

ХІМІЧНА ІНЖЕНЕРІЯ ТА ЕКОЛОГІЯ

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INTRODUCTION OF VIDEO RESOURCES IN INTERACTIVE LEARNING OF STUDENTS SPECIALTY IN CHEMICAL TECHNOLOGIES AND ENGINEERING DURING THE COVID-19 PANDEMIC

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The main problems and difficulties that arose in the educational process after the introduction of quarantine regulations during the COVID-19 pandemic are considered. The most common online platforms used by teachers to conduct classes in video conferencing are described. The expediency of improving the methods of distance learning of students is noted. The main attention is focused on the technological advantages of the introduction of video resources in the interactive training of students of chemical and technological specialties, which is due to the specialization of the authors.

Key words: video resources, interactive learning, distance learning, screencasts.

Introduction

The COVID-19 pandemic has led to significant changes not only in the economic and social spheres, but also in education. The introduction of quarantine regulations forced the transfer of all educational institutions to the distance form of education for an indefinite period and made significant adjustments to the methods and techniques of the educational process in all educational institutions, including the Lviv Polytechnic National University. The transition to distance learning, which is an alternative to full-time education, has led to the need to introduce new Internet technologies in education, which allowed not only to ensure the conduct of classes, but also to improve their quality [1–3].

Until recently, distance learning in Ukraine was relevant only for people who preferred to deepen and improve their knowledge and skills, in fact,

performed the functions of part-time studying. However, online learning for foreign universities is not new. In European countries there are specialized universities for distance education. They work through special educational platforms and services that provide communication between teachers and students. For this purpose, properly prepared printed publications are used as educational material, which are supplemented with audio and video materials, computer learning technologies, television lectures and teletext [1, 4, 5]. The latter are provided thanks to such standard services as Microsoft Teams or Skype (if the number of participants in online classes is not too large). In the case of classes for a large audience, large-scale platforms are used: Zoom, Gotowebinar, Mentimetr, Click Meeting, etc. However, the free versions of the offered video resources have a number of restrictions that you need to pay attention to in a particular case and, if

necessary, make a full paid subscription to get the most convenient service.

For the convenience of online learning, the world's leading universities, such as Harvard, Stanford and Yale, have made the teaching materials publicly available on their platforms. So Daniel Stanford [5], director of the Faculty of Development and Technological Innovation at the Center for Teaching and Learning at De Paul University (USA) developed a spreadsheet in which he collected all known resources for online learning. The proposed table, for the purpose of updating, can be filled in by the teacher of the higher educational institution having specified the name of educational institution and the reference to the corresponding materials through the Google form. As of today, the table has more than 400 links.

The introduction of distance learning has led to certain difficulties, primarily in communication between teachers and students. During traditional face-to-face learning, there was non-verbal and verbal communication between teacher and student. However, during the period of distance learning, social communication began to decline sharply, and its non-verbal part disappears altogether. This, in turn, has a negative impact on the formation of social communication and cooperative skills for students [1–5]. Also a significant disadvantage of this form of education is the online mode of student internships, especially for students of technological specialties, in particular chemists-technologists. After all, it was during the internship that students gained basic skills of professional activity in technological industries under the guidance of mentors with work experience. This contributed to the formation of students' skills in using theoretical knowledge acquired during classes in practical professional activities. Lack of practical skills of the future engineer-technologist can lead to untimely detection of failures during production and appearance of emergency situations. Therefore, teachers were faced with questions in the motivation and communication of the student and the individualization of learning.

Communication without audio-visual contact due to problems with the Internet and technical support is quite ineffective for students and teachers during distance learning. Therefore, online classes were often held without the ability to see and hear each other. In this way, students sometimes had

“excuses” for not being in class. In addition to overcoming possible technical difficulties and providing reliable high-speed Internet, the teacher must also carefully consider and prepare for an online meeting with students in advance, as distance communication is significantly different from the classroom. There were also some difficulties in identifying students. In the first months of quarantine, there were difficulties in clearly regulated time for classes due to the lack of a unified platform for lectures, practical and laboratory classes [1–4].

Distance learning involves asynchronous and synchronous modes of teaching [1]. In the first case, the teacher and students communicate with each other via e-mail, forum, social networks, cloud services, etc. in a certain time interval. In the second case, all participants who are registered in the webinar, video conference, seminar, chat, etc. are present at the same time. In general, the process of planning online learning should include careful tracking of the combination of different modes of teaching, which will give learning a more cognitive nature, rather than just a matter of information transfer. Effective online learning should be aimed at not only facilitating the teacher's work in explaining new material, but also enabling the student to better understand the subject. For this purpose, in higher educational institutions of Ukraine, in particular in Lviv Polytechnic National University, advanced training courses on distance learning methods for teachers were implemented, as well as improved software and hardware for online classes. The authors of the work [2, 6] considered in detail and analyzed the experience of teachers of Lviv Polytechnic National University in the implementation and use of virtual learning environment on the platform LCMS Moodle during the COVID-19 pandemic. Significant success in distance learning can be achieved by using video conferencing tools, such as Microsoft Teams, Google Meet, Zoom, etc.

In general, the methods and techniques of distance learning are almost completely implemented in the educational process with all the advantages and therefore disadvantages. That's why, distance learning, with its features, has become a serious challenge for the education system as a whole. At the same time, the events that took place became a

"catalyst" for changes in education in Ukraine, accelerated the introduction of new teaching methods, changed the models of teaching and learning, as well as the roles of student and teacher, and so on [2, 4].

The labor market is also experiencing a deep transition due to the pandemic. Employers are constantly attracting new digital tools to their fields of activity. This means that there can be a complex and unstable team in the workplace, and students must be prepared to cope with such a new situation in the best possible way. The reality is that most of the existing jobs simply will not be present in the near future, and therefore the responsibility of educational institutions, including technical specialties, in the period of online learning is also to give students practical skills and confidence to build their future [1, 4]. Therefore, online learning has significant changes for students and teachers of chemical technology, as the training of chemists-technologists takes place in the conditions of acquiring practical skills through video communication.

Students strive for higher education as a comprehensive, competitive person who is able to contribute to the development of society [1]. In this regard, there is an urgent need to improve flexible skills, as well as learning according to the program. The way we collaborate, work in a team, think critically and connect the understanding of the possibility of solving specific problems in the workplace, are important in the employment of students, including chemists-technologists and demonstrate their knowledge, skills and abilities.

The aim of the study

Given the above, the purpose of the publication is to improve methods of distance learning for students and develop recommendations for the introduction of video resources in the interactive learning of students of chemists and technologists.

Materials and methods of research

The paper explores the video conferencing resources like Zoom, Microsoft Teams, Google Meet, Skype, Loom, etc., as well as working with screencasts.

The Zoom application was developed by Zoom Video Communications in 2013 and allows

you to connect up to 100 devices simultaneously for free using the video telephony service. For free accounts, the Zoom platform provides video communication with a 40-minute limit. In order to increase its level of service, users can use advantageous tariff plans that can provide a maximum number of connections up to 1000 people at a time and without time restrictions [7], and more expensive corporate plans add dozens of new features to Zoom, including control panels for administrators and automatic transcripts. The advantage of this platform is that you can customize the format of the conference and flexibly manage its participants, automatically and efficiently separate the background from people. It is enough for the conference organizer to send a link-invitation to the online meeting to all participants, who in turn will be able to connect to the conference from any device without having to install the Zoom application and communicate simply in the browser. Free versions are available for private use. Zoom has many necessary functions for remote team work: recording a conference and storing it in the cloud, screen sharing, virtual board, file sharing, integration with third-party services [8, 9].

The corporate platform Microsoft Teams is not only a tool for making video calls, but also a full-fledged platform for working together [9, 10]. It was developed by Microsoft and is part of the Microsoft 365 services. You can participate in such a conference through a corporate subscription. This platform combines in the workspace such tools as chat, meetings, notes, attachments, file storage, free web versions of Word and Excel and competes with the popular enterprise solution Slack. In addition, Microsoft 365 is also integrated with Skype, there is also the ability to integrate with third-party applications [8–10]. This service was developed for smartphones running Android, iOS, Windows Phone and computers running Windows, Linux, macOS and was introduced by developers in 2016. In the free version, Teams only supports group video calls for up to 50 participants, and a paid account must be used to organize, record, and schedule large meetings (up to 250 people), and up to 10000 people can attend the webinar format. Microsoft Teams lets you split people into chat teams where you can make audio or video calls between them, integrate it all into your calendar, and share files. In turn, this

allows you to report on the use of all Microsoft Office tools [8-10].

The Google Meet videophone service (formerly Hangouts Meet), which was developed by Google and is one of two applications that replaced Google Hangouts [11], is also of practical interest. In connection with the COVID-19 pandemic in March 2020, free access to the program was announced. This led to an increase in the number of users in April this year by 30 times, compared to January of that year, reaching 100 million users per day (in a similar service Zoom, the number of users at this time has reached 200 million per day).

The YouTube platform is a popular video hosting service that allows to post different video materials. It was founded in 2005 by three PayPal employees and is a division of Google. On this platform, users can add, view and comment on certain videos. YouTube is considered one of the most popular online environments for both professional and amateur video files due to its simplicity and convenience. Thanks to this platform, you can also conduct video blogs, easily find the right video and recommend it to others. Indicative of this platform is its feed and the number of views that increase every minute [12].

In the conditions of remote classes, as never before, there is a need for an application with which you can make video recordings from the screen. It is a kind of tool for teachers to create their own author's classes. Loom is a free screen viewer that works in the Chrome web browser and Yandex browser. It is also used on Mac or Windows computers, provided that there is an account to which the downloaded videos are uploaded, which can then be processed, forwarded by links, posted on a YouTube channel or stored on a computer. Loom allows you to record everything on your own computer screen. It should be noted that since 2018, the developers of this program have removed time restrictions on its use [13].

Video resource Skype, one of the oldest applications, is one of the priority closed source systems that provides text, voice and video communications. Skype Technologies was founded in 2003 by Swede Niklas Zennström and Dane Janus Friis [14]. This application allows you to make conference calls of up to 50 subscription accounts. It also provides the possibility to send text messages

and transfer files (up to 300 MB). This platform also allows you to transfer images from the monitor screen together with the image from the webcam, and create and send video messages to other users. For the stable use of video communication, the required Internet speed must be more than 200 Kbit/s and the clock frequency must be at least 1 GHz [14].

Research results and their discussion

Logistics of the educational process is an important component for the organization and conduct of distance learning at the appropriate methodological level. Teachers and students must have constant access to the Internet and have their own technical tools for communication: computer or laptop, smartphone or tablet.

Remote building of communication between teachers and students during distance real-time classes is not an easy but responsible task. In order for the online classes to be effective and for the knowledge gained by the students to have a positive result, it is necessary to hold meetings on a certain virtual platform in real time. In order for distance learning subjects to be able to see and hear each other continuously during the lesson, it is advisable to use various functions of video and audio tools, such as Microsoft Teams, Zoom, Google Meet, Skype, etc. You should also strictly follow the schedule. This makes it possible to ensure the predictability of the teacher's actions and teaches students discipline and systematic learning [1-14].

In recent months, shared video chat services, or as they are called in the scientific community, video conferencing, are experiencing an explosive growth in user interest. Restrictions related to the coronavirus pandemic have forced higher education institutions to look for new opportunities for remote communication between teachers and students. And if earlier video meetings testified to a high technological level of the organization, now use of Zoom, Cisco Webex, Slack, Teams or other decisions is urgent need.

Particular attention should be paid to conducting online classes in the form of video, video lectures (practical, laboratory) and screencasts. The video lecture (practical, laboratory) has the form of a short educational video, which in format resembles a TV show with a carefully thought-out script. However, most teachers conduct classes in video format, ie a video in which the teacher sits in front of

the camera and explains the material. Usually in this format there are video classes where PowerPoint presentations are used and you need to comment on slides. Screencasts allow you to record from a computer screen with a voice-over that comments on what is happening in the video [15].

As practice has shown, the Zoom platform (Fig. 1), which most teachers did not know about before the introduction of quarantine, is optimal for communication during distance learning in the form of video conferencing in disciplines provided by the curricula of technical specialties, in particular for chemists-technologists. This platform is convenient and accessible to use. It provides various features that allow you to demonstrate presentations, show and record videos, and more. The main advantage is

that Zoom is a free platform. The disadvantage is the limited time of use up to 40 minutes. The expediency of using this platform is that the vast majority of participants in groups are up to 25 people (provided by the platform up to 100). This is the number of students that is optimal for conducting classes, and for a laboratory workshop it is generally recommended that no more than 12 students work in the classroom at a time.

Since disciplines for chemists-technologists involve the ability to draw technological schemes, the combination of such Zoom functions as electronic message board (Fig. 2) and Screen Sharing allow the teacher to demonstrate real-time sequence technological operations in the technological process using the appropriate toolbar (Fig. 3).

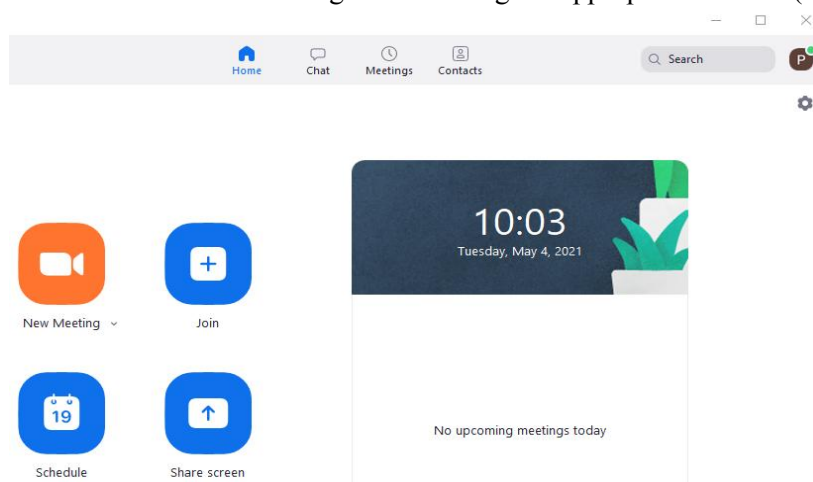


Fig. 1. General view of the main page of the Zoom platform

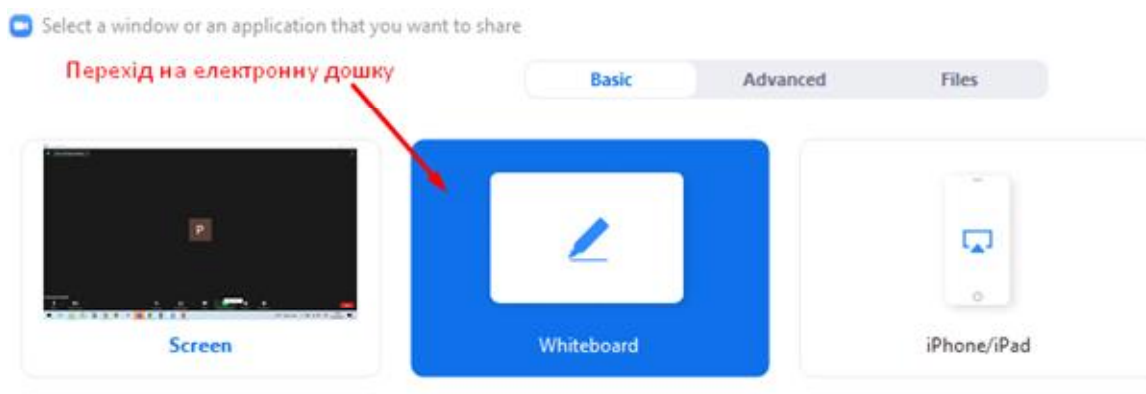


Fig. 2. Function of the virtual board in Zoom

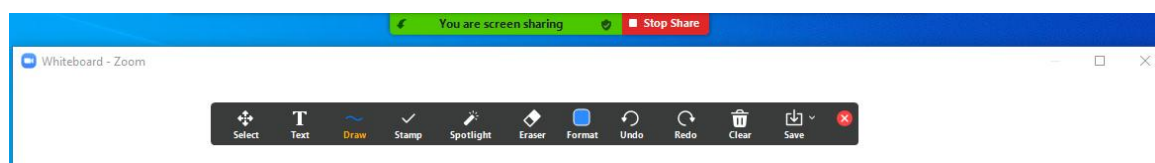


Fig. 3. Toolbar in the virtual board of the Zoom platform

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The provided tools are also convenient to use for the organization of collective works with drawings of devices and technological schemes. With the help of text and graphic tools, students have the opportunity to synchronously enter the designation of certain components of the drawing (Fig. 4). This method of working on consolidating the processed material allows for active communication between teachers and students.

The Microsoft Teams platform has proved itself quite well for technical specialties during distance learning (Fig. 5). With it, you can instantly switch between group chat and video conferencing windows with one click. Microsoft Teams supports a variety of call features, including call forwarding, group calls, and cloud voicemail. In Microsoft Teams, it is easy to find the files you need, share them with other participants in the online meeting, and edit them in real time using programs such as Word, PowerPoint and Excel [16].

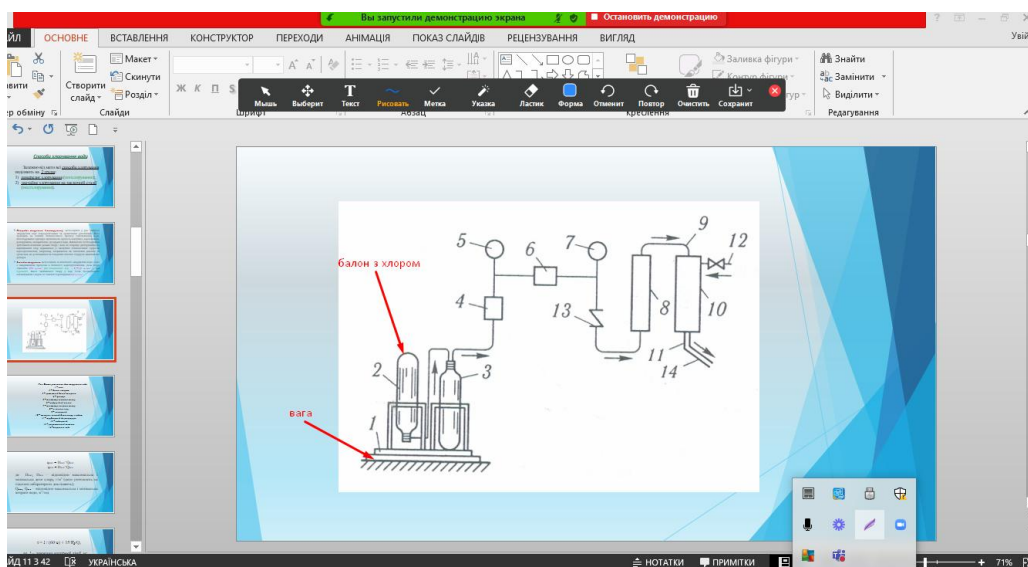


Fig. 4. Example of working with the technological scheme

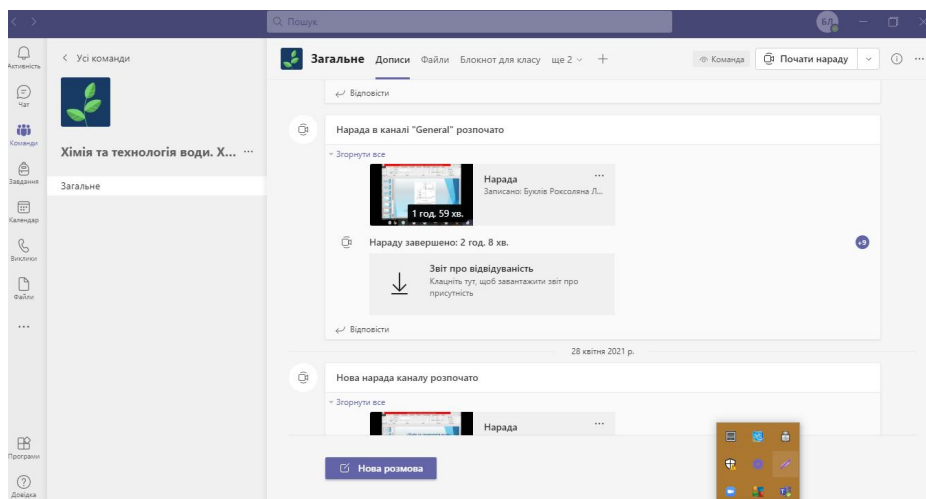


Fig. 5 General view of the main page of the Microsoft Teams platform

With the use of this corporate platform, you can send the appropriate tasks for students to perform individually.

Teams is an alternative application during the control activities provided by the curriculum:

exams, tests, testing, etc. With the help of the task function, students can be sent both tasks and test questions, which can be immediately identified, indicate the maximum score and the deadline for the work submission (Fig. 6). A

large number of technological schemes that describe technological processes need both their drawing and description. Therefore, thanks to the Teams platform, students can upload photo files and descriptive parts included in task response.

Attention should be paid to the «Attendance Report» function, which allows the teacher to monitor the presence of students in class. You can also fully track both the duration of the lesson and the time of the video.

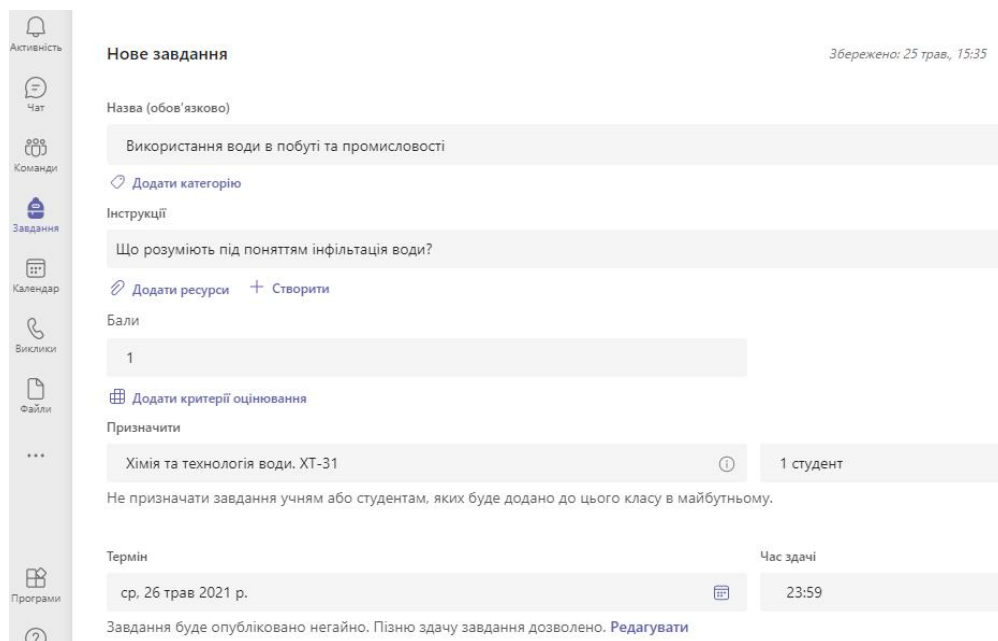


Fig. 6. Formation of tasks for students on the Teams platform

Analyzing the work of the above platforms, it can be noted that they have the opportunity to schedule a video conference in advance and remind about the online meeting. For those students who were not able to make a video call at a certain time, you can use the recording of a video meeting (Fig. 6).

An alternative to conducting video meetings with students is to use the Meet platform. On this platform, participants can join online video conferences directly from a computer from a calendar event, through an invitation sent by the organizer to e-mail or directly from Gmail. You can use the latest version of any browser to do this and you do not need to install any additional software. If you use a mobile device, you can join online meetings from the Gmail mobile app or the special Meet app. The main advantages of this platform are unlimited time and free use for everyone who has a Google account, as well as the ability to adapt to network speeds and provide a fairly high quality of communication during video calls, regardless of the location of online meeting participants [16]. All the details of the planned or held event are shown on it and can be used at a convenient time,

regardless of how the participant joins the meeting, from a computer, phone or conference room. The following functions make the meetings between the participants more productive: live subtitles, low light mode and noise reduction.

Meetings organized by Google Workspace users create a phone number for each meeting. Therefore, every guest has the opportunity to participate in the conference even on the road without Wi-Fi and mobile data.

YouTube video hosting has proven itself for mass open broadcasts of recorded videos, which allow to demonstrate, in particular to students of chemical technology specialties, on model laboratory installations, the conduct of processes as close as possible to production. Today, this resource is used quite actively by teachers, because in the Internet, unfortunately, there can be found very little available and interesting technical information that would show the achievements of teachers-technologists of higher education institutions of Ukraine. Therefore, the YouTube channel has become indispensable in the case of online laboratory classes. It allows users

to store, deliver and display videos that reproduce real existing technological production in Ukraine, but reproduced in the laboratory.

Using Loom app when teaching technology is quite convenient, as it is automatically displayed on the Chrome toolbar during installation. To record, simply click on the «New Video» button (Fig. 7). This app lets you record from your webcam, microphone, and desktop from Chrome [13]. The main advantage of using Loom by teachers is that after recording the lesson, the clip is automatically uploaded to the Loom hosting, and gives the author a link that he can share with students. The student, at the same time, is able to

view and listen to information on the topic of the lesson (lecture, laboratory or practical) at a convenient time. In this way, the teacher can record the thematic lesson in advance. In case of Internet failures, information can be provided to students via corporate mail by sharing a link. Having such video lectures, the teacher can, after listening to them, make adjustments to the methodology of the lesson. For disciplines of technical specialties it will allow to show more clearly all difficulties of passing the technological processes. Their more detailed interpretation can be done by analyzing the record, focusing more on technological devices, basic technological units and detailing.

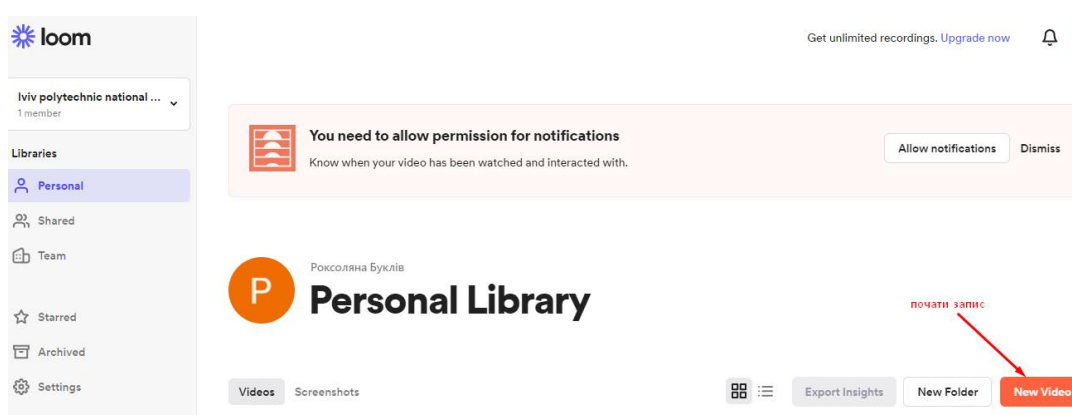


Fig. 7. General view of the Loom main page

A positive feedback to the use of the Skype video resource during online classes should also be given. You can use it to write messages, send contacts, record messages, schedule calls, create polls and show locations. Conference participants must activate a camera and a microphone on their gadget to see and hear each other [14]. However, it was not widely used.

Conclusion

The COVID-19 pandemic has given impetus to global processes of digital transformation in all spheres of human life, including education. Mankind must draw adequate conclusions, learn to adapt to new conditions and future challenges. Under such conditions, the role of digital technologies in education becomes extremely important and in the long run they should become a tool for testing the reliability and flexibility of innovative models of education. Our work focuses on the technological advantages of introducing video resources in interactive learning of students of chemical

technology, which is due to the specialization of the authors, but remained virtually undiscovered social component of innovative teaching methods, including their ability to save lives and ensure the educational process. We hope that these topical issues will be the subject of future research by experts in various fields of human activity.

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ВПРОВАДЖЕННЯ ВІДЕОРЕСУРСІВ У ІНТЕРАКТИВНЕ НАВЧАННЯ СТУДЕНТІВ СПЕЦІАЛЬНОСТІ ХІМІЧНІ ТЕХНОЛОГІЇ ТА ІНЖЕНЕРІЯ В ПЕРІОД ПАНДЕМІЇ COVID-19

Розглянуто основні проблеми та труднощі, які виникли в навчальному процесі після запровадження карантинних заходів у період пандемії COVID-19. Описано найпоширеніші інтернет-платформи, які використовують викладачі під час проведення занять у форматі відеоконференц-зв'язку. Зазначено доцільність вдосконалення методів дистанційного навчання студентів. Зосереджено основну увагу на технологічних перевагах впровадження відеоресурсів у інтерактивне навчання студентів хіміко-технологічних спеціальностей, що зумовлено спеціалізацією авторів.

Ключові слова: відеоресурси, інтерактивне навчання, дистанційне навчання, скрінкасти.