

Comparative Analysis of Ways to Integrate Microsoft Teams, Zoom, Google Meet Into the Educational Process of Higher Education Institutions of Ukraine

Maryna Grynshyna

Kyiv National University of Culture and Arts

Tetiana Boiko

Kyiv National University of Culture and Arts

Mykola Boklan

Kyiv National University of Culture and Arts

Nina Husakova

Kyiv National University of Culture and Arts

Artem Pozniak

Kyiv National University of Culture and Arts

The use of online platforms for educational purposes is a topical issue and detailed studies in this field are not sufficient. The purpose of the article is the comparative analysis of ways of integration of the dominant and popular Microsoft Teams, Zoom, Google Meet services into the educational process. The article describes the Kyiv National University of Culture and Arts experience in the use of enumerated platforms in the learning process during the lockdown as well as in terms of the military aggression of the Russian army in 2022. The main scientific methods of the research: analysis, synthesis and empirical (SWOT analysis). The following issues were considered: digital tools used to solve educational tasks, analysis of possibilities and evaluation of the platforms, without specific characteristics of each platform. The results have shown that based on the analysis of the teachers' practice, the Zoom platform was most frequently used, nevertheless Microsoft Teams has a significant potential for the further development, but its security mechanisms and general characteristics are still insufficiently evaluated.

Keywords: distance learning, Microsoft Teams, Zoom, Google Meet, Ukraine

INTRODUCTION

The COVID-19 pandemic confirmed that a modern learning process means the access to online learning platforms. This is important for adapting students and universities in emergency situations. The spread of COVID-19 virus pointed to alternative ways of learning organization. The quarantine and self-isolation

provoked changes in the society. The new reality demands the mastery of the latest learning technologies. In the modern learning process numerous platforms are used: Microsoft Teams, Google Meet, and Zoom. Each of them has their own disadvantages and advantages. The study of this problematic is of great importance because the implementation of the learning process in the conditions of distance learning (especially in Ukraine – in terms of the military Russian aggression). Therefore, the aim of this scientific work is to compare and to analyze the ways of integration of online platforms Microsoft Teams, Zoom and Google Meet into the educational process of higher education institutions in Ukraine. The analysis was carried out on the base of Kyiv National University of Culture and Arts materials. The context of “Ukrainian crisis” is of a great importance in the scientific literature. So, the self-actualization of the objectives would ensure the consideration of the problem in terms of advantages and disadvantages of the mentioned online platforms. It should allow the formulation of recommendations for further improvement of working in this field. The proposed analysis would lead to the development and improvement of individual practices of using Microsoft Teams, Zoom and Google Meet in the educational process. This is an important finding for the digitalization of education, its adaptation to the requirements of modern society. Since the beginning of the COVID-19 pandemic, there has also been an increase in the number of scientific works where contemporary scientist tried to address the complex issues of efficiency in distance education. In particular, Laufer et al. (2021) characterize the functioning features of distance education. Kem (2022) explore key platforms for distance and smart learning. Parsons et al. (2022) based on a pedagogical survey of teachers in New Zealand investigate the features of distance learning implementation according to respondents' experiences. The described survey shows data from 31 teachers. Their main task was to experience the digital learning. The questioning pointed on the challenges that teachers face during online learning. The results showed that many teachers were not able to find suitable approaches for the distance learning form, but in most cases, teachers were well-prepared in e-learning. The methodological basis for this article is also based on the work of authors who have researched various distance platforms. Ayoub et al. (2020) analyze Coursera-based instructional design. In particular, Alfadda & Mahdi (2021) characterized the functionality of the Zoom platform. In addition, Wedari et al. (2022) also analyze the Zoom application in the context of its security, learning, and other features. Accordingly, the literature review principally covers the problem of distance education in general, or the authors focus, specifically on a single application. Consequently, there are few complete comparative studies in this field. In addition, the problem of the development of distance education platforms is steel opened. The main research question is whether a separate, additional educational platform for classes will be developed, will the existing applications be improved?

MATERIALS AND METHODS

Two main research methods were used in the work:

1. The general scientific method (logical)
2. Pedagogical knowledge method.

The analysis, synthesis, induction, and deduction occupy an important place among the general scientific methods. These theoretical methods help to study the main research subjects in the broadest way. The subject of the study is divided into several parts (analysis of modern pedagogical literature, highlighting of the main crucial problems, analysis of the phenomenon of distance learning in Ukraine, the characteristics of modern online platforms). By means of synthesis it was possible to combine the previously highlighted problems and to formulate the findings. Using the induction and deduction methods one managed to generalize the obtained data on the basis of logical considerations from the concrete to the general. Structural, multifunctional, systemic methods were additionally used. It should be noted that on the basis of the systematic method, the phenomenon of distance education is considered as a complex, constantly developing system.

Among the theoretical pedagogical methods, one singles out the comparative method, the classification and generalization. As a method of pedagogical research, the comparative method is a technology that implies a careful comparison of certain results. In particular, in this article on the basis of comparative

method one managed to compare the features of using Microsoft Teams, Zoom, Google Meet as integration platforms in the learning process. On the basis of generalization there was a transition from the specific obtained results to the formation of general conclusions on the problem of integrating the above-mentioned platforms into the learning process (Sherman et. Al., 2022).

Other theoretical pedagogical methods of research were also used, in particular abstraction and concretization. Using them, one managed to analyze the coverage of the mentioned problem in different ways. In this study a special attention is paid to empirical pedagogical research methods. In this work one highlights the observation and experiment (the study is based on the experience of implementing distance learning in the Kyiv National University of Culture and Arts). The method of rating is of great importance here, because on the basis of rating systems it was possible to trace the features of the application of the analyzed distance platforms in Ukraine. The method of systemic analysis was used to highlight the functionality of tools from platforms Google Meet, Zoom and Microsoft Teams.

At the same time, the main place in this study occupies the SWOT-analysis, which was used to compare Google Meet, Zoom, Microsoft Teams platforms. Directly on the basis of SWOT-analysis one succeeded to evaluate the competitive position of a software product in the market, formulating the internal and external factors, affecting its performance (advantages, disadvantages, ways of use or opportunities). The use of this method contributed to the systematization of the results of the study.

RESULTS AND DISCUSSION

Heading Digital Tools of Modern Distance Learning (Based on the Analysis of the Educational Process in Kyiv National University of Culture and Arts)

The sudden COVID-19 pandemic outbreak, which spread into many countries, contributed to the shift to a remote format of work, as a result, such concepts as distance work or remote learning became especially popular in the first half of 2020 (Laufer et al., 2021). In particular, the Kyiv National University of Culture and Arts has been actively introducing distance learning platforms since that time. The main forms of learning (lectures and seminars) were conducted on the popular learning platforms Google Meet, Zoom, and Microsoft Teams. A distinct role in this process played Moodle platform, which was used to control the success and quality of students' knowledge. At the same time, as a result of the full-scale invasion of the Russians in Ukraine (February 2022) there was a problem with the recommencement of distance learning in schools and higher educational institutions of Ukraine. Consequently, the training from that time became possible on the basis of modern Internet resources, contributing to the provision of interactivity and multimedia support of the learning process, monitoring the assessment of cognitive activity of students.

Taking into account the experience of teachers at Kyiv National University of Culture and Art, one can affirm that modern Internet technologies allow a teacher to conduct training without being close to the student, to use resources for distance learning, creating conditions for the full assimilation of the material. Note that one of the modern pedagogical problems is the interpretation of the concepts of distance and e-learning (Petrenko et al., 2020). Many scientists use them as synonyms, however, although these terms are close in content, they are not identical (Kem, 2022). In particular, distance learning should be understood as a form of learning, and e-learning should be understood as the means of learning that underlie the use of digital technology and telecommunications systems. It is these that facilitate the achievement of knowledge through virtual environments.

Comparing the traditional form of learning with distance learning, the advantages of the later should be noted. First of all, the possibility of obtaining educational services at a convenient time and regardless of the location of the educational institution, the possibility of professional education taking into account the individual predispositions of the student, the use of a large number of sources of information, the extensive use of information and telecommunications technologies, the combination of obtaining educational services and work, etc. (Parsons et al., 2022).

The experience of Kyiv National University of Culture and Arts demonstrates that among other advantages of distance learning can be highlighted the possibility of increasing the level of IT competence,

which allows students and teachers to remain competitive in terms of constantly changing technical and intellectual innovations (Prokopenko, 2021).

The effectiveness of the distance education system does not just depend on the use of modern digital technology, but also on the understanding of the need for creativity. (Kem, 2022). Currently, there are many online resources, or programs, which allow distance communication between teachers and students and maximize the productive and sometimes unconventional organization of the learning process. Such online platforms facilitate both organizational and practical issues. In particular, digital tools that solve organizational problems include WhatsApp, Telegram, Google Charts, Canva, Quizizz, Moodle, Mentimeter, Google Forms, and others. Learning tasks include Skype, Cisco, Google Meet, Zoom, Microsoft Teams, etc.

Consequently, capabilities and options for managing learning work, organizing online conferences, conducting lectures, seminars, tests, etc. - all this is not a complete set of tools of the analyzed service (See Table 1).

TABLE 1
DIGITAL TOOLS THAT FACILITATE MANY LEARNING TASKS

Digital tools	Typical functional purpose
Organization of webinars, conferences, lectures and seminars	Skype, Cisco, Google Meet, Zoom, Microsoft Teams
Communicating via messengers	Telegram, Viber, WhatsApp
Managing a study group	Microsoft Teams, Zoom
Conducting surveys, testing	Quizizz, Moodle, Zoom, Mentimeter, Google Forms
Tools to aid visualization	Google Charts, Canva, Piktochart, etc.
Tools for presentations	Prezi, Emaze, Microsoft Office Power Point, Moovly, etc.

The transition to a distance format at Kyiv National University of Culture and Arts under the COVID-19 pandemic presented the faculty with a number of challenging tasks. Many faculty members were faced with new formats of distance learning that needed to be mastered as quickly as possible. One of the main problems was a variety of online network platforms (Sydoruk et al., 2022). In particular, at Kyiv National University of Culture and Arts the most popular platforms that contributed to the organization of online learning were: Microsoft Teams, Zoom, Google Meet.

Online Platform Zoom: The Main Functionalities

The most popular platform at Kyiv National University of Culture and Arts is Zoom. The Zoom online platform ensures a real time communication. This resource offers software communication, which is one of the key advantages of this system that combines video conferencing, chat and teamwork between students and faculty through various features (Wedari et al., 2022). The main learning aim at Kyiv National University of Culture and Arts is the formation of critical thinking, communication skills, creativity, which are important criteria for the activities of modern creative people. Directly Zoom platform contributes to the development of the mentioned skills, as it points toward the use of different creative opportunities (Alfadda & Mahdi, 2021). At the same time, one should note that when the teachers at Kyiv National University of Culture and Arts started to use this platform, they experienced certain difficulties, as they had no sufficient experience and relevant skills. However, during the durable use of this resource during remote classes, most of the teachers mastered Zoom perfectly.

On Zoom's online platform, teachers have opportunities for oral and written communication while utilizing the offered system's possibilities. One of the key advantages of this resource is the conference recording option. In this way, the instructor will later be able to replay previous classes that students have missed.

Obviously, students will be able to review the missed lecture on their own at a convenient time. A significant advantage is the demonstration function of the screen on this platform (Wedari et al., 2022). The teacher can display on the screen any informational materials needed for the class (speaking of various images, audio and video files, presentations, and other visual materials). Zoom has a special function, where the teacher has the ability to organize control, write refinements, comments to the whole group.

The advantage part of the platform is the quick sharing of the necessary link for conference participants (Alfadda & Mahdi, 2021). At the same time, Zoom also has an important function as a transfer of organizing functions to another conference participant. An important advantage is also that the platform has the option to mute the camera and microphone, which allows a particular student to participate in a seminar without interrupting others. In addition, it also contributes to the organization of the lecture sessions. In general, based on the experience of using this platform, one can summarize that it is basically stable, despite the heavy loading due to the large number of users around the world (Alfadda & Mahdi, 2021). However, the analyzed platform also has some disadvantages. One believes that the most inconvenient is the limitation of the conference session, which is 40 minutes (Feature comparison: Zoom and Teams, 2021). Obviously, this time is enough for a typical high school lesson, but not enough for students. For this reason, the participants need to join the link again, and it requires some time. It is possible to activate the paid version, but unfortunately not all educational organizations in Ukraine have the possibility to allocate funding for this.

Microsoft Teams: Features of Use

Microsoft Teams was launched in 2017. The developer planned this project as an opportunity for Office 365 users to communicate with each other in a video conferencing format. Microsoft Teams is a part of Office 365, it is integrated with other applications, and it is part of the subscription to the Microsoft Office Suite. Only in 2018 users got access to a separate version of this program, which functioned without access to Office 365, but had certain restrictions, such as a maximum number of participants in a video meeting. Microsoft Teams has gained popularity in European schools. The platform is also used in the U.S. university system (Kem, 2022). In Ukraine, this service is also popular because the Ministry of Education and Science of Ukraine has concluded the agreement on free access to the Microsoft resources. This tool plays an important role in modern distance education and contributes to the development of the industry. In particular, in some Ukrainian universities (e.g., Kyiv National University of Culture and Arts or Ivan Franko Lviv National University) the use of Microsoft Teams is conditioned by the possibility of monitoring students' aptitude and attendance provided by the service. Students typically have email accounts and access to Office 365, which allows instructors to record attendance, etc. (Feature comparison: Zoom and Teams, 2021).

Microsoft Teams is an adaptive place for teamwork based on the main four aspects: chat, teamwork center, customization options and robust security. The platform allows you to organize conversations by their relevance. For this reason, it is very convenient to conduct practicals - a group of students can actively discuss individual issues that are considered during a particular class, show their illustrations or presentations to all members of the group. Students can also participate in a live discussion using a regular microphone (Feature comparison: Zoom and Teams, 2021). Microsoft Teams also allows instructors to conduct seminars and lectures. In order to evaluate the effectiveness of student learning, the instructor can conduct tests because the system supports several types of test tasks. These include: multiple-choice questions, open-ended questions with a yes/no answers range yes-no questions, (tasks with gaps to fill in, missing terms, dates, formulas) open cloze tasks, writing short answers to questions and explaining your opinion in longer paragraphs. The efficiency of the educational process is ensured by checking the correctness of the answers to a specific question, automatic scoring (Pinheiro & Santos, 2022). The settings allow instructors to automatically receive an email notification that students have passed a certain test with the corresponding automatically posted results. Let's compare the functionality of Microsoft Teams and the more popular Zoom platform (See Table 2).

TABLE 2
COMPARISON OF THE FUNCTIONALITY OF LECTURE AND SEMINAR CONFERENCES
IN ZOOM AND MICROSOFT TEAMS

Functionality	Zoom	Microsoft Teams
Raise your hand function	+	-
Chat function	+	+ (Up to 100 people)
Function for distributing materials	Organizer only	All participants have the right
File transfer	-	+
Record function	+	+
Recording	Local or Cloud-based	Based on Cloud
Number of visitors	300 persons	250 persons
Remote Control feature	+	+
Outlook calendar integration	Probable potential function	Available
Waiting room functionality	+	+
Background Blur function	+	+
Video Sharing	All participants	Conference presenters
Phone Conf Bridge Included	+	+
Digital whiteboard	+	+

Source: Adaptive from “Feature comparison: Zoom and Teams” (2021). (<https://www.technology.pitt.edu/help-desk/how-to-documents/feature-comparison-zoom-and-teams>)

As you can see from the comparison of the two platforms, the functionality of Microsoft Teams is not inferior to Zoom. The only thing missing is the “Raise Hand” function. However, it is claimed that this is not a problem if the cameras of all the participants of the class are turned on. At the same time, Zoom lacks the file transfer feature. In general, we think that Microsoft Teams has a great functionality. This platform is expected to be more actively/widely used in the higher educational institutions of Ukraine because of rapid development of distance learning due to several factors. These factors are the pandemic, the war in Ukraine, economic crisis.

To conclude, the potential of Microsoft Teams platform is underestimated in Ukrainian higher educational institutions. Obviously, the tools of this resource allow a detailed analysis of students' training, quality and prompt transfer of necessary information, comfortable conducting of classes, etc. The use of Microsoft Teams can contribute to the development of the university education in Ukraine. In the future, one believes that this potential will lead to serious interest, because in the conditions of Russian aggression, which is still ongoing, there are almost no options for the development of education other than distance learning.

Is Google Meet Also an Underrated Platform, or Not?

The question posed in the title of the paragraph is rather rhetorical, because, despite its popularity in European countries and the United States, it's being used in Ukraine a little. Also, this platform is less popular among teachers at the Kyiv National University of Culture and Arts. Google developed Google Meet, or the first version the Hangouts Meet, in 2017. Previously it was used in the company's business service packages (Kem, 2022) and then was improved for new needs. Google Meet allowed audio and video calls and conferences, working together on documents, using Google disk resources and other tools.

In March 2020, taking into account the spread of the COVID-19 pandemic, Google made access to this product free of charge, which led to an increase in the popularity of the service in the world. However, for educational purposes, it was inferior to its competitors. Note that the free version has no video recording function, the number of participants is limited to one hundred people, and the duration of video conferences do not exceed one hour. Also, Google Meet gives access to a weighty functionality: an unlimited number of meetings, the function of live online subtitles (if you want to mute, it's available only for English), a

wide range of operating systems on which the platform is open, flexible screen settings, chat between the participants, in which you can distribute specific files or links needed for training (Abd- Rabo & Hashaikeh, 2021). For security and privacy reasons, other people’s microphones cannot be turned on, and all chat recordings are only available when a person joins the conference. Only the administrator has the right to mute and delete participants during the video conference. At the same time, there are certain disadvantages to using the platform. For instance, it is not technically easy to give access to users from higher education institutions who do not belong to the domain of the organizing lecturer (Hamzah, et al., 2021). The problem of using Google Meet in 3G or 4G Internet mode on mobile devices that support multiple SIM cards is palpable. Due to an error, it is necessary to remove one card. The solution to this issue is unknown to everyone, and in wartime conditions in Ukraine, the number of students who will use mobile Internet will only grow. There may also be failures in the service itself, which sometimes does not start or does not allow other users to join.

Swot-Analysis of Microsoft Teams, Zoom, and Google Meet Platforms

For a thorough comparative analysis of training platforms, a Swot-analysis of the advantages and disadvantages of Microsoft Teams, Zoom, and Google Meet was conducted. Its results have been formed in the table (See Table 3).

TABLE 3
ADVANTAGES AND DISADVANTAGES OF USING MICROSOFT TEAMS, ZOOM, GOOGLE MEET PLATFORMS BASED ON SWOT ANALYSIS METHODOLOGY

Microsoft Teams	
Pros	Cons
Presence as part of the Office365 package, which in the corporate system is provided free of charge to educational institutions	Supports a variety of browsers, except Firefox
The presence of a built-in system with Microsoft resources. We are talking about Word, Outlook, Excel, OneNote, PowerPoint and others	Complex interface
Function of demonstration of participants on the basis of common mode (especially effective for discussions and brainstorming)	Conferences, seminars and lectures based on a closed Microsoft system
Security elements through the use of Microsoft system security policy	
Maximum number of attendees - 300	
Zoom	
Pros	Cons
Easy interface to use	Time limit in the free version
Many features for organizing trainings are available in the free version	The maximum number of participants in the free version - 100 people.
Possibility to delegate the functions of organizer to other participants	There is no possibility of automatic tracking of student attendance
Individual chat in the conference	The general chat shows only messages sent after a participant joins the conference

Google Meet	
Pros	Cons
Contains enterprise package	Time limit - up to 1 hour.
Ability to integrate with various Google services	The maximum number of participants - 100 people (in the free version of the resource).
Availability of a digital whiteboard - a completely separate application that allows you to prepare it before class.	Poor sound quality, when not only the lecturer's microphones are turned on, but also those of other participants
Protected by Google security policy	When there is a conference in virtual rooms, you cannot record
Simple and friendly interface	No individual chat

Source: Developed by the authors of the article

So, Swot-analysis has shown that the above platforms are easy to use and have user-friendly interfaces for organizing training. At the same time, all platforms have extensive tools to improve the quality of the learning process. However, their main disadvantage is the time limitation of the online class duration. Some of them (Google Meet and Microsoft Teams) function based on corporate systems, which are characterized by closed systems. In addition, a noticeable disadvantage of Zoom and Google Meet platforms are the limitation of the number of conference participants (up to 100 people). Consequently, it isn't easy to imagine the organization of a large-scale online conference for many participants. However, the paid versions of the mentioned platforms have no such limitation.

Security and Online Learning On Zoom, Google Meet, and Microsoft Teams: Recommendations and Practices

Working online requires special attention, given the hybrid threats and cyber challenges of today. An agreement to use personal data always has certain hidden threats, especially when it comes to questionable platforms. Note that Google Meet, Zoom, and Microsoft Teams belong to proven companies, nevertheless some flaws are partly present in their activities. Experts recommend sharing less personal information with apps. In particular, it would be ideal to use the platform as a guest in order to pass less information about yourself to a third-party company. If signing up is unavoidable, however, choose one particular platform and use only that platform in the future to minimize your digital footprint. What is also essential is to familiarize yourself with privacy and security settings and learn how to use those (Yovenko et al., 2021). First of all, it is better to have a separate email or account that is not connected to any bank cards, social media accounts, etc. for creating a videoconference and registering. It's also wise to use a well-protected password containing a set of different characters and numbers. Since videoconferences are recorded, turn off the microphone and camera if possible. We believe that the best protected platform is Microsoft Teams, which uses security mechanisms from Microsoft and encrypted communication. Less secure is the Zoom platform. A simple numeric meeting ID has been used for Zoom bombing bullying. It is about connecting random people to the conference with the goal of insulting all participants and disrupting the meeting. Zoom's owners have also been accused of divulging their customers' personal data (Wedari et al., 2022). As a result, a number of government agencies refused to cooperate with this platform. Thus, each of the studied online learning platforms has its own threats and potential opportunities (See Table 4).

TABLE 4
COMPARATIVE ANALYSIS OF POTENTIAL OPPORTUNITIES AND THREATS

Microsoft Teams	
Potential opportunities	Threats
The option to apply at the national level (for this reason, the experience of Poland, where all schools use this platform, is important)	A recording of the conference may be available to all participants, which in certain situations may violate personal rights
The support for the application of this platform at the level of a particular institution	
The increase of functional tools	
Zoom	
Potential opportunities	Threats
The potential to use at the state level	Zoom bombing - the possibility of connection of unauthorized persons
The elimination of time constraints	High probability of hacking, insecure data
The expanding functionality	No automatic tracking of student attendance
	General chat shows messages sent after participant joins the conference
Google Meet	
Potential opportunities	Threats
Ability to apply at the state level	Platform inaccessibility on Huawei mobile devices
The option of the application of this platform at the educational institution level	By direct link, access to the digital whiteboard is publicly available.
The expansion of functionality, primarily to improve sound quality.	

Created by the authors on the basis of the Swot-analysis methodology.

Therefore, when comparing threats, one believes that the Zoom platform is less secure to use than others. At the same time, Google Meet also has its own security threats. In particular, having a direct link can access the digital board. For this reason, the Microsoft Teams platform is the safest to use. Despite this, all of the aforementioned platforms have extensive features that will help to improve them.

CONCLUSION

To conclude, the use of online platforms in distance education is a standard practice, which will continue in Ukraine even in conditions of hostilities or regardless of new outbreaks of the COVID-19 pandemic. The experience of teachers at Kyiv National University of Culture and Arts demonstrates that Zoom remains a popular platform for teaching. At the same time, security problems (the French company was accused of distributing users' private data to outsiders) in the future may lead to a gradual transition to other platforms. The most promising, as we found out, is Microsoft Teams. The potential to combine with other Microsoft products (primarily Office 365), and the security policy of the powerful American company makes this service important for classes in the future. Note that Microsoft has established bonds with the Ministry of Education and Science of Ukraine, so there will be cooperation for further improvement. The Google Meet platform also looks underestimated, but it is experiencing difficulties with the technical plan. In 3G or 4G Internet mode on mobile devices that support multiple SIM cards, it may not work properly. The number of students who will be using mobile Internet will grow in a military environment. This may cause inconveniences during activities.

REFERENCES

- Abd-Rabo, A.M., & Hashaikeh, S.A. (2021). The Digital Transformation Revolution. *International Journal of Humanities and Educational Research*, 3(4), 124–128. doi:10.47832/2757-5403.4-3.11
- Alfadda, H.A., & Mahdi, H.S. (2021). Measuring Students' Use of Zoom Application in Language Course Based on the Technology Acceptance Model (TAM). *Journal of Psycholinguistic Research*. doi:10.1007/s10936-020-09752-1
- Ayoub, A., Amin, R., & Wani, Z.A. (2020). Contribution of developed countries towards MOOCs: An exploration and assessment from a representative platform Coursera. *Asian Association of Open Universities Journal*, 15(2), 251–262. <https://doi.org/10.1108/aaouj-03-2020-0016>
- Hamzah, N., Ahmad, M.F., Zakaria, N., Ariffin, A., & Rubani, S.N.K. (2021). Technical and Vocational Education Students' Perception of Using Learning Videos during Covid-19 Pandemic Period. *2021 IEEE International Conference on Automatic Control & Intelligent Systems (I2CACIS)*. <https://doi.org/10.1109/i2cacis52118.2021.9495895>
- Information Technology. (2021, April 20). *Feature comparison: Zoom and teams*. University of Pittsburgh. Retrieved from <https://www.technology.pitt.edu/help-desk/how-to-documents/feature-comparison-zoom-and-teams>
- Kem, D. (2022). Personalised and adaptive learning: Emerging learning platforms in the era of digital and smart learning. *International Journal of Social Science and Human Research*, 5(2), 385–391. <https://doi.org/10.47191/ijsshr/v5-i2-02>
- Laufer, M., Leiser, A., Deacon, B., de Brichambaut, P., Fecher, B., Kobsda, C., & Hesse, F. (2021). Digital higher education: A divider or bridge builder? Leadership perspectives on edtech in a COVID-19 reality. *International Journal of Educational Technology in Higher Education*, 18(1). doi:10.1186/s41239-021-00287-6
- Parsons, D., Gander, T., Baker, K., & Vo, D. (2022). The Post-COVID-19 Impact on Distance Learning for New Zealand Teachers. *International Journal of Online Pedagogy and Course Design*, 12(1), 1–16. doi:10.4018/ijopcd.295955
- Petrenko, L., Kravets, S., Bazeliuk, O., Maiboroda, L., & Muzyka, I. (2020). Analysis of the current state of distance learning in the vocational education and training institutions. *E3S Web of Conferences*, 166, 10010. doi:10.1051/e3sconf/202016610010
- Pinheiro, M.M., & Santos, V. (2022). Building the future of distance and online learning. Case of Portuguese University. *Online Distance Learning Course Design and Multimedia in E-Learning*, pp. 114–141. <https://doi.org/10.4018/978-1-7998-9706-4.ch005>
- Prokopenko, O. (2021). Technological challenges of our time in the digitalization of the education of the future. *Futurity Education*, 1(2), 4–13. <https://doi.org/10.57125/FED/2022.10.11.14>
- Sherman, M., Puhovskiy, E., Kambalova, Y., & Kdyrova, I. (2022). The future of distance education in war or the education of the future (the Ukrainian case study). *Futurity Education*, 2(3), 13–22. <https://doi.org/10.57125/FED/2022.10.11.30>
- Sydoruk, L., Bakhmat, N., Poberezhets, H., Misenyova, V., & Boyarova, O. (2022). Formation of future economist professional competence in adaptive-digital environment conditions of higher educational institution. *International Journal of Health Sciences*, 6(1), 103–114. <https://doi.org/10.53730/ijhs.v6n1.3390>
- Wedari, L.K., Fatihah, A.N., & Rusmanto, T. (2022). Zoom Application Acceptance in Online Learning: An Analysis with the Technology Acceptance Model. *International Journal of Information and Education Technology*, 12(9), 821–830. doi:10.18178/ijiet.2022.12.9.1690
- Yovenko, L., Novakivska, L., Sanivskiy, O., Sherman, M., Vysochan, L., & Hnedko, N. (2021). Pedagogical Analysis of the Phenomenon of Digital Competence. *IJCSNS International Journal of Computer Science and Network Security*, 21(6), 7–10. Retrieved from <https://www.koreascience.or.kr/article/JAKO202121055603990.pdf>