Embracing digital innovation and cloud technologies for transformative learning experiences

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Abstract

The 11th Workshop on Cloud Technologies in Education (CTE 2023) was held in Kryvyi Rih, Ukraine, on December 22, 2023. This volume of proceedings comprises 18 peer-reviewed papers that explore the state-of-the-art advancements and applications of cloud technologies in various educational contexts.

Keywords

cloud computing, education, e-learning, adaptive learning, blended learning, artificial intelligence, virtual labs, learning platforms, soft skills, asynchronous learning, HyFlex learning

1. Introduction

1.1. CTE 2023 at a glance

Cloud **T**echnologies in **E**ducation (CTE) is a peer-reviewed international Computer Science workshop focusing on research advances and applications of cloud technology in education.

The workshop considers 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.

CTE topics of interest since 2012 [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]:

- Adaptive Cloud Learning Platforms
- Blended Learning
- Blockchain in Education
- Cloud-based AI Education Applications
- Cloud-based E-learning Platforms, Tools and Services
- Cloud-based Learning Environments
- Competency-Based Education Platforms
- Digital Transformation of Education

Figure 1: CTE 2023 logo.

CTE 2023: 11th Workshop on Cloud Technologies in Education, December 22, 2023, Kryvyi Rih, Ukraine
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- Educational Data Mining
- Emotion AI
- Immersive Technology Applications in Education
- Mobile Learning
- Smart Campus Technologies
- Social Analytics in Education

This volume represents the proceedings of the 11th Workshop on Cloud Technologies in Education (CTE 2023), held in Kryvyi Rih, Ukraine, on December 22, 2023. It comprises 18 contributed papers that were carefully peer-reviewed and selected from 37 submissions. Two program committee members reviewed each submission. The accepted papers present a state-of-the-art overview of successful cases and provide guidelines for future research.

1.2. CTE 2023 committees

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- *Nataliia Soroko*, Institute for Digitalisation of Education of the NAES of Ukraine, Ukraine [37]
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2. Workshop overview

2.1. Adaptive Cloud Learning Platforms

The article "Modeling ship cybersecurity using Markov chains: an educational approach" by Kaminska et al. [48] proposes using Markov chain models to represent and analyse the cybersecurity system on ships mathematically. The authors emphasise the growing importance of cybersecurity in the maritime industry, citing guidance from the International Maritime Organization requiring proper consideration of cyber risks. They argue that while general provisions exist, shipping companies must implement effective cybersecurity systems.

The core contribution is developing a Markov chain model to characterise the states of a ship's cybersecurity system (safe, potential threat, risk of attack, active attack) and the probabilities of transitioning between states over time. They define the states, lay out the mathematical formulation using transition matrices, and illustrate with a numerical example.

A strength of the article is that it grounds the modelling approach in the practical cybersecurity vulnerabilities and attack vectors affecting ships based on established maritime guidelines. Mapping this context to the model states lends real-world relevance. The Markov chain formulation also seems reasonable for capturing the memoryless property of cyberattack occurrences.

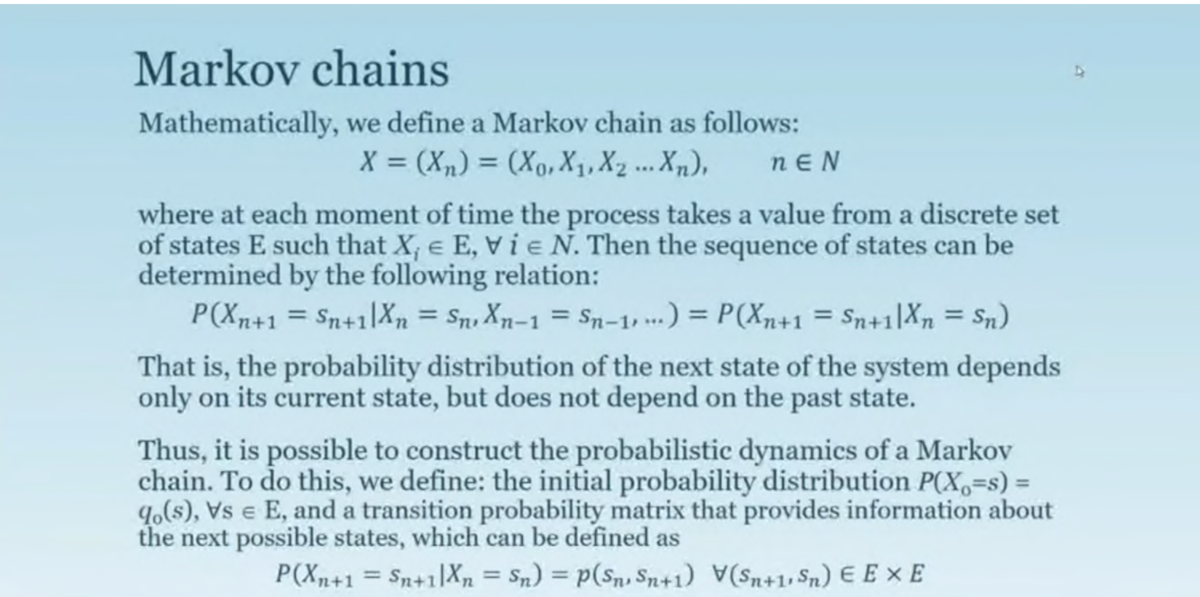

Figure 2: Presentation of paper [48].

The article "Cloud-oriented systems for open science: supporting virtual research teams through adaptive content management and collaboration tools" by Shyshkina and Svetsky [49] discusses the development of cloud-oriented systems for open science to support virtual research teams through adaptive content management and collaboration tools. It examines the use of such systems in the "V4 Educational Academic Portal for Integrating IT into Education" (EDUPORT) project. The key points are:

1. Open science principles promote cooperation, exchange of results, and systemic changes in scientific research implementation. Cloud-oriented open science systems provide tools to support virtual teams' open research activities.
2. The modern trends in forming open science cloud systems in higher education, including cloud platforms, educational software, and communication services to enable virtual team collaboration, are analysed.
3. The EDUPORT project created a cloud-oriented IT system to support a virtual research team, consisting of network infrastructure, educational software WPadV4, and an online communication system PIKS.
4. WPadV4 is database software that processes and manages educational content in tables, enabling adaptive content management.
5. Using cloud platforms and various corporate cloud services allows the creation of specialised environments tailored to research needs, introducing new forms and models of educational and scientific activities.
6. Broader involvement of cloud tools and services in higher education can positively impact learning outcomes, scientific research development, organisation level, and efficiency.

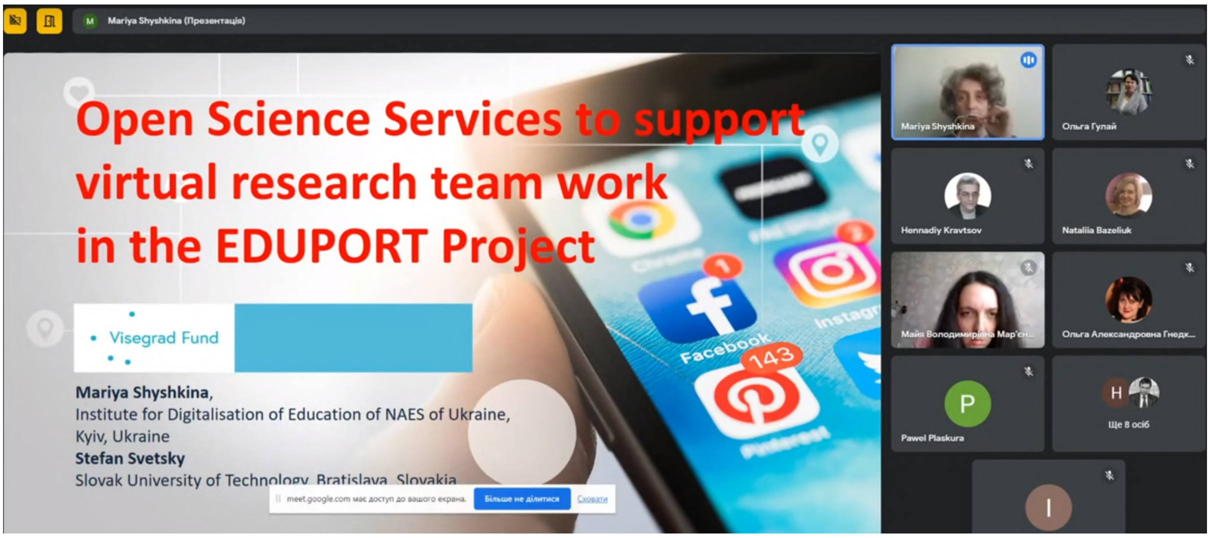

Figure 3: Presentation of paper [49].

2.2. Blended Learning

The article "Three-subject didactic model for teaching algorithmisation and programming online" by Lvov et al. [50] proposes a three-subject didactic model for teaching algorithmisation and programming online. It describes the pedagogical system and learning process model used for students in the "Software Engineering" speciality, focusing on courses involving programming mathematical tasks.

The article "Use of information and communication technologies in the organisation of blended learning of future vocational education professionals" by Kucher et al. [51] is devoted to using information and communication technologies (ICT) in organising blended learning for students training to become vocational education professionals.

The article discusses the importance of ICT and modern educational technologies in today's educational system. It outlines key competencies that vocational education students should develop, including using ICT, managing projects, implementing learning strategies, etc.

The results describe various ways ICT can be leveraged throughout the stages of an educational design project:

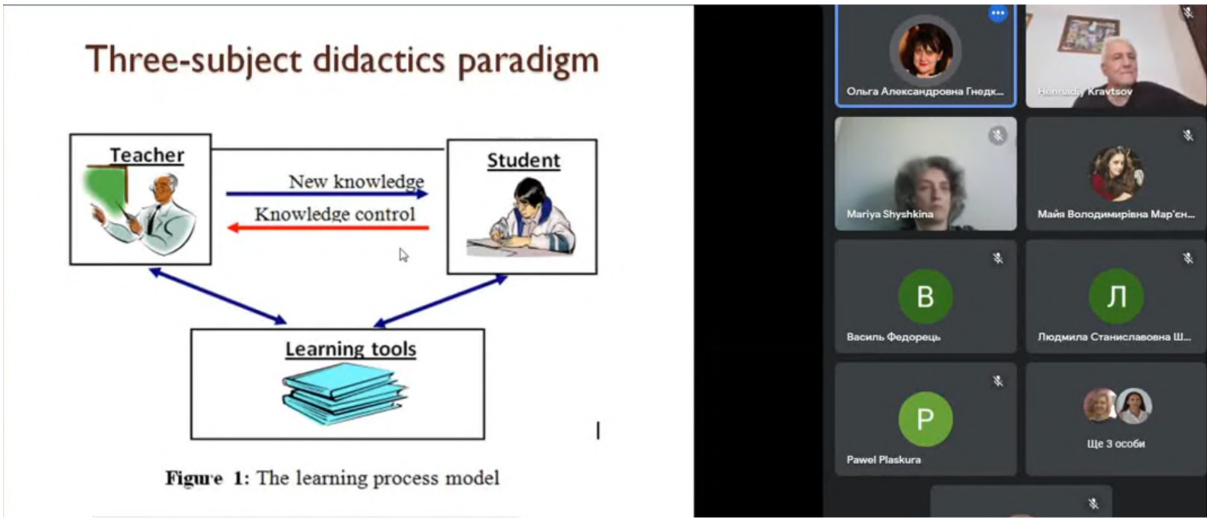

Figure 4: Presentation of paper [50].

- In the planning/brainstorming stage, online whiteboards and mind-mapping tools can facilitate collaboration and idea generation.
- For designing clothing patterns, open-source CAD programs like Valentina allow students to practice computer-aided design skills.
- Online learning platforms like Moodle with multimedia resources provide the basis for blended learning courses.
- Tools like online boards, video conferencing, and messaging enable communication, feedback, and group work.

The article argues that integrating these ICT tools into project-based learning helps systematically develop students' competencies in computer literacy, design, modelling, evaluation, and self-evaluation compared to traditional approaches.

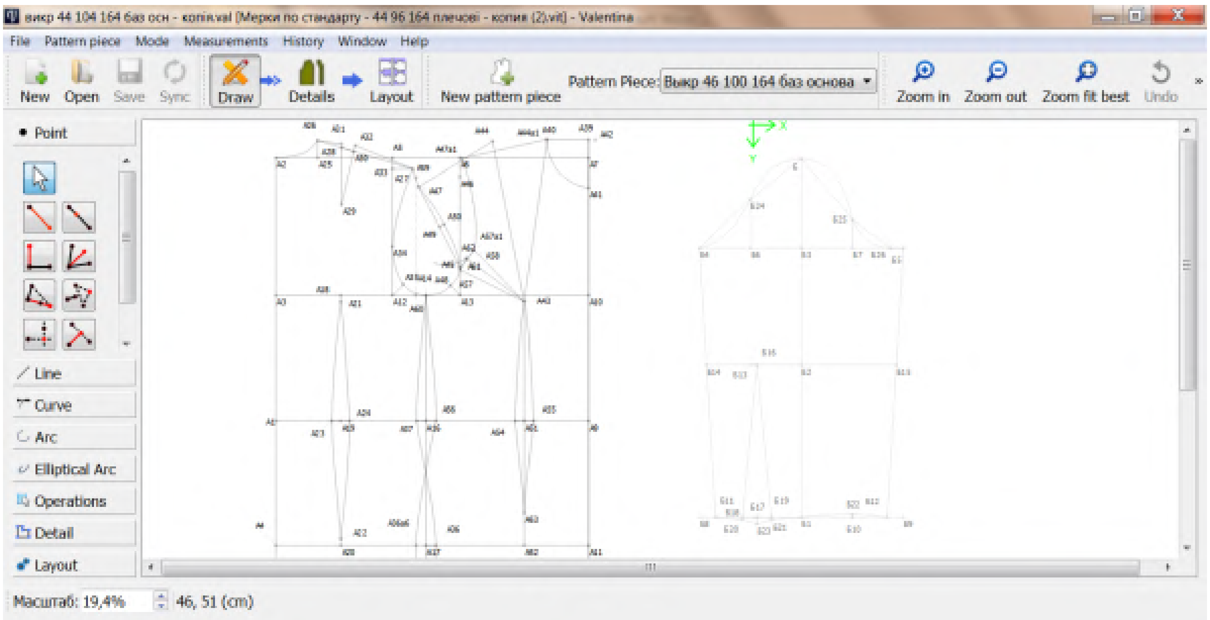

Figure 5: Presentation of paper [51].

2.3. Cloud-based AI Education Applications

The article "Application of neural networks for adaptive and flexible electronic tourist guide" by Moroz et al. [52] makes a case for the promising applications of large language models and neural networks to create more intelligent, flexible and adaptive electronic tourist query systems compared to traditional logic-based approaches.

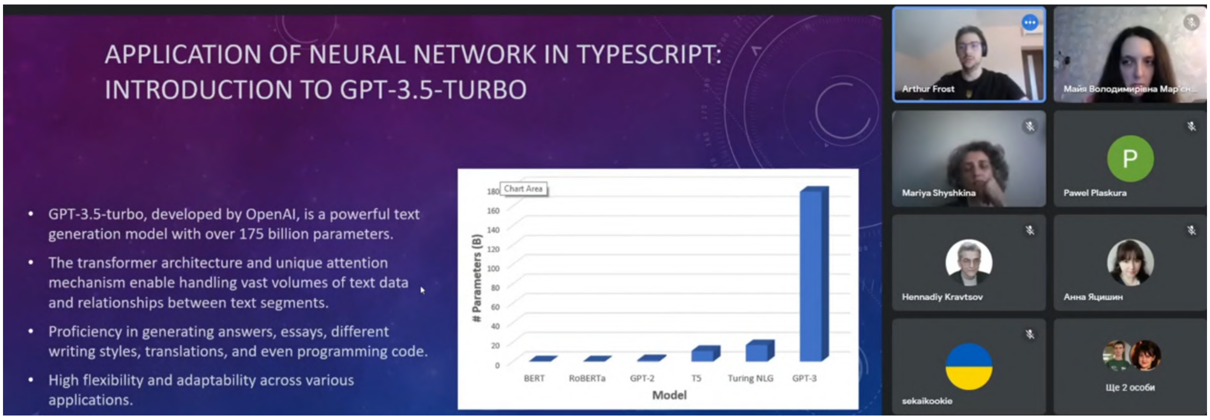

Figure 6: Presentation of paper [52].

The article "Accelerating software development with AI: exploring the impact of ChatGPT and GitHub Copilot" by Solohubov et al. [53] investigates the impact of artificial intelligence tools on code development. The authors analyse two particular AI tools, Copilot and ChatGPT, which can be used to generate code, correct errors, and answer questions about programming. The study finds that Copilot can accelerate development by suggesting code completions and helping developers write boilerplate code. ChatGPT can be used to learn new programming languages and libraries more quickly and find solutions to specific programming problems. The authors conclude that AI tools are having a revolutionary impact on software development and enabling programmers to focus on more creative and strategic tasks.

Figure 7: Presentation of paper [53].

The article "Artificial intelligence literacy in secondary education: methodological approaches and challenges" by Marienko et al. [54] examines the challenges and prospects of using artificial intelligence (AI) in secondary education in Ukraine. The authors begin by highlighting the lack of understanding and use of AI among the general Ukrainian population, as evidenced by a survey conducted by ZN.UA. They argue that there is a need to develop "AI literacy" as a component of digital competence, including understanding AI concepts and technologies, awareness of potential ethical issues, and the ability to effectively and ethically use AI throughout one's education and beyond.

The authors provide an overview of recent research on AI literacy, including its components (understanding, using, evaluating/creating with AI, and ethics) and pedagogical approaches such as digital storytelling. They also discuss the inclusion of AI services in the European Open Science Cloud and provide a practical example of using the AI-GeoSpecies service for studying plant species in biology and geography lessons.

The authors report on an intermediate stage of their pedagogical experiment, which involved surveying educators' attitudes towards and using AI services. The results indicate a positive attitude and interest in further training on using AI in education despite a lack of established methodologies.

The article draws on relevant literature and provides insights from the authors' research. It also highlights the interdisciplinary nature of AI literacy and the potential for AI to enhance inclusive education. On the other hand, the article could be improved by addressing potential counterarguments or limitations to the widespread adoption of AI in education and providing more specific recommendations for curriculum development and teacher training.

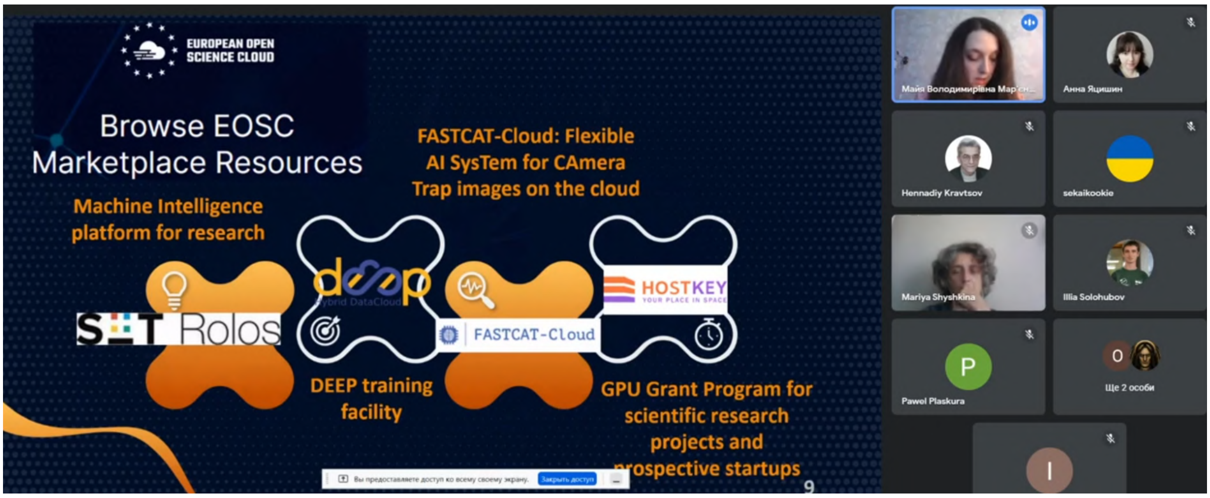

Figure 8: Presentation of paper [54].

2.4. Cloud-based E-learning Platforms, Tools and Services

The article "Development and implementation of virtual physics laboratory simulations for enhanced learning experience in higher education" by Tsvetkova et al. [55] describes the development and implementation of virtual laboratory simulations for physics courses at Pryazovskyi State Technical University in Ukraine. The authors make a strong case for the importance of virtual labs in enhancing student learning, mainly when physical lab access is limited or unsafe.

The introduction provides an overview of the role of physics labs and the need for virtual simulations to supplement traditional hands-on activities. The authors highlight how the COVID-19 pandemic and the ongoing war in Ukraine have made virtual labs even more essential.

The theoretical background section reviews prior work on virtual labs at different educational levels. The authors critique existing school-level virtual labs as being too simplistic "illusions" rather than accurate simulations. They emphasise that high-quality university-level virtual labs should accurately model real equipment and experimental processes.

The heart of the paper is the "Experience in developing virtual labs in physics" section, which describes the various virtual lab simulations created by the authors across topics like thermodynamics, electromagnetism, and quantum mechanics. Screenshots illustrate how the virtual interfaces mimic actual lab setups and measurement devices. The authors have put considerable effort into making the virtual experience as authentic as possible.

One strength is that some of the virtual labs go beyond what is possible with real equipment by allowing multiple-varied inputs, pausing, zooming in on small scales, and safely simulating hazardous conditions. The integrative mass spectrometry and Compton effect virtual labs that combine multiple physics domains are particularly innovative.

The conclusion persuasively argues that the 27 virtual labs provide comprehensive support for the university's physics curriculum. The authors also discuss limitations, like the current unavailability of real lab video due to the war, and outline plans for continued improvement of the virtual labs.

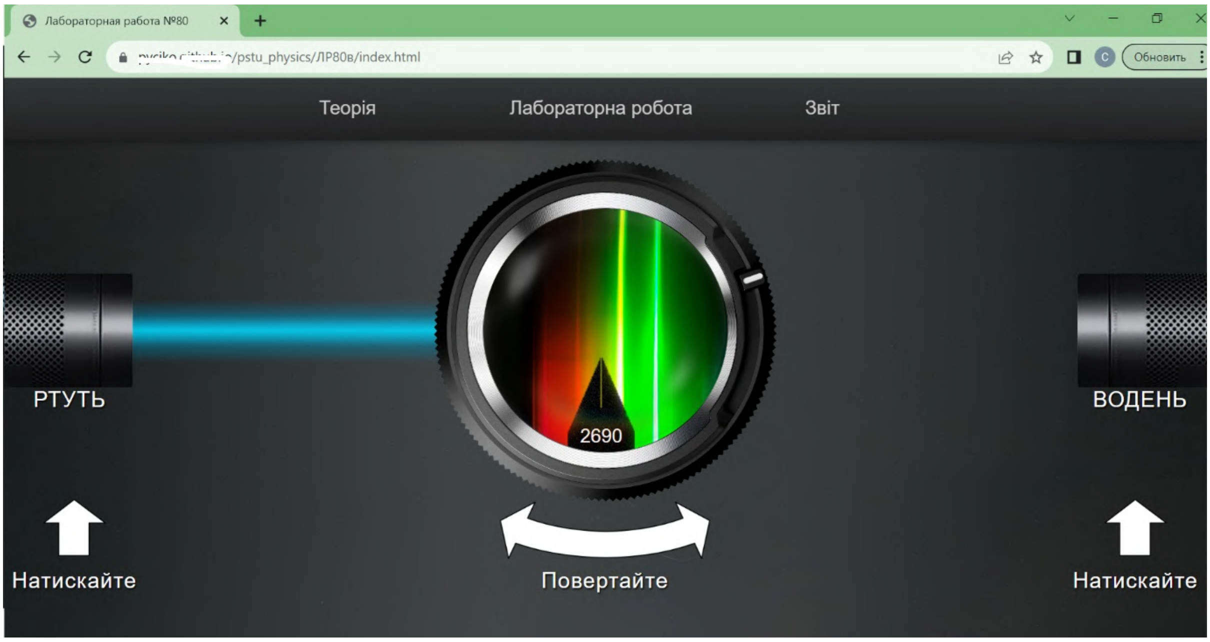

Figure 9: Presentation of paper [55].

The article "Evaluating the effectiveness of a cloud-based laboratory for teaching Linux operating systems to Computer Science students" by Oleksiuk et al. [56] investigates using a cloud lab called CL-OS to teach the Linux operating system to future computer science teachers. The authors developed this cloud lab by integrating the Cisco Network Academy's NDG Linux Essentials MOOC course with Apache Cloudstack and Proxmox VE private cloud platforms. They outlined the cloud lab architecture and described additional teaching materials like tests, essays, and assignments they created to complement the MOOC resources.

The authors conducted a pedagogical experiment using the CL-OS cloud lab to evaluate its effectiveness. Statistical analysis methods like ANOVA for repeated measures and Spearman's rank correlation were used to analyse factors influencing student performance in learning Linux, such as prior experience, gender, and satisfaction with different course components.

The authors conclude that the cloud lab approach, supplemented with short theoretical lectures and immediate practical tasks, enhances computing resource utilisation and improves students' time management skills for successful course completion. Overall, their methodology using cloud labs positively impacted the study of Linux by future computer science teachers.

The article "Leveraging cloud technologies to create an effective educational environment for developing soft skills in future primary school teachers" by Vasko et al. [57] examines the potential of cloud technologies for creating an effective educational environment aimed at developing soft skills in future primary school teachers. The authors provide a thorough overview of the topic, supported by relevant literature and their practical experience implementing cloud technologies.

The article begins by emphasising the growing importance of soft skills and the need for higher education to produce graduates with skills aligned with labour market demands. It defines an effective educational environment and outlines its key characteristics, such as fostering collaboration, providing an individualised approach, and utilising modern technologies like cloud tools.

The authors describe cloud technologies' various possibilities for soft skills development, including

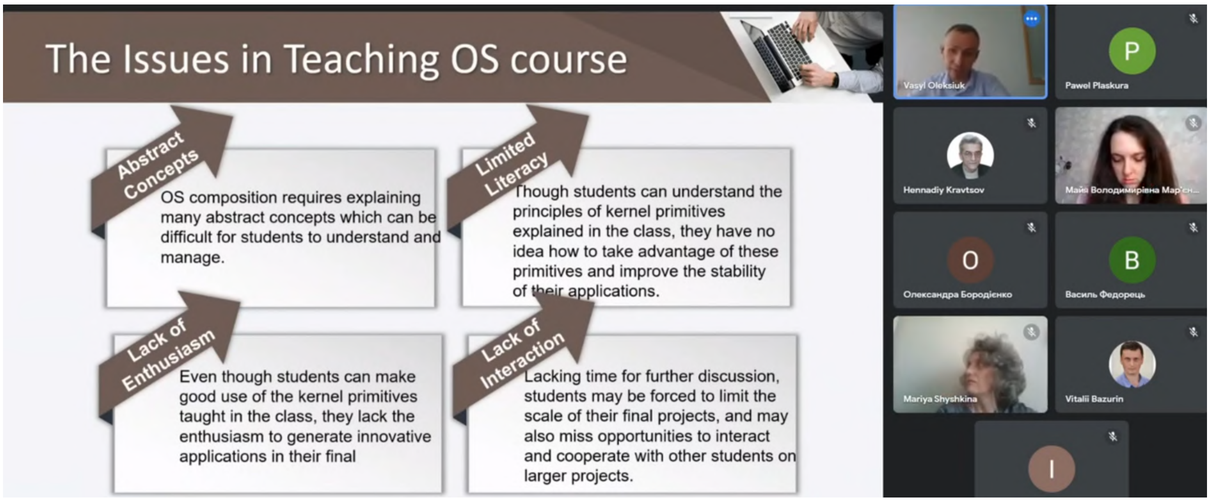

Figure 10: Presentation of paper [56].

access to advanced content, enabling collaboration and communication, personalised learning, independent skills acquisition, and mobile/flexible learning. They reference the SAMR model for evaluating technology integration, which guided their practical implementation.

Practical examples of cloud tools like Mentimeter, Padlet, and Jamboard are provided for activities like determining emotional state, reflection, collaborative projects, and visualising ideas. Screenshots illustrate the application of these tools, mapped to their level on the SAMR model. The examples effectively demonstrate how cloud technologies can facilitate specific activities that develop essential soft skills like communication, teamwork, critical thinking and creativity.

The advantages of cloud technologies, such as accessibility, flexibility, and data storage, are discussed. Potential challenges like internet dependence, privacy concerns, and costs are also acknowledged. The authors persuasively argue that cloud technologies have significant potential for creating environments conducive to soft skills development.

Figure 11: Presentation of paper [57].

The article "Implementing innovative teaching methods for asynchronous learning using Moodle LMS" by Morze et al. [58] addresses an important issue in education today – how to effectively implement innovative teaching methods like project-based learning, formative assessment, and facilitate communication/collaboration in an asynchronous online learning environment. The context is particularly relevant given the challenges faced by universities in Ukraine during the ongoing war, where synchronous online learning is often complex due to air raid alerts, power outages, and students/faculty being dispersed across different locations and time zones.

The authors make a strong case for leveraging the capabilities of learning management systems (LMS) like Moodle to overcome these obstacles. They provide an excellent overview of innovative pedagogical approaches like problem-based learning, gamification, storytelling, etc. and analyse survey results showing that while many instructors at their university are familiar with these methods, adoption in online courses still needs to be improved.

A key contribution is a detailed walkthrough of how various activities in Moodle, such as Forums, Workshops, Wikis, etc., can enable effective asynchronous communication, peer assessment, group project work, and other student-centred learning experiences. The screenshots and step-by-step explanations are quite valuable for instructors looking to utilise the full potential of their LMS.

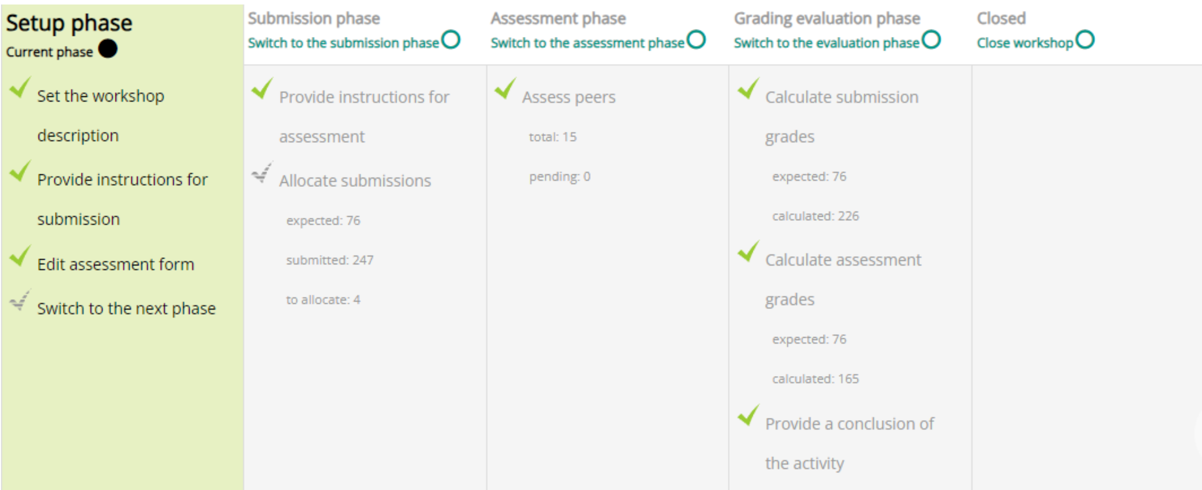

Figure 12: Presentation of paper [58].

2.5. Cloud-based Learning Environments

The article "Evaluating transactional distance and student engagement in HyFlex art therapy education amidst the war in Ukraine" by Bondar et al. [59] presents an in-depth examination of transactional distance and student engagement in the context of a HyFlex art therapy course taught at a Ukrainian university during the ongoing war. The authors provide a comprehensive overview of the challenges faced by Ukrainian higher education institutions amidst the conflict, including internal displacement, infrastructure damage, and the need to adapt teaching methods to accommodate students' diverse circumstances.

One of the study's strengths is its multifaceted approach, employing quantitative and qualitative methods to analyse transactional distance and student experiences. The authors effectively integrate concepts such as "trickle-down engagement" and the empathetic course design perspective, emphasising the importance of considering students' cognitive and emotional perspectives in the learning process.

The article offers valuable insights into the design and implementation of the HyFlex art therapy course, highlighting innovative strategies such as integrating interactive online art therapy tools, responsive attendance policies, and student-centred assignments. The authors' attention to the reframing, reforming, and reclaiming concepts within art therapy practice is particularly noteworthy, as it aligns with promoting self-exploration, personal growth, and empowerment among students.

The study's findings reveal the prevalence of stress among students, with a substantial proportion experiencing moderate to high-stress levels. This underscores the need for effective stress management strategies within the educational context. Additionally, the analysis of transactional distance highlights positive student satisfaction, valuable learning experiences, and strong engagement with online art therapy tools.

However, the authors acknowledge limitations, such as potential bias in student self-reports due to the stress of war, varying attendance conditions, and limited generalizability to other art therapy programs. Nonetheless, the article contributes valuable insights into the challenges and opportunities of delivering art therapy education in a HyFlex format during conflict.

Figure 13: Presentation of paper [59].

2.6. Digital Transformation of Education

The article "The role of information technologies in developing innovative bioeconomic ecosystems for sustainable transformation" by Vostriakova et al. [60] starts by motivating the need for bioeconomic transformation to address challenges like climate change, resource depletion, and ecosystem loss. It highlights the potential of the bioeconomy, especially in combining knowledge from different sectors like agriculture, processing industries, biotechnology, and information technology.

The authors then evaluate innovative activities in Ukraine's bioeconomic sector. They find that while the processing industry accounts for the most innovative enterprises, the level of innovation, especially in low-tech bioeconomy subsectors like food and wood, is very low compared to European standards. This low innovativeness is attributed to limited investment in R&D and innovation in these sectors.

The core contribution lies in conceptualising "innovative bioeconomic ecosystems" as regional agglomerations that provide formal and informal support services for bio-innovative entrepreneurship. The authors argue that such ecosystems, driven by a culture of innovation and involving diverse stakeholders, can catalyse the bioeconomic transformation by facilitating knowledge transfer, creating value networks, and attracting investment.

The article assesses the development of Ukraine's IT sector, highlighting its growth potential despite challenges like Russian aggression. It then provides a systematic overview of how information technologies can contribute to bio-innovation, including integrating biotechnology with engineering design cycles, green biotechnology, data analysis, security, skills development, and digitising biological resources.

A conceptual model is proposed outlining four critical roles for IT in bio-innovative ecosystems:

(1) digital networks to connect sectors and blockchain, (2) bioresource management and satellite technologies, (3) new biomaterials databases and decentralised production, and (4) augmented reality for training and smart manufacturing.

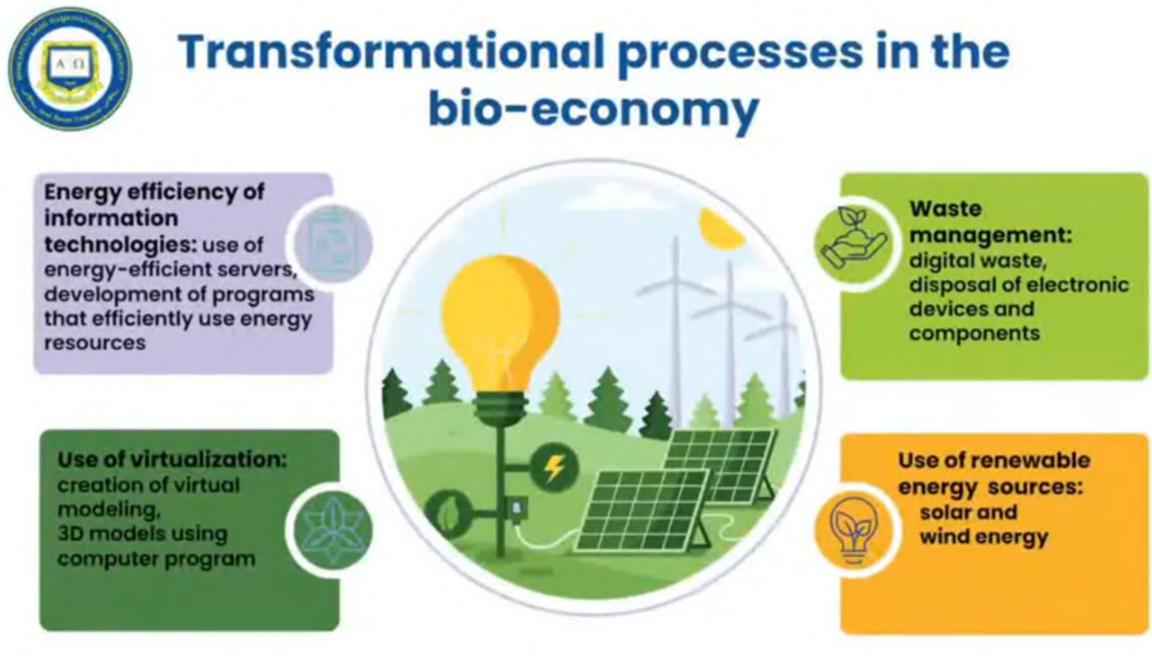

Figure 14: Presentation of paper [60].

The article "Integrating digital competencies of researchers into Ph.D. curricula: a case study on open science education" by Kuzminska et al. [61] examines the importance of integrating digital competencies and open science practices into training Ph.D. students and future researchers. The authors argue that the openness and digitalisation of science are increasingly critical in the modern era, requiring new approaches to scholarly work and innovation at universities. However, these skills are often overlooked in traditional Ph.D. curricula.

The authors set out to determine the key digital competencies needed by researchers, evaluate how well they are integrated into current Ph.D. programs, develop an elective training module on "Open Science" to build these competencies and assess the module's effectiveness through an empirical study.

A significant contribution is the detailed mapping and comparison of frameworks for defining digital competencies, like DigComp and the Jisc Researcher profile. The authors leverage the Jisc profile as the basis for specifying the target digital competencies for researchers. They then analyse the current Ph.D. curricula and design a new "Open Science" module aligned with building those competencies.

The module covers open-access publishing, research data management, open-source tools, scholarly communication networks, research integrity, and interdisciplinary platforms. The authors validate the module's importance and relevance through expert evaluation.

The paper's core is an empirical study assessing the module's impact on Ph.D. students at a Ukrainian university. Using surveys and statistical analysis, the authors find that students who took the module showed significantly higher self-assessed digital competencies compared to a control group across several key areas, such as digital research skills, productivity, and identity development.

While the module proved effective for building basic digital capabilities, the authors identify gaps in fully integrating open science practices and digitalisation into the Ph.D. experience. They propose expanding practical experiences through stronger connections between universities and research projects.

The article "Formation of digital competence of specialists in socionomic professions as a pedagogical problem" by Lovianova et al. [62] examines the critical issue of developing digital competence among professionals working in "socionomic" fields like teaching, law, social work, psychology, etc. The authors

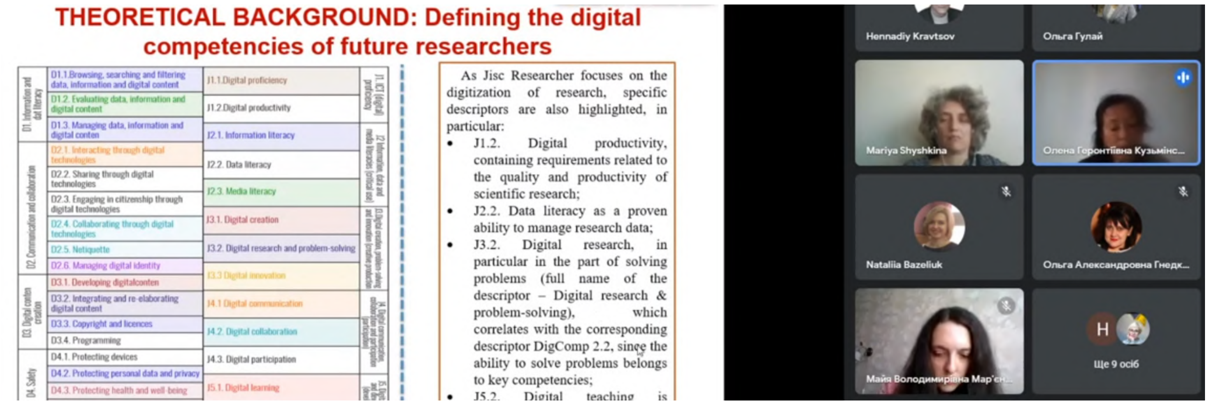

Figure 15: Presentation of paper [61].

rightly point out that digitalisation rapidly transforms society and the workplace, necessitating new competencies for successful job performance. This article makes a valuable contribution by synthesising prior work and convincingly arguing why developing digitally competent socionomic professionals should be a pedagogical priority. Future research could pilot digitally-infused curriculum models focused on shared socionomic core competencies to push the thesis further. However, within its scope, the paper capably frames the issue's importance for modern professional education.

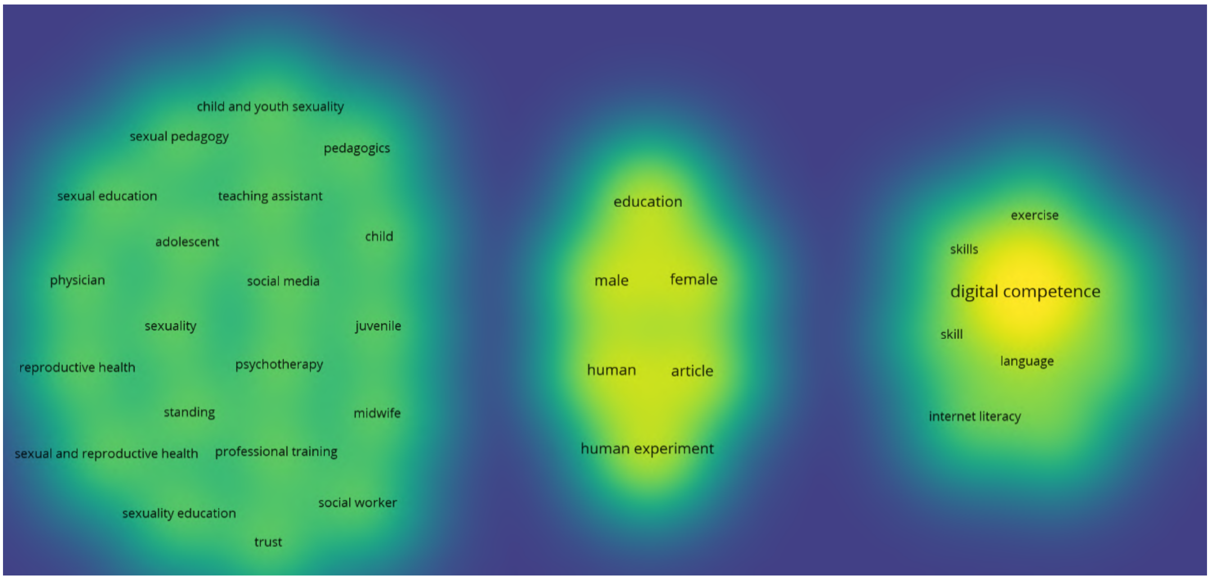

Figure 16: Presentation of paper [62].

2.7. Educational Data Mining

The article "A content analysis software system for efficient monitoring and detection of hate speech in online media" by Krylova-Grek and Burov [63] presents an interdisciplinary project that combines a computer program for quantitative content analysis with a psycholinguistic approach for qualitative analysis to identify hate speech in online media. The key aims were to develop a content analysis program to monitor Russian media outlets and apply psycholinguistic methods to detect hidden and manipulative hate speech.

The quantitative analysis was conducted using a Python program that searched selected websites using a dictionary of hate keywords, periods, and outlet names. This allowed efficient filtering of many articles that potentially contained hate speech for further qualitative review.

The qualitative analysis utilised the authors' psycholinguistic text analysis method to categorise the articles into three types: direct hate speech, indirect/hidden hate speech, and manipulative hate speech. This manual analysis could identify nuances like sarcasm, newly constructed hate words, and implicit meanings that automated methods would miss.

The combined approach was applied to monitor 11 Russian language online media outlets publishing on the Ukraine-Russia conflict from December 2020 to May 2021. Out of 1,284 publications analysed, 560 were identified as containing hate speech elements after the qualitative review.

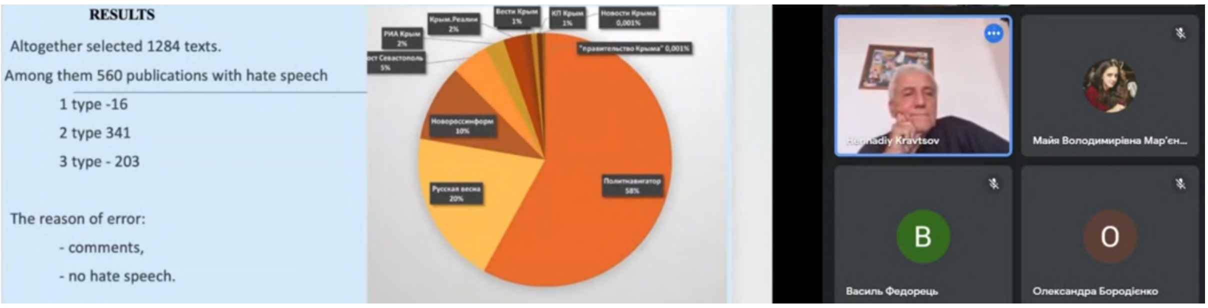

Figure 17: Presentation of paper [63].

2.8. Social Analytics in Education

The article "Assessing the state of research e-infrastructures for open science in Ukrainian higher education institutions" by Drach et al. [64] provides a thorough analysis of the current state of research e-infrastructures within the realm of Open Science at Ukrainian higher education institutions (HEIs). The authors ground their research in the context of the challenges posed by the Russian invasion of Ukraine in 2022, which has severely impacted HEIs' operations and research capabilities.

The authors establish a robust theoretical framework by examining existing literature, policies, and initiatives related to Open Science and research e-infrastructures in Ukraine and Europe. They propose a model for the ecosystem of research e-infrastructures, encompassing components such as open access to publications, open research data, citizen science, education and skills development, research integrity, and performance evaluation.

The study's empirical component employs a comprehensive survey involving 1,502 participants from over 110 HEIs across Ukraine. The findings reveal areas for improvement in organisational support, awareness, and utilisation of research e-infrastructure services. While some HEIs have established dedicated units or appointed staff for e-infrastructure development, many need more systematic efforts, leading researchers to rely on publicly available resources.

The authors highlight discrepancies in perceptions and awareness levels among staff categories, scientific degrees, and research experience. Limited awareness is particularly evident regarding services for open data management, research integrity, and professional development in Open Science.

The study identifies institutional and national repositories as the primary sources for facilitating open access to publications, while the adoption of international services remains limited. The authors also note challenges related to server damage due to military operations and the need for better support and guidance, especially for young researchers.

The paper's strengths lie in its comprehensive coverage, empirical data analysis, and practical recommendations. The authors propose establishing a pervasive culture of Open Science at the institutional level, enhancing normative documents, appointing competent professionals for e-infrastructure management, fostering communication and awareness, engaging IT and library staff, and prioritising continuous professional development.

The article "Information-analytical systems for supporting scientific research in Ukraine: development and applications" by Kamyshyn et al. [65] provides an in-depth analysis of the role of information-analytical systems (IAS) in supporting scientific research activities, with a focus on Ukraine's experience

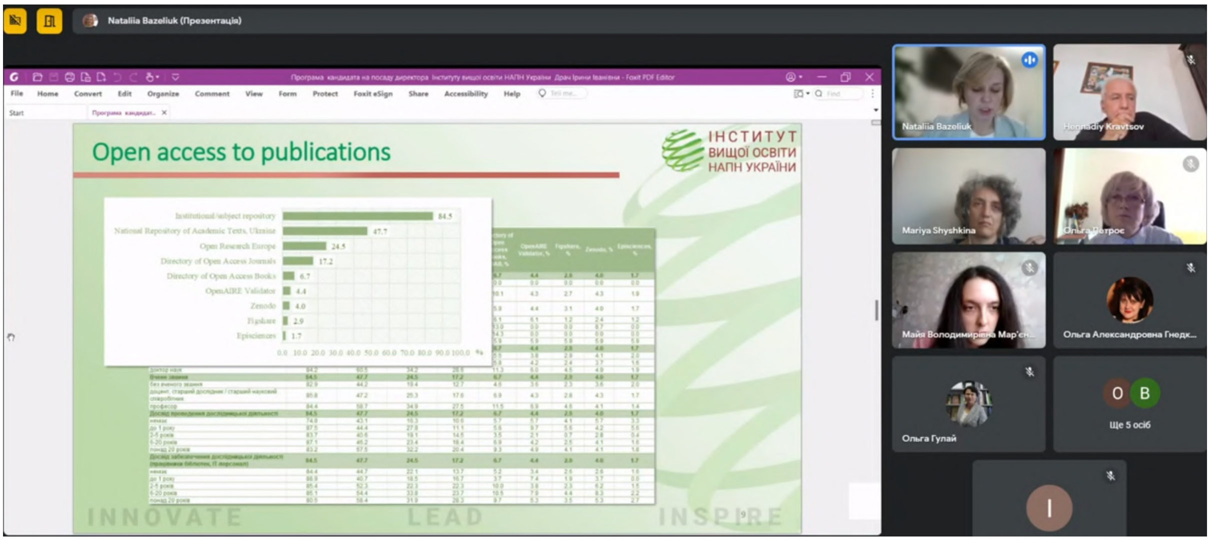

Figure 18: Presentation of paper [64].

and efforts in developing and implementing such systems. The authors effectively establish the significance of IAS in the digital era, highlighting their multifaceted benefits, including data collection, analysis, collaboration, information retrieval, modelling, and decision support.

The article commences with a well-structured literature review, underscoring the growing interest in leveraging digital technologies to enhance scientific endeavours. The authors then articulate the study's aim and objectives, which revolve around exploring how Ukrainian IAS contribute to the digitalisation of science and the organisational support of research activities.

A noteworthy strength of the article lies in its systematic examination of the concept of "IAS for supporting scientific activities" and elucidating their pivotal role in research processes. The authors provide a comprehensive overview of the functions and advantages offered by IAS, substantiating their arguments with relevant citations from the existing literature.

Furthermore, the article presents a detailed account of Ukraine's experience in the digital era, showcasing the various IAS developed by the State Scientific Organization "Ukrainian Institute of Scientific Technical and Expertise and Information" (UkrISTEI). The authors meticulously describe the features and capabilities of these systems, such as the National Repository of Academic Texts, the Automated System for Formation of Interstate Information Resources, and the Electronic Registration System for Open Scientific Research and Development Works, among others. This section offers valuable insights into IAS's practical implementation and real-world applications in supporting scientific research in Ukraine.

The authors also acknowledge the challenges and limitations associated with implementing IAS, including regulatory, organisational, and software-related hurdles and the need to enhance digital and information-analytical competencies among scientific and academic staff.

3. Conclusion and outlook

The 11th Workshop on Cloud Technologies in Education (CTE 2023) has once again demonstrated its commitment to fostering the growth of emerging researchers and providing a platform for exchanging innovative ideas and early research findings. The CTE 2023 proceedings offer valuable insights into the potential of cloud technologies to transform and enhance educational experiences. The papers showcase a diversity of innovative approaches and applications across various disciplines and educational levels. They highlight the potential for cloud-based solutions to address challenges faced by educators, such as limited access to physical resources, the need for flexible learning environments, and the growing importance of soft skills development.

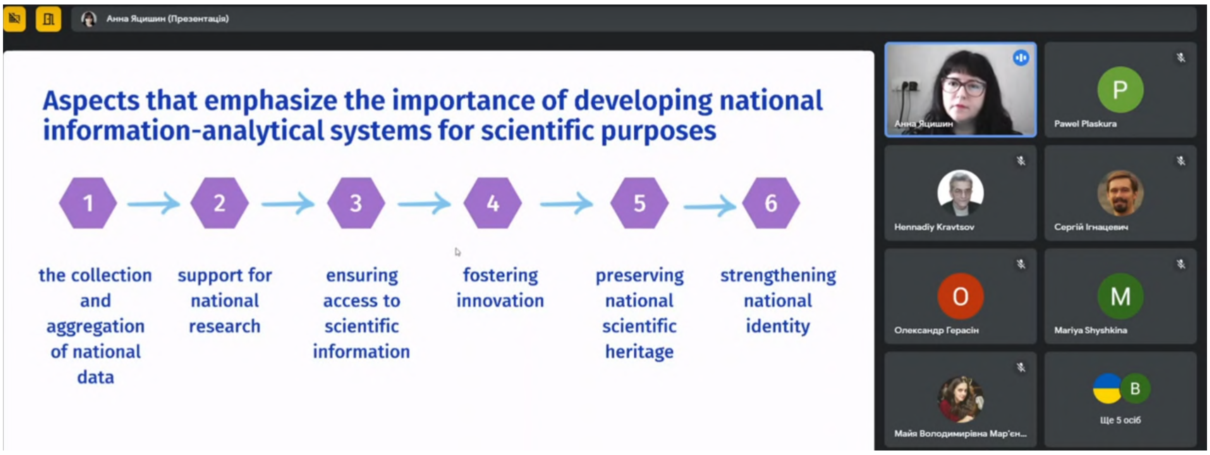

Figure 19: Presentation of paper [65].

As we conclude this successful edition of the workshop, we extend our gratitude to all the authors, delegates, program committee members, and peer reviewers who have contributed to its success. Their invaluable efforts and commitment have ensured the high quality and relevance of the presented work, further elevating the standards of academic excellence.

We want to acknowledge the developers and professional staff of the *Academy of Cognitive and Natural Sciences* (https://acnsci.org) and the *Not So Easy Science Education* platform (https://notso.easyscience.education) for providing us with the excellent and comprehensive conference management system that facilitated the smooth running of the workshop.

Since CTE 2017, our workshop is **sponsored** by the CEUR Workshop Proceedings (CEUR-WS.org), the world's best Diamond Open-Access proceedings publisher for Computer Science workshops. Long live CEUR-WS.org!

We look forward to the next instalment of CTE, scheduled for December 27, 2024, in Kryvyi Rih, Ukraine. This future gathering promises to be an even more enriching and thought-provoking experience, where emerging talents will converge to share their latest discoveries, engage in stimulating discussions, and forge lasting connections that will shape the future of these dynamic and ever-evolving fields.

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