

**COLLECTION OF RESEARCH PAPERS**

of the 7th International Research and Practical Conference

**CHEMICAL TECHNOLOGY:  
SCIENCE, ECONOMY AND PRODUCTION**

**ЗБІРНИК НАУКОВИХ ПРАЦЬ**

VII Міжнародної науково-практичної конференції

**ХІМІЧНА ТЕХНОЛОГІЯ:  
НАУКА, ЕКОНОМІКА ТА ВИРОБНИЦТВО**



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Збірник містить наукові праці учасників VII Міжнародної науково-практичної конференції «Хімічна технологія: наука, економіка та виробництво», що складаються з узагальнених матеріалів науково-дослідних робіт науковців різних галузей виробництва та наукових закладів України.

У збірнику висвітлюються актуальні питання спеціальної хімічної технології і виробництва боєприпасів, утилізації відходів виробництв різних галузей, енергозбереження, моделювання технологічних процесів, соціально-економічні аспекти виробництва та природокористування в умовах війни.

Збірник корисний робітникам хімічної промисловості, науковим співробітникам, аспірантам і студентам спеціальностей хіміко-технологічного та соціально-економічного профілів, фахівцям інформаційних технологій виробництва.

Наукові праці учасників конференції подаються в авторській редакції.

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## **ORGANISING E-LEARNING IN WAR CONDITIONS USING GOOGLE CLASSROOM**

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The priority task of the higher education system is the training of personnel who are able to creatively solve professional tasks and be ready for lifelong learning and self-development in the conditions of the changing needs of the labour market.

The modern period of the development of society is characterized by a strong influence on it of digital technologies, which penetrate into all areas of human activity, which ensures the spread of information flows in them, forming a global information space. Digital technologies' development and implementation in the world is happening faster than the implementation of any other innovative developments. The rapid spread of digital technologies requires a wide variety of new knowledge and skills, fundamentally new approaches to education and work, and a qualitatively new relationship between work and leisure.

The accelerated development of information and communication technologies presents teachers with the task of fluency and application of information and communication technologies in the educational process. Thanks to electronic learning systems and information and communication technologies, the teacher transforms and improves traditional learning models.

Strict quarantine measures, which were introduced due to the COVID-19 pandemic, forced the education industry to adapt and reorganize its work to remote mode. There are also significant problems with the use of online learning. First of all, some students from low-income families faced additional obstacles in their studies. Educational institutions also faced significant technical and methodological problems, forced to make operational changes to the infrastructure in order to facilitate distance teaching.

The war in Ukraine brought new challenges to the education sector: the destruction of educational institutions and housing, the forced relocation of both students and teaching staff to other regions of Ukraine and abroad. In a number of regions of the country, face-to-face training of education seekers has become impossible, and therefore distance learning has become the only available form of education.

The Law of Ukraine "On Education" (Article 57-1 "State guarantees in conditions of martial law, state of emergency or state of emergency") states that students who have changed their place of residence, place of study, left their workplace for a special period are guaranteed by the organization educational process in remote form or in any other form that is the safest for its participants.

According to available data, the war in Ukraine forced more than 6 million Ukrainians to seek refuge in neighboring countries. These include approximately 665,000 students, representing 16% of the total number of students, and more than 25,000 teachers, representing 6% of the total number of teachers in the country. This mass displacement has profoundly affected the provision of educational services, exacerbating the problems associated with the damage and destruction of educational institutions [1].

An important aspect of e-learning during the war is not so much the acquisition and assimilation of knowledge, but also psychological support, communication, a sense of unity, closeness, etc. for the participants of the educational process [2].

Organizing high-quality distance learning in wartime is a very difficult process. It requires systematic work on the introduction and improvement of modern distance learning technologies in the educational process, which will later help to obtain positive results.

Distance learning technologies ensure the delivery of basic educational material to students and interactive interaction between students and teachers in the learning process. Such teaching technologies have such advantages as flexibility, relevance, convenience, modularity, economic efficiency, interactivity, absence of geographical borders for obtaining education [3, 4].


Today in the world there is a significant number of e-learning platforms for the organization of e-learning, which are divided into two large categories: commercial and open source. Learning Management Systems (LMS) allow to organize the educational process and monitor the progress of students by creating online courses or virtual classes, available anytime and anywhere in the world. It is important that all educational materials are stored in one place where it is convenient to view and edit them.

Worthy of attention is the Google Classroom platform, presented by Google, developed on the basis of Google Apps. Importantly, Google Classroom is a free service for schools, non-profits, etc. The Google Classroom platform was introduced into the practice of teaching various courses in 2014 and is used by teachers and students of different countries in more than 42 languages. The platform has integration with Google services and other additional services.

The aim of this work is to analyze the functionality and features of the Google Classroom service from the point of view of its use for e-learning, to generalize the experience of using Google Classroom in teaching the discipline "Information Technologies" to students of the Chemical-Technological Faculty of Igor Sikorsky Kyiv Polytechnic Institute.

To start with Google Classroom, the student should have a Google account, and if the educational institution has organized a corporate information space using the Google *G Suite for Education* service (a set of free Google tools and services designed specifically for educational institutions and organizations for the online educational process), then according to the account provided. To provide e-learning for scientific and pedagogical staff and students at Igor Sikorsky Kyiv Polytechnic Institute created corporate accounts of the form xxxxxx@ill.kpi.ua in G Suite for Education. According to the distance learning platform Sikorsky Distance (<https://www.sikorsky-distance.org/>), there is a significant increase in the number of registered distance courses (in particular, from March 2020 to January 2021, the number of courses registered on the platform increased from 221 to 3072; and in 2023, this indicator increased several times).

A corporate account gives users more advantages when using Google cloud services. If there is an Internet connection, access to the Google Classroom service is carried out through any browsers (new versions) or from mobile devices on Android or iOS using a corporate account.

The procedure for creating a class is quite simple. To create a new course, it is needed to log in from a personal Google account to the Classroom application from the main menu, which is opened by clicking on the Google Applications button  at the top right of the browser. After pressing the + button, the user can create a training class or join an existing one. Choosing the status of a teacher allows you to proceed to the creation and configuration of your own class (course). In the course creation window,

you should enter its name (required) and some attributes (optional) and click the Create button (Figure 1).

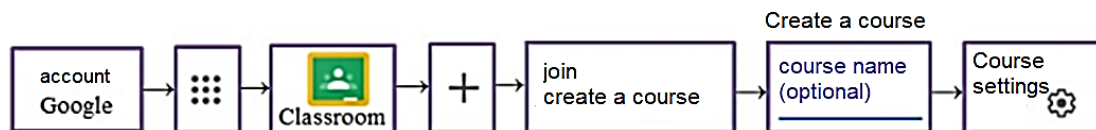


Figure 1 The sequence of creating a class (course) in Google

Approbation of the Google Classroom features was carried out when using it to teach the discipline "Information Technologies" to students of the Chemical-Technological Faculty of Igor Sikorsky Kyiv Polytechnic Institute. The volume of the discipline reaches 4 credits. The course includes lectures (36 hours), computer workshops (36 hours), homework, writing a modular test, and independent student work.

The distance course "Information technologies" was created using the Google Classroom service (Figure 2). Joint teaching and filling of the course was carried out by three teachers and academic groups of the faculty studying this course were attached to the course. To join, students were given a course code and open access to all course materials.

The created class should be configured. Google Classroom provides a variety of templates and classroom theme settings (Figure 2). If necessary, a photo can be uploaded as a theme.



Figure 2 Example of the "Information Technologies" course design


Each newly created class is provided with its own access code, which can be displayed in the theme or hidden. Google Meet support can be enabled, and students can get links to future meeting videos. Setting up grade categories can be done at the beginning or delayed.

Work with Google Classroom and further settings are carried out through the main panel, which shows four tabs (Figure 3): **Stream**, where all actions are displayed; **Classwork** that provides an opportunity to attach various materials and tasks, assign a period and time for their completion; **People** with information about users (students and teachers) who joined the class; **Grades** with information on the success of course students.

Stream      Classwork      People      Marks

Figure 3 Google Classroom tabs

The teacher can invite other teachers (up to 20) to join the class to co-teach the course and students to learn (Figure 4).

To join, the teacher can provide an access code or invite to join using the **People** tab button . In the window that opens, it is necessary to enter email address and click the **Invite teacher** button. The invitee will receive a letter inviting them to join the course.

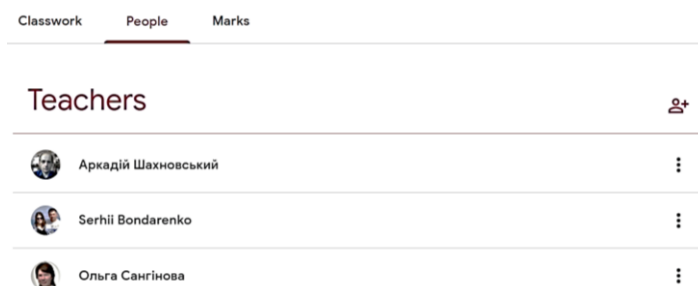


Figure 4 Course instructors on the People tab

Google Classroom enables the teachers to post course materials, create assignments, initiate thematic online discussions, assign grades, and make announcements. If necessary, teacher can add comments and edit at each stage. To create a task, question, topic, etc., teacher should go to the **Classwork** tab and, clicking the **Create** button, add materials of different categories (Figure 5). Materials can be structured by topics.

Within the presented course, the educational material is divided into logical thematic blocks. An important point is the presence in the Google class of clear instructions for mastering each block of material and criteria for evaluating the result.

When creating the distance course, topics were chosen that can be transferred to independent study by students; topics that are usually easier to learn were condensed, and those topics that require more detailed study were also identified; priority topics were determined, without which the assimilation of further materials of the educational component is impossible.

This makes it possible to flexibly use the materials of the educational component provided for in the syllabus in the conditions of war.

When creating an assignment (Figure 5), a teacher can add it to the schedule or save a draft for further work on the task. Select the **Assignment** type if a teacher need to attach the task as a file or link. If the file is attached, a teacher can choose the following options: students can view the file; can edit the file; an individual copy of the file can be created for everyone. The **Quiz assignment** automatically connects the test to Google Forms. Distance learning forces the teacher to pay special attention to the means of testing to verify knowledge. An important point is to check the independence of the works for their objective evaluation and to fulfill the requirements of academic integrity.

Google Forms is a versatile tool that allows the teachers to create multiple-choice or multiple-choice quizzes, open-ended tasks, tasks with pictures, videos, etc.

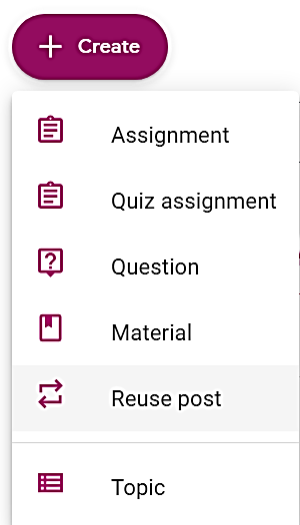


Figure 5 Types of assignments

The Question type allows a teacher to ask a question and get an answer. The response can be scheduled as a short response or one from a list. The Material type allows a teacher to attach educational materials. The Reuse post type allows a teacher to use material or assignments in another course. The Topic section is designed to create a new topic in the course. The publication time can be scheduled. The publication appears on the Stream tab and students receive information to their email address (and if the application is installed on the phone, a push message will appear).

The sequence of actions during training is simple and clear. The teacher provides materials, creates assignments, attaches files, adds his comments, and students familiarize themselves with the information, complete the assignments, and receive grades.

Students send completed work to the teacher. At the same time, the work status will change to **Handed in**. The received work is checked and graded. It is also possible to leave comments. Then the work should be returned. Teacher can switch to receiving and evaluating a task through the **Stream**, where the teacher should click on the name of the task in the ribbon, or through the **Classwork** tab, where the teacher can view the task.

The **Marks** section shows a summary of grades for each type of assignment, and it is possible to calculate the grade point average.

An important advantage of Google Classroom is the integration with other Google services: Google Disk, which provides opportunities to create a multifunctional user environment; Google Documents, which provide an opportunity for joint work on documents; Google Sheets; Google Slides, etc. The fact that all course materials are stored on Google Disk, including tasks completed by students, is a positive for classroom learning.

The **Classwork** tab has additional tabs (Figure 6) for working with Google Meet, Google Calendar, and Google Disk.



Figure 6 Tools for working with Google Disk, Google Calendar and Google Meet

Lectures and practical classes of the "Information Technologies" distance course, consultations and assessment were conducted using Google Meet. Weekly classes were planned in Google Calendar. The time of publication of educational materials was planned. Based on the provided materials, the students prepared for computer workshops and performed the assigned tasks in scheduled classes. The defense of the completed tasks was carried out according to the schedule based on pre-prepared tests developed by means of Google Forms. The time for the tests was planned to be sufficient for the preparation of a high-quality answer and limited in order to prevent nondependent work of students. The module test was carried out according to pre-prepared tests developed using Google Forms. Students placed the completed



homework test on Google Disk for teachers to check and determine the grade. The defense of works was carried out according to pre-prepared tests developed by means of Google Forms. Assessments were conducted according to the schedule. Students received grades in accordance with the rating system.

Some of the shortcomings in the work of Google Classroom should include: the difficulty of checking the constant presence of students at lectures, because after some time the cameras were turned off by students; distortion of formulas in MS Word documents as a result of opening them during the checking of student works in the Google Documents service; the impossibility of carrying out real-time laboratory works, if they are planned in the course (replacing them with videos does not allow the student to learn how to work with real equipment). It should also be noted that the basis of distance learning is the independent work of students. Therefore, one of the main factors of the successful implementation and implementation of distance learning should be considered the presence of students at a high level of self-motivation and purposefulness.

Correctly selected course materials, based on the goals and tasks of training and the characteristics of the educational process in the online environment, will ensure a positive result for students, and positive feedback for the teacher.

Education in the conditions of war faces many challenges, a significant part of which helps to overcome the distance form of education. At the same time, e-learning requires the joint efforts of students and pedagogical staff, as well as the administration of the educational institution to achieve the necessary learning results. Support from the government is also an important factor in the effective provision of educational services.

An analysis of the capabilities of the Google Classroom service showed its convenience and effectiveness for creating distance courses. As a result of an intuitive interface and powerful services, it can be considered one of the best tools for distance learning. The use of cloud services for the organization of the educational process makes it possible to increase the level of visibility of education, to differentiate the assimilation of knowledge, to establish a systematic control of the acquired knowledge to increase the effectiveness of education.

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