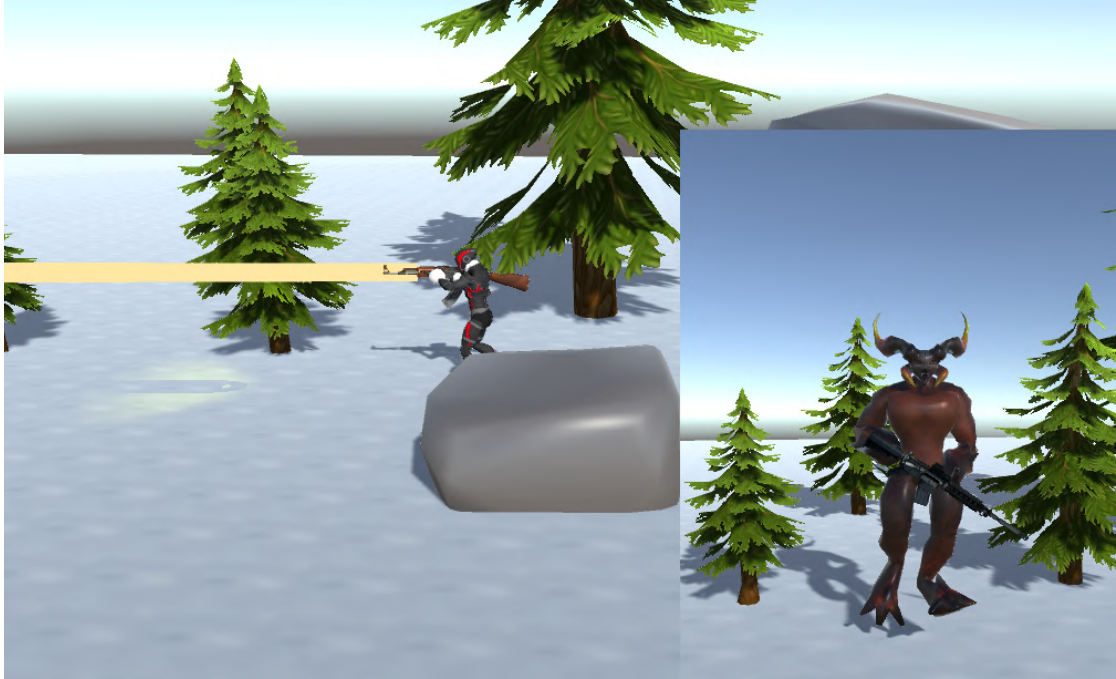


Figure 12: Presentation of paper [64].

The paper concludes with a vision of a cloud-based open learning and research university environment that leverages serverless technologies to improve the quality and accessibility of education and research. The paper envisions a scenario where learners and researchers can use various serverless components to access, process, analyze, share, and publish data in an open and collaborative manner. The paper also suggests some directions for future research and practice in this field.

The paper “Teaching computer game development with Unity engine: a case study” by Natalia V. Moiseienko, Mykhailo V. Moiseienko, Vladyslav S. Kuznetsov, Bohdan A. Rostalny, and Arnold E. Kiv reports on the design and evaluation of a course on computer game development for master’s students in the specialty 014.09 Secondary education (Informatics) at the Kryvyi Rih State Pedagogical University. The paper aims to fill the gap in the literature on how to effectively teach computer game development in the context of secondary education.

The paper begins with an introduction that explains the importance and challenges of teaching computer game development, as well as the main concepts and terms related to computer games, software engineering, and Unity Engine. The paper then reviews the literature on the existing courses and methods for teaching computer game development in different educational levels



**Figure 13:** Presentation of paper [65].

and settings.

The paper then describes the methodology of the case study, which involved designing, delivering, and evaluating a course on computer game development for master's students in the specialty 014.09 Secondary education (Informatics) at the Kryvyi Rih State Pedagogical University. The paper explains the objectives, content, software tools, and teaching methods of the course, which was based on Unity Engine, a popular and powerful platform for creating games. The paper also describes the challenges and outcomes of implementing the course, such as technical difficulties, student engagement, project quality, etc.

The paper then presents the results of the evaluation of the course, which was based on a framework proposed by Ritzhaupt, which consists of four dimensions: (1) student satisfaction; (2) student learning; (3) instructor satisfaction; and (4) instructor learning. The paper shows that the course was successful in achieving high scores in all four dimensions, indicating that the course was effective in enhancing students' knowledge and skills in game development, as well as satisfying both students and instructors.

The paper then discusses the implications and recommendations of the case study for future practice and research in the field of computer game development education. The paper suggests some ways to improve and optimize the course, such as providing more guidance and feedback to students, using more diverse and interactive game genres and mechanics, integrating more interdisciplinary and cross-cultural elements, etc. The paper also calls for more studies on the impact of computer game development education on students' cognitive, affective, social, and professional outcomes.

The paper concludes with a summary of the main points and contributions of the paper. The paper highlights that Unity Engine is a suitable platform for teaching computer game development in secondary education, as it offers a low barrier to entry, a rich set of features, a cross-platform compatibility, and a wide adoption in the game industry. The paper also argues that a team-based approach is beneficial for fostering collaboration and creativity among students.

## 4. Conclusion

The 3L-Person 2022 workshop provides a unique opportunity for researchers and practitioners from various fields and regions to exchange ideas and experiences on the use of ICT for lifelong learning and professional development. The goal of 3L-Person 2022 is to create a forum for presenting and discussing the latest research findings, innovative solutions, and best practices in this interdisciplinary field. The workshop also promotes collaboration and networking among participants, who will benefit from the exchange of knowledge and feedback.

We are grateful to all authors who submitted papers and to the delegates for their participation and interest in 3L-Person as a platform for sharing their ideas and innovations. We also thank all program committee members for their continuous guidance and the efforts of peer reviewers who helped improve the quality of papers. The constructive criticism, improvements, and corrections provided to authors are greatly appreciated for their contribution to the success of the conference. Additionally, we would like to thank the developers and other professional staff of the *Not So Easy Science Education* platform (<https://notso.easyscience.education>) and the Academy of Cognitive and Natural Sciences (<https://acnsci.org>) for making it possible for us to use the resources of this excellent and comprehensive conference management system, from calling for papers and inviting reviewers to handling paper submissions, communicating with authors, etc.

The war in Ukraine has had a devastating effect on the country and its people, including its scientific community, with many researchers forced to flee their homes and laboratories. Despite being held in the shadow of this war, the 3L-Person 2022 workshop serves as a testament to the resilience of Ukraine's scientific community. The workshop provides a platform for Ukrainian researchers to share their work and connect with colleagues from around the world. We hope that the workshop will aid in rebuilding Ukraine's scientific community and contribute to the country's recovery.

We also hope that the conference will increase understanding of the war in Ukraine and its impact on education. The papers in the proceedings address a variety of topics related to this disaster.

In conclusion, we express our solidarity with the people of Ukraine and hope for a swift and peaceful resolution to the war.

## References

- [1] S. Lytvynova, O. Burov, N. Demeshkant, V. Osadchyi, S. O. Semerikov, 3L-Person: Report, in: S. Lytvynova, O. Burov, N. Demeshkant, V. Osadchyi, S. O. Semerikov (Eds.), Proceedings

- of the VI International Workshop on Professional Retraining and Life-Long Learning using ICT: Person-oriented Approach (3L-Person 2021) co-located with 17th International Conference on ICT in Education, Research, and Industrial Applications: Integration, Harmonization, and Knowledge Transfer (ICTERI 2021), Kherson, Ukraine, October 1, 2021, volume 3104 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2021, pp. i–v. URL: <https://ceur-ws.org/Vol-3104/paper000.pdf>.
- [2] O. Y. Burov, S. H. Lytvynova, S. O. Semerikov, Y. V. Yechkalo, ICT for disaster-resilient education and training, *CEUR Workshop Proceedings (2023)* 1–25.
  - [3] R. A. Corey, M. Baaden, M. Chavent, A brief history of visualizing membrane systems in molecular dynamics simulations, *Frontiers Bioinform.* 3 (2023). doi:10.3389/fbinf.2023.1149744.
  - [4] L. Bilousova, L. Gryzun, N. Zhytienova, Interactive methods in blended learning of the fundamentals of UI/UX design by pre-service specialists, *Educational Technology Quarterly* 2021 (2021) 415–428. doi:10.55056/etq.34.
  - [5] O. Llorente-Vazquez, I. S. Grueiro, P. G. Bringas, When Memory Corruption Met Concurrency: Vulnerabilities in Concurrent Programs, *IEEE Access* 11 (2023) 44725–44740. doi:10.1109/ACCESS.2023.3272833.
  - [6] O. Y. Burov, O. P. Pinchuk, A meta-analysis of the most influential factors of the virtual reality in education for the health and efficiency of students’ activity, *Educational Technology Quarterly* 2023 (2023) 58–68. doi:10.55056/etq.435.
  - [7] W. M. Tessema, N. Cavus, Design and Evaluate the Efficiency of Ethiopic Local Integrating System in Open-Source Database, *IEEE Access* 10 (2022) 116819–116829. doi:10.1109/ACCESS.2022.3218418.
  - [8] I. F. Ibrahim, M. M. Morsey, A. M. Mahmoud, E. M. El-Horbaty, Towards Developing a Metaverse Authentication Model for Mobile Features, in: J. Filipe, M. Smialek, A. Brodsky, S. Hammoudi (Eds.), *Proceedings of the 25th International Conference on Enterprise Information Systems, ICEIS 2023, Volume 1*, Prague, Czech Republic, April 24-26, 2023, SCITEPRESS, 2023, pp. 691–697. doi:10.5220/0012039000003467.
  - [9] J. Bacca-Acosta, R. Fabregat, S. Baldiris, Kinshuk, J. Guevara, Determinants of student performance with mobile-based assessment systems for English as a foreign language courses, *J. Comput. Assist. Learn.* 39 (2023) 1017–1037. doi:10.1111/jcal.12783.
  - [10] I. Georgescu, Inventory problems with fuzzy numbers as demands, *Soft Comput.* 26 (2022) 3947–3955. doi:10.1007/s00500-022-06758-w.
  - [11] F. Nazir, M. N. Majeed, M. A. Ghazanfar, M. Maqsood, A computer-aided speech analytics approach for pronunciation feedback using deep feature clustering, *Multim. Syst.* 29 (2023) 1699–1715. doi:10.1007/s00530-021-00822-5.
  - [12] M. Garg, A. Goel, Preserving integrity in online assessment using feature engineering and machine learning, *Expert Syst. Appl.* 225 (2023) 120111. doi:10.1016/j.eswa.2023.120111.
  - [13] C. S. González-González, V. Muñoz-Cruz, P. A. T. Delgado, E. Nacimiento-García, Personalized Gamification for Learning: A Reactive Chatbot Architecture Proposal, *Sensors* 23 (2023) 545. doi:10.3390/s23010545.
  - [14] S. Link, H. Koehler, A. Gandhi, S. Hartmann, B. Thalheim, Cardinality constraints and functional dependencies in SQL: Taming data redundancy in logical database design, *Inf.*

- Syst. 115 (2023) 102208. doi:10.1016/j.is.2023.102208.
- [15] E. Y. Arici, M. Kalogiannakis, S. Papadakis, Preschool Children's Metaphoric Perceptions of Digital Games: A Comparison between Regions, *Comput. 12* (2023) 138. doi:10.3390/computers12070138.
- [16] A. Kiv, S. Semerikov, V. Soloviev, XII International Conference on Mathematics, Science and Technology Education: conference report, *Educational Technology Quarterly 2021* (2021) 140–256. doi:10.55056/etq.54.
- [17] O. Gayevska, H. Kravtsov, Approaches on the augmented reality application in Japanese language learning for future language teachers, *Educational Technology Quarterly 2022* (2022) 105–114. doi:10.55056/etq.7.
- [18] O. V. Prokhorov, V. O. Lisovichenko, M. S. Mazorchuk, O. H. Kuzminska, Implementation of digital technology for student involvement based on a 3D quest game for career guidance and assessing students' digital competences, *Educational Technology Quarterly 2022* (2022) 366–387. doi:10.55056/etq.430.
- [19] A. A. Enughwure, F. Lelli, On Developing Human Centric Digital Twins in Industry 4.0 and Beyond, in: M. Zelm, A. Boza, R. D. León, R. Rodríguez-Rodríguez (Eds.), *Proceedings of Interoperability for Enterprise Systems and Applications Workshops co-located with 11th International Conference on Interoperability for Enterprise Systems and Applications (I-ESA 2022)*, Valencia, Spain, March 23-25, 2022, volume 3214 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2022. URL: <https://ceur-ws.org/Vol-3214/WS5Paper11.pdf>.
- [20] V. Chang, M. Ramachandran, C. Li, Special issue editorial on emerging trends in internet of things for e-health and medical supply chain systems, *Expert Syst. J. Knowl. Eng.* 39 (2022). doi:10.1111/exsy.12870.
- [21] J. Niedzwiedzki, P. Lipinski, L. Podsedkowski, IDTMM: Incremental Direct Triangle Mesh Mapping, *IEEE Robotics Autom. Lett.* 8 (2023) 5416–5423. doi:10.1109/LRA.2023.3293751.
- [22] L. Nanni, A. Loreggia, A. Lumini, A. Dorizza, A Standardized Approach for Skin Detection: Analysis of the Literature and Case Studies, *J. Imaging* 9 (2023) 35. doi:10.3390/jimaging9020035.
- [23] N. Morze, O. Buinytska, L. Varchenko-Trotsenko, S. Vasylenko, D. Nastas, A. Tiutiunyk, S. Lytvynova, System for digital professional development of university teachers, *Educational Technology Quarterly 2022* (2022) 152–168. doi:10.55056/etq.6.
- [24] S. Papadakis, A. E. Kiv, H. M. Kravtsov, V. V. Osadchyi, M. V. Marienko, O. P. Pinchuk, M. P. Shyshkina, O. M. Sokolyuk, I. S. Mintii, T. A. Vakaliuk, A. M. Striuk, S. O. Semerikov, Revolutionizing education: using computer simulation and cloud-based smart technology to facilitate successful open learning, *CEUR Workshop Proceedings 3358* (2023) 1–18.
- [25] R. Mehmood, K. Mpungu, I. Ali, B. Zaman, F. H. Qureshi, N. Khan, A new approach for designing the Shewhart-type control charts with generalized sensitizing rules, *Comput. Ind. Eng.* 182 (2023) 109379. doi:10.1016/j.cie.2023.109379.
- [26] D. S. Shepiliev, S. O. Semerikov, Y. V. Yechkalo, V. V. Tkachuk, O. M. Markova, Y. O. Modlo, I. S. Mintii, M. M. Mintii, T. V. Selivanova, N. K. Maksyshko, T. A. Vakaliuk, V. V. Osadchyi, R. O. Tarasenko, S. M. Amelina, A. E. Kiv, Development of career guidance quests using WebAR, *Journal of Physics: Conference Series 1840* (2021) 012028. doi:10.1088/1742-6596/1840/1/012028.

- [27] L. Hrynevych, N. Morze, V. Vember, M. Boiko, Use of digital tools as a component of STEM education ecosystem, *Educational Technology Quarterly* 2021 (2021) 118–139. doi:10.55056/etq.24.
- [28] A. Ferraro, A. Galli, V. Moscato, G. Sperli, Evaluating explainable artificial intelligence tools for hard disk drive predictive maintenance, *Artif. Intell. Rev.* 56 (2023) 7279–7314. doi:10.1007/s10462-022-10354-7.
- [29] C. Braun, F. Kayali, T. Moser, Erstellung und Einsatz von 360-Grad-Medien in der Lehre - leicht gemacht, in: P. A. Henning, M. Striewe, M. Wölfel (Eds.), *DELFI 2022*, Die 20. Fachtagung Bildungstechnologien der Gesellschaft für Informatik e.V., 12.-14. September 2022, Karlsruhe, volume P-322 of *LNI*, Gesellschaft für Informatik e.V., 2022, pp. 129–134. URL: <https://doi.org/10.18420/delfi2022-024>. doi:10.18420/delfi2022-024.
- [30] A. Chowdhury, S. Kaiser, M. E. Khoda, R. K. Naha, M. A. Khoshkholghi, M. Aiash, IoT-Based Emergency Vehicle Services in Intelligent Transportation System, *Sensors* 23 (2023) 5324. doi:10.3390/s23115324.
- [31] T. Vakaliuk, I. Pilkevych, D. Fedorchuk, V. Osadchyi, A. Tokar, O. Naumchak, Methodology of monitoring negative psychological influences in online media, *Educational Technology Quarterly* 2022 (2022) 143–151. doi:10.55056/etq.1.
- [32] L. F. Panchenko, V. Y. Velychko, Unveiling the potential of structural equation modelling in educational research: a comparative analysis of Ukrainian teachers' self-efficacy, *Educational Technology Quarterly* 2023 (2023) 157–172. doi:10.55056/etq.601.
- [33] S. Papadakis, A. E. Kiv, H. M. Kravtsov, V. V. Osadchyi, M. V. Marienko, O. P. Pinchuk, M. P. Shyshkina, O. M. Sokolyuk, I. S. Mintii, T. A. Vakaliuk, L. E. Azarova, L. S. Kolgatina, S. M. Amelina, N. P. Volkova, V. Y. Velychko, A. M. Striuk, S. O. Semerikov, Unlocking the power of synergy: the joint force of cloud technologies and augmented reality in education, *CEUR Workshop Proceedings* 3364 (2023) 1–23.
- [34] O. P. Pinchuk, L. A. Luparenko, Web-oriented encyclopedic edition as a tool for dissemination of verified knowledge in the field of education, *Educational Technology Quarterly* 2023 (2023) 141–156. doi:10.55056/etq.582.
- [35] M. Kurz, P. Offenhäuser, D. Viola, O. Shcherbakov, M. M. Resch, A. Beck, Deep reinforcement learning for computational fluid dynamics on HPC systems, *J. Comput. Sci.* 65 (2022) 101884. doi:10.1016/j.jocs.2022.101884.
- [36] N. Khairova, O. Mamyrbayev, N. Rizun, M. Razno, G. Ybytayeva, A Parallel Corpus-Based Approach to the Crime Event Extraction for Low-Resource Languages, *IEEE Access* 11 (2023) 54093–54111. doi:10.1109/ACCESS.2023.3281680.
- [37] A. Alkuhlani, W. K. Gad, M. I. Roushdy, A. M. Salem, GNNGLY: Graph Neural Networks for Glycan Classification, *IEEE Access* 11 (2023) 51838–51847. doi:10.1109/ACCESS.2023.3280123.
- [38] Z. K. Papamitsiou, M. E. Filippakis, M. Poulou, D. G. Sampson, D. Ifenthaler, M. N. Giannakos, Towards an educational data literacy framework: enhancing the profiles of instructional designers and e-tutors of online and blended courses with new competences, *Smart Learn. Environ.* 8 (2021) 18. doi:10.1186/s40561-021-00163-w.
- [39] C. D. Sanmartin, A. S. Cabezuelo, A. A. Belmonte, A new approach to predicting mortality in dialysis patients using sociodemographic features based on artificial intelligence, *Artif. Intell. Medicine* 136 (2023) 102478. doi:10.1016/j.artmed.2022.102478.

- [40] D. Budianskii, M. Drushlyak, O. Semenikhina, Analysis of e-resources for the specialist's rhetorical culture development, *Educational Technology Quarterly* 2021 (2021) 87–102. doi:10.55056/etq.15.
- [41] P. P. Nechypurenko, S. O. Semerikov, O. Y. Pokhliestova, Cloud technologies of augmented reality as a means of supporting educational and research activities in chemistry for 11th grade students, *Educational Technology Quarterly* 2023 (2023) 69–91. doi:10.55056/etq.44.
- [42] S. M. Amelina, R. O. Tarasenko, S. O. Semerikov, L. Shen, Using mobile applications with augmented reality elements in the self-study process of prospective translators, *Educational Technology Quarterly* 2022 (2022) 263–275. doi:10.55056/etq.51.
- [43] P. K. Singh, Uncertainty analysis in document publications using single-valued neutrosophic set and collaborative entropy, *Artif. Intell. Rev.* 56 (2023) 2785–2809. doi:10.1007/s10462-022-10249-7.
- [44] N. Pinchuk, O. Pinchuk, O. Bondarchuk, V. Balakhtar, K. Balakhtar, N. Onopriienko-Kapustina, M. Shyshkina, O. Kuzminska, Personal indicators of occupational stress of employees working remotely in a pandemic quarantine, *Educational Technology Quarterly* 2022 (2022) 129–142. doi:10.55056/etq.8.
- [45] T. Vakaliuk, O. Spirin, O. Korotun, D. Antoniuk, M. Medvedieva, I. Novitska, The current level of competence of schoolteachers on how to use cloud technologies in the educational process during covid-19, *Educational Technology Quarterly* 2022 (2022) 232–250. doi:10.55056/etq.32.
- [46] O. Y. Burov, A. E. Kiv, S. O. Semerikov, A. M. Striuk, M. I. Striuk, L. S. Kolgatina, I. V. Oliinyk, AREdu 2020 - How augmented reality helps during the coronavirus pandemic, in: O. Y. Burov, A. E. Kiv (Eds.), *Proceedings of the 3rd International Workshop on Augmented Reality in Education*, Kryvyi Rih, Ukraine, May 13, 2020, volume 2731 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2020, pp. 1–46. URL: <https://ceur-ws.org/Vol-2731/paper00.pdf>.
- [47] M. A. Gutiérrez, F. Vexo, D. Thalmann, *Stepping into Virtual Reality*, 2 ed., Springer, 2023. doi:10.1007/978-3-031-36487-7.
- [48] T. A. Vakaliuk, O. V. Chyzhmotria, O. H. Chyzhmotria, S. O. Didkivska, V. V. Kontsedailo, The use of massive open online courses in teaching the fundamentals of programming to software engineers, *Educational Technology Quarterly* 2023 (2023) 106–120. doi:10.55056/etq.37.
- [49] V. Velychko, E. Fedorenko, N. Kaidan, V. Kaidan, Application of cloud computing in the process of professional training of physics teachers, *Educational Technology Quarterly* 2021 (2021) 662–672. doi:10.55056/etq.38.
- [50] K. V. Vlasenko, S. V. Volkov, I. V. Lovianova, I. V. Sitak, O. O. Chumak, N. H. Bohdanova, Exploring usability principles for educational online courses: a case study on an open platform for online education, *Educational Technology Quarterly* 2023 (2023) 173–187. doi:10.55056/etq.602.
- [51] T. Chan, C. Looi, B. Chang, W. Chen, L. Wong, S. L. Wong, F. Yu, J. Mason, C. Liu, J. Shih, Y. Wu, S. Kong, L. Wu, T. Chien, C. C. Y. Liao, H. N. H. Cheng, Z. Chen, C. Chou, IDC theory: creation and the creation loop, *Res. Pract. Technol. Enhanc. Learn.* 14 (2019) 26. doi:10.1186/s41039-019-0120-5.
- [52] N. Jofche, K. Mishev, R. Stojanov, M. Jovanovik, E. Zdravevski, D. Trajanov, *PharmKE:*



- Knowledge Extraction Platform for Pharmaceutical Texts Using Transfer Learning, *Comput.* 12 (2023) 17. doi:10.3390/computers12010017.
- [53] O. G. Kucheryaviy, D. G. Gryshchuk, Online training of youth volunteers for projecting socially significant actions in the COVID-19 pandemic, *CEUR Workshop Proceedings* (2023) 26–38.
- [54] P. V. Merzlykin, M. V. Marienko, S. V. Shokaliuk, CoCalc: an integrated environment for open science education in informatics and mathematics, *CEUR Workshop Proceedings* (2023) 39–53.
- [55] I. A. Kravtsova, A. O. Mankuta, V. A. Hamaniuk, O. S. Bilozir, A. V. Voznyak, Internet resources for foreign language education in primary school: challenges and opportunities, *CEUR Workshop Proceedings* (2023) 54–83.
- [56] O. V. Ovcharuk, I. V. Ivaniuk, O. Y. Burov, M. V. Marienko, N. V. Soroko, O. O. Gritsenchuk, O. Y. Kravchyna, Digital resources for developing key competencies in Ukrainian education: teachers' experience and challenges, *CEUR Workshop Proceedings* (2023) 84–104.
- [57] O. V. Chorna, V. A. Hamaniuk, O. Y. Markheva, A. V. Voznyak, YouTube as an open resource for foreign language learning: a case study of German, *CEUR Workshop Proceedings* (2023) 105–127.
- [58] L. I. Bilousova, L. E. Gryzun, Developing digital learning aids for pre-service IT specialists using the functional approach in holistic vocational training, *CEUR Workshop Proceedings* (2023) 128–147.
- [59] H. B. Varina, K. P. Osadcha, S. V. Shevchenko, V. V. Voloshyna, Developing professional stability of future socioeconomic specialists using cloud technologies in blended learning, *CEUR Workshop Proceedings* (2023) 148–168.
- [60] K. V. Vlasenko, O. H. Rovenska, I. V. Lovianova, O. M. Kondratyeva, V. V. Achkan, Y. M. Tkachenko, Inquiry-based learning for enhancing students' interest in mathematical research: a case study on approximation theory and Fourier series, *CEUR Workshop Proceedings* (2023) 169–186.
- [61] T. V. Konovalenko, Y. A. Nadolska, T. B. Poyasok, A. M. Striuk, Developing digital and ICT literacy skills for future foreign language teachers: a comparative and action research approach, *CEUR Workshop Proceedings* (2023) 187–202.
- [62] K. M. Binytska, O. O. Bilyakovska, O. I. Yankovych, G. V. Buchkivska, O. P. Binytska, V. V. Greskova, I. P. Ocheretna, Exploring the potential of immersive technologies in university education worldwide, *CEUR Workshop Proceedings* (2023) 203–217.
- [63] M. V. Marienko, Designing a cloud-oriented methodological system for training science and mathematics teachers in scientific lyceums, *CEUR Workshop Proceedings* (2023) 218–228.
- [64] I. A. Bezverbnyi, M. P. Shyshkina, Serverless computing for data processing in open learning and research environments, *CEUR Workshop Proceedings* (2023) 229–236.
- [65] N. V. Moiseienko, M. V. Moiseienko, V. S. Kuznetsov, B. A. Rostalny, A. E. Kiv, Teaching computer game development with Unity engine: a case study, *CEUR Workshop Proceedings* (2023) 237–251.