

**University of Security Management in Košice  
National University of Life and Environmental Sciences of  
Ukraine**

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**THE STRATEGY OF DIGITAL COMPETENCE  
FORMATION USING A HYBRID LEARNING  
ENVIRONMENT BASED ON MICROSOFT 365  
SERVICES**

Collective monograph

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## INTRODUCTION

COVID-19 and military actions on the territory of Ukraine fundamentally changed the organization of the educational process, forcing educational institutions to transfer classroom learning to virtual space. To organize the educational process remotely, we need to organize an educational environment in which we can ensure the implementation of all types of educational activities, as well as creation and selection of e-resources depending on their types. Having guidelines in the form of modes, forms and learning outcomes, it is necessary to structure the content of educational disciplines, corresponding curricula, to ensure the activity of students during lectures and the implementation of practical tasks with the necessary tools, to determine and carry out the selection of electronic educational resources for the effective organization of the educational process in conditions of open education. First of all, it is important to take into account all types of student activities, namely: those ones, which are usually implemented in class and determine the possibility of their implementation in a remote format using cloud services.

The monograph considers the problem of effective use of Microsoft 365 services for the organization of e-learning through the prism of the competency approach. In particular, the study established a correspondence between training activities and M365 services, which can provide tools support for their implementation.

**Chapter 1** analyzes the components of digital competence and the abilities necessary for the organization of the e-learning process. Based on the analysis, the correspondence between the components of digital competence and M365 services, the possession of which indicates the existing level of digital competence, was established.

**Chapter 2** of the monograph describes the digital competences necessary for the organization of various types of training using Microsoft 365 services. It studies features of using digital identity cloud services, Microsoft 365 services for digital data management and collaboration, e-learning management, design and creation of digital content, problem solving and innovation, digital communication, cooperation and interaction.

**Chapter 3** offers a developed model of hybrid educational environment architecture based on Microsoft Teams platform and

analyzes digital competences for the organization of asynchronous interaction between students and teachers using MS Teams tools.

**Chapter 4** is devoted to the results of an experimental study of the effectiveness of the use of Microsoft 365 services for the organization of e-learning and the readiness of teachers and students to use them.

# **CHAPTER 1. THE USAGE OF MICROSOFT 365 FOR FORMING THE DIGITAL COMPETENCE IN THE EDUCATIONAL PROCESS PARTICIPANTS USING E-LEARNING**

## **1.1. Microsoft 365 service platforms for organizing educational activities of university students**

E-learning platforms have become more and more complex. Their functionality included in learning management systems is extended with collaborative platforms, which allow better communication, group collaboration, and face-to-face lectures [119]. The Ministry of Education and Science of Ukraine in the Recommendations on the implementation of blended education in institutions of vocational pre-higher and higher education [91] offers to move away from the traditional division into lectures, seminars, laboratory and practical classes; instead, to plan work as a set of different types of activities, each of which can be tentatively assigned to one of two categories:

- contact hours (offline activity);
- online activity.

Contact hours (offline activity) involve direct interaction of the participants of the educational process with each other in the classroom during traditional education. In turn, online activity involves the mediated interaction of the participants of the educational process with each other and with various types of electronic content in the classroom or outside it using online technologies during blended or distance learning. Online activities can be synchronous (when everyone is connected at the same time, for example, a webinar, video conference, etc.) and asynchronous (when each participant in the educational process performs an activity at a different time, for example, a chat, a forum, etc.).

When planning the content of an educational discipline, it is recommended to base it on the expected learning outcomes and choose activities, materials and the type of their presentation accordingly. When planning the types of educational activities of students, it is necessary to follow basic recommendations regarding the sequence of interaction at all levels of studying the discipline: from a separate topic to a section or module, and select cloud services that allow you to

deliver the necessary educational content to the student. It is worth moving away from the division into lectures, laboratory and practical classes and independent work; instead, to plan the work as a cyclical sequence of activities that will reflect the stages of the educational process described below, and the forms of interaction and tools should be selected depending on the tasks, time resources, technical and functional capabilities. Table 1.1.1 provides a classification of types of activities according to which e-content should be created and selected.

*Table 1.1.1*

**Classification of educational activities**

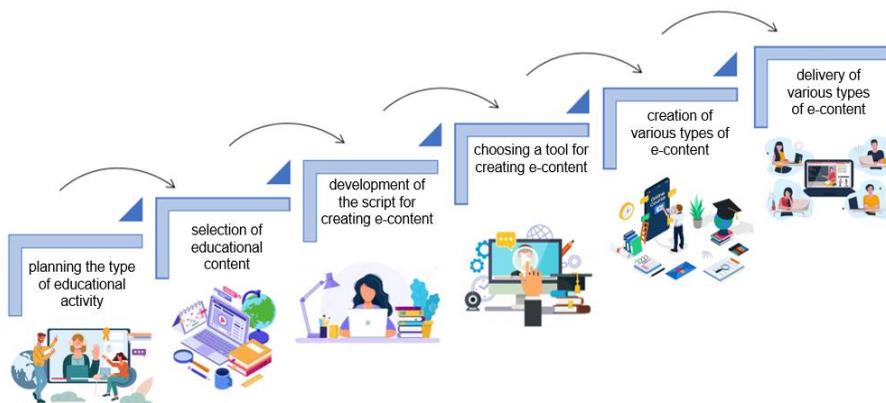
<b>Activity type</b>	<b>Offline activity</b>	<b>Online activity</b>	<b>Services</b>
Preliminary work	<ul style="list-style-type: none"> <li>– survey</li> <li>– input control</li> </ul>	<ul style="list-style-type: none"> <li>– introduction or revision of the terminology necessary for working with the topic</li> <li>– short promotional video/audio</li> <li>– infographics</li> <li>– diagnostic testing</li> </ul>	<ul style="list-style-type: none"> <li>– ClassNotebook</li> <li>– OneNote</li> <li>– StaffNotebook</li> <li>– Forms</li> <li>– PowerPoint</li> <li>– Stream</li> </ul>
Presentation of theoretical material (lectures)	<ul style="list-style-type: none"> <li>– presentation</li> <li>– search for control questions by topic</li> <li>– case study discussions</li> </ul>	<ul style="list-style-type: none"> <li>– video recording</li> <li>– audio recording</li> <li>– texts</li> <li>– video conference</li> <li>– case study activities</li> <li>– search for control questions by topic</li> </ul>	<ul style="list-style-type: none"> <li>– OneDrive</li> <li>– Stream</li> <li>– Word Online</li> <li>– Teams Meetings</li> <li>– PowerPoint</li> <li>– Sway</li> </ul>
Training	<ul style="list-style-type: none"> <li>– discussion</li> <li>– debates</li> <li>– questions and answers</li> <li>– group tasks (not for assessment)</li> <li>– practical tasks (for assessment)</li> <li>– observation of</li> </ul>	<ul style="list-style-type: none"> <li>– questions for self-test discussion (chat, forum)</li> <li>– performance of interactive exercises</li> <li>– virtual simulators</li> <li>– observation of the phenomenon</li> <li>– work with cases</li> </ul>	<ul style="list-style-type: none"> <li>– PowerPoint Online</li> <li>– Sway</li> <li>– Stream</li> <li>– Whiteboard</li> <li>– Kazaila</li> <li>– Outlook</li> </ul>

	<p>the phenomenon</p> <ul style="list-style-type: none"> <li>- role-playing games, simulations</li> </ul>	<ul style="list-style-type: none"> <li>- searching for answers to questions</li> <li>- viewing an educational video (video lecture, video lesson, videocast)</li> </ul>	
<p>Performance of laboratory (practical) work</p>	<ul style="list-style-type: none"> <li>- tasks performed during practical and laboratory classes</li> </ul>	<ul style="list-style-type: none"> <li>- searching for answers to control questions by topic</li> <li>- virtual laboratory work</li> <li>- interactive practical tasks</li> <li>- individual and group tasks of different levels (report, presentation, project, video recording, etc.)</li> <li>- work on joint documents</li> </ul>	<ul style="list-style-type: none"> <li>- Word Online</li> <li>- Excel Online</li> <li>- Visio Online</li> <li>- PowerPoint</li> <li>- Sway</li> <li>- Teams</li> <li>- SharePoint</li> </ul>
<p>Independent student work/teacher's self-education</p>	<ul style="list-style-type: none"> <li>- questions for self-check</li> <li>- performing independent work</li> </ul>	<ul style="list-style-type: none"> <li>- questions for self-check</li> <li>- performance of interactive tasks</li> <li>- virtual simulators</li> <li>- observation</li> <li>- work with cases</li> <li>- searching for answers to questions</li> <li>- watching videos (video lesson, video lesson, videocast)</li> </ul>	<ul style="list-style-type: none"> <li>- To-Do</li> <li>- Calendar</li> <li>- Stream</li> <li>- Microsoft Viva</li> <li>- Microsoft Teams</li> <li>- Planner</li> <li>- Project</li> </ul>

Team work	<ul style="list-style-type: none"> <li>– setting objectives</li> <li>– distribution of roles and tasks</li> <li>– discussion</li> <li>– group performance of the task</li> <li>– presentation of results</li> </ul>	<ul style="list-style-type: none"> <li>– setting objectives</li> <li>– discussion (chat, forum)</li> <li>– analysis of tools and familiarization with instructions (text and video)</li> <li>– distribution of roles and tasks</li> <li>– environment design</li> <li>– joint work on project implementation</li> <li>– publication and presentation of results</li> </ul>	<ul style="list-style-type: none"> <li>– People</li> <li>– Delve</li> <li>– Teams</li> <li>– Planner</li> <li>– Project</li> <li>– Bookings</li> <li>– To-do</li> <li>– Lists</li> <li>– SharePoint</li> </ul>
Assessment	<ul style="list-style-type: none"> <li>– students' answers</li> <li>– oral answer (interview)</li> <li>– performance of practical (laboratory) work</li> <li>– performance of independent work</li> </ul>	<ul style="list-style-type: none"> <li>– interactive testing</li> <li>– oral answer (video recording)</li> <li>– performance of the practical work</li> <li>– written task</li> </ul>	<ul style="list-style-type: none"> <li>– Forms</li> <li>– Kazaila</li> <li>– Stream</li> <li>– Teams Meetings</li> </ul>
Reflection	<ul style="list-style-type: none"> <li>– dialogue, group</li> <li>– discussion</li> <li>– brief oral/written answers to the questions</li> </ul>	<ul style="list-style-type: none"> <li>– development of notes for lectures</li> <li>– memory cards</li> <li>– preparation of multimedia presentations</li> <li>– answers to reflective questions</li> <li>– the student's portfolio</li> <li>– keeping a grade book</li> </ul>	<ul style="list-style-type: none"> <li>– Lists</li> <li>– Visio Online</li> <li>– PowerPoint Online</li> <li>– Sway</li> <li>– Forms</li> <li>– Excel Online</li> <li>– Power BI</li> </ul>

Feedback	<ul style="list-style-type: none"> <li>– group and individual tutorials</li> <li>– teacher’s comments during the class</li> </ul>	<ul style="list-style-type: none"> <li>– automated tests for self-check</li> <li>– chat, forum, survey</li> <li>– audio, video or text messages with a comment</li> <li>– tasks for mutual assessment of knowledge</li> <li>– assessment by the teacher</li> <li>– results of group work</li> </ul>	<ul style="list-style-type: none"> <li>– Forms</li> <li>– Teams Meetings</li> <li>– Yammer</li> <li>– Kazaila</li> </ul>
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For high-quality management of educational activities within a certain discipline, it is necessary to choose tools that will make it possible to ensure the creation, placement and interaction with educational content in accordance with the types of activities and will have the best effect online (synchronously or asynchronously). The stages of creating and delivering educational content in the conditions of distance learning are shown in Figure 1.1.1.



**Figure 1.1.1. Stages of creating educational content by the types of activities**

With each type of educational activity, provision of all activities online or remotely is possible only with the use of information and communication technologies. The learning process at home can be carried out through online or distance learning using digital platforms, one of which is the use of Microsoft 365. This platform is focused on organizing interaction between the teacher and students using various services, the combination of which makes it possible to organize a digital educational environment.

Diva Rizkana Hasanah and Dian Novita Dewi stress the benefits of using Microsoft 365, as it ensures efficient work and increases productivity, which is undoubtedly very useful for teaching in conditions of remote tuition [22].

Aleksandar Skendzic, Bozidar Kovacic in their research feature the peculiarities of the MS Office 365 platform based on the “cloud” concept as a cost-effective product and compare it with Google Apps [124]. Microsoft Office 365 in combination with Microsoft Windows Azure platform ensures companies of all sizes high productivity with low costs, saving time, money and free up valuable resources [122].

Microsoft 365 licenses for students and employees of educational institutions provide access to Microsoft Office programs from various devices and operating systems, such as for displaying digital educational content, as well as a full set of online services necessary for managing educational activities. For educators, Microsoft 365 provides the following opportunities:

- *availability and security*. Teachers and technical staff have the opportunity to work from any place and device using cloud platform services. This gives them a greater level of accessibility and mobility, and features such as single sign-on and active monitoring of activities ensure the safety of teachers and preserve the confidentiality of their data;

- *saving time and increasing efficiency*. The Microsoft 365 platform is designed to increase work efficiency, since the main tasks of the teacher are planning, development and delivery of educational content, establishing communication and interaction with students;

- *creation and delivery of educational content*. Using Microsoft 365 services, teachers can create different types of content and structure the already created content depending on the type of educational activity and the student’s learning style;

– *cooperation*. Microsoft 365 cloud services enable teachers to easily and efficiently co-create, exchange various educational content, provide feedback, join online meetings, share experience, increase their own professional and digital competence;

– *assessment of students*. Teachers can monitor the progress and activity of their students in real time, change the type of learning material or their delivery options.

In addition to these benefits of using Microsoft 365 for educators, there are also benefits for students. The organization of remote tuition using the Microsoft 365 cloud platform provides students with the opportunity to take advantage of this platform, which includes not only security tools, but also services for effective management of educational activities. In this way, students have constant access to the relevant tools that are necessary for online learning, namely:

– *constant access* from various devices and operating systems of the type for displaying digital educational content depending on the type of student's educational activity;

– *communication and cooperation*. Students can use the Microsoft 365 platform to communicate with their colleagues, form study groups and perform group projects, exchange educational content and perform practical tasks together;

– *access to teachers*. Students can constantly interact with teachers, send them messages and plan meetings with them by having access to joint communication services;

– *access to various educational content*. Having corporate accounts of the Microsoft 365 platform, students get access to educational materials to effectively build an individual educational trajectory.

Creating an e-learning environment starts with logging into Microsoft 365, where in this case it is an educational institution, the administrator registers users under the institutional domain so that every teacher and student has an institutional email account. NUBiP of Ukraine has a license agreement with Microsoft Enrollment for Education Solutions, within which students and teachers have access to the Microsoft 365 cloud platform (institutional domain @it.nubip.edu.ua).

In distance learning, having the appropriate skills, both teachers and students use the services available on the Microsoft 365 platform

to organize all types of educational activities (Table 1.1.1). Variants of the possibilities of their use in distance education for teachers and students are presented in Figure 1.1.2.



**Figure 1.1.2. Possibilities of using the services of the Microsoft 365 platform for organizing educational activities**

Accordingly, the use of the Microsoft 365 platform makes it possible to organize the educational activities of students of a higher education institution in the virtual space, since the teacher has the opportunity to plan educational activities, create and host various types of educational content, and manage educational students' activities.

## 1.2. The structure of digital competence of participants in the educational process

For the effective use of the digital educational environment of the educational institution in terms of e-learning and all its digital tools, all participants in the educational process use their skills in using digital tools and resources. To date, both teachers and students have such skills according to the digital competence framework [10], which allow effective management of e-learning activities of all participants of the educational process. According to this framework, digital competence includes: ICT proficiency (functional skills); digital literacy; digital creation, problem solving and innovation; digital communication, cooperation and interaction; digital learning and development; digital identity and wellbeing (Figure 1.2.1).



**Figure. 1.2.1. The structure of the digital competence**

Depending on the purpose of the application and the Microsoft 365 tool, participants in the educational process use different digital skills that allow them to achieve the defined educational goals and better learning outcomes.

To use the services of the Microsoft 365 platform on various devices, as well as to perform tasks effectively and efficiently, all participants in the educational process must have ICT (functional skills), which will allow them to confidently use the capabilities of the cloud platform during e-learning (Table 1.2.1).

*Table 1.2.1*

**Proficiency in ICT (functional skills)**

<b>A component of digital competence</b>	<b>Microsoft 365 capabilities</b>
<b>Services: Microsoft 365</b>	
ICT skills	<p><b>Using services of the Microsoft 365 platform on different devices:</b></p> <ul style="list-style-type: none"> <li>– confident use of new services and facilities, as well as the ability to master new knowledge and opportunities as they develop;</li> <li>– the ability to solve problems and service failures when they arise;</li> <li>– use of Microsoft 365 services and facilities on different devices;</li> <li>– understanding of the basic concepts of processing various types of information;</li> <li>– the ability to integrate the necessary services among themselves depending on the learning goals.</li> </ul>
ICT performance	<p><b>Using Microsoft 365 tools for efficient and high-quality performance of tasks:</b></p> <ul style="list-style-type: none"> <li>– the ability to evaluate the functionality of Microsoft 365 services and facilities;</li> <li>– the ability to choose services and facilities according to the types of educational activities;</li> <li>– the ability to make an independent choice of tools, depending on the tasks;</li> <li>– the ability to freely work with various</li> </ul>

	platform tools to perform complex tasks.
<b>Type of educational activity:</b> all types of educational activity	

Possessing digital literacy skills with the support of Microsoft 365 services, participants of the educational process (Table 1.2.2) can manage information and deliver various types of content in e-learning conditions. For the interpretation of digital information for academic and professional purposes, processing and delivery of visual and multimedia educational content on the Microsoft 365 platform, the following services are available: OneDrive, Word Online, Excel Online, Power BI Online, Forms, Visio Online, PowerPoint Online, Sway, Teams Meetings, Stream. The method of using these services is described in Paragraph 1.3.

*Table 1.2.2*

**Digital literacy via Microsoft 365-based services**

Digital literacy	information management and delivery of various types of content
<b>Services:</b> OneDrive, Word Online, Excel Online, Power BI Online, Forms, Visio Online, PowerPoint Online, Sway, Teams Meetings, Stream	
Information literacy	<p><b>Interpretation of digital information for academic and professional purposes:</b></p> <ul style="list-style-type: none"> <li>– the ability to search, evaluate, manage and share digital information;</li> <li>– the ability to critically perceive information from the point of view of its reliability, relevance, value;</li> <li>– the ability to create diverse content for academic and professional purposes;</li> <li>– the ability to review, analyze and re-submit digital educational content in different settings (blended or distance learning);</li> <li>– the ability to understand copyright rules and open alternatives such as Creative Commons;</li> <li>– the ability to appropriately refer to digital content in a variety of contexts.</li> </ul>

Data literacy	<p><b>Development and delivery of visual educational content:</b></p> <ul style="list-style-type: none"> <li>– knowledge of legal, ethical and security principles of data collection and use for the purpose of creating and delivering educational content;</li> <li>– the ability to accumulate, manage, access and use digital data in spreadsheets, databases and other formats;</li> <li>– the ability to interpret data using queries, data analysis and reports, interactive digital panels.</li> </ul>
Media literacy	<p><b>Development and delivery of multimedia interactive educational content:</b></p> <ul style="list-style-type: none"> <li>– understanding of digital media material as an educational tool;</li> <li>– the ability to edit, use and deliver educational media content;</li> <li>– critical approach to evaluating educational media material from the point of view of its origin and purpose of creation.</li> </ul>
<p><b>Type of educational activity:</b> preparatory work, presentation of theoretical material, training, performance of laboratory works</p>	

Taking care of their own digital identity and well-being as a user of a digital educational environment, using Delve, Yammer, People, Planner services, participants in the educational process can create and maintain digital personal and corporate profiles and other identification resources (Table 1.2.3). The method of using these services is presented in Paragraph 1.4.

*Table 1.2.3*

**Digital identity and user well-being using Microsoft 365 services**

Digital identity and well-being (self-actualization)	
<b>Services:</b> Delve, Yammer, People, Planner	
Digital identity management	<p><b>Ability to develop and project a positive digital identity on the Microsoft 365 platform:</b></p> <ul style="list-style-type: none"> <li>– the ability to create and maintain digital profiles and other identification resources, such as records of achievements;</li> <li>– the ability to manage online activity, both one’s own and that of other users of the digital environment;</li> <li>– the ability to manage personal data and materials in</li> </ul>

	digital networks; – understanding of the reputational benefits and risks associated with digital participation; – understanding of the user recognition procedure in cloud services.
Digital wellbeing	<b>Ability to act safely and responsibly in a digital environment:</b> – ability to negotiate and resolve conflicts; – the ability to manage digital workload, overload and rest; – the ability to consciously use digital technologies; – ability to use digital tools to achieve set goals; – understanding the benefits and risks of using digital technologies in virtual space.
<b>Type of educational activity:</b> independent work, reflection, preparatory work, training	

Table 1.2.4. reveals the content of Digital Learning and Development competence (Design). To ensure the formation of this component of digital competence, To-Do, Calendar, Microsoft Viva (Microsoft 365 Training, Microsoft Learn, LinkedIn Learning), Microsoft Teams services are used. The method of using these services is described in Paragraph 2.1.

Effective organization of e-learning requires the teacher to create high-quality digital content, implement new practices of using digital tools in the learning process, and involve students in conducting digital research and data analysis. The content of competence in digital creation, problem solving and innovation using Sharepoint, Whiteboard, ClassNotebook, OneNote, StaffNotebook services is given in Table 1.2.5. The method of using these services is described in Paragraph 2.2.

To ensure quality provision of educational services in the conditions of e-learning, the teacher must ensure communication, collaboration and interaction of participants in the educational process. The components of digital communication, collaboration

Table 1.2.4

**Digital learning and development using Microsoft 365 cloud services**

<p><b>Services:</b> To-Do, Calendar, Microsoft Viva (Microsoft 365 Training, Microsoft Learn, LinkedIn Learning), Microsoft Teams</p>	
<p>Digital learning</p>	<p><b>Ability to manage educational activities and own self-education:</b></p> <ul style="list-style-type: none"> <li>– the ability to select and use digital educational content;</li> <li>– the ability to participate in educational professional digital forums and blogs;</li> <li>– the ability to use digital tools for organization, planning and reflection of learning;</li> <li>– the ability to record educational events/data and use them for self-analysis, reflection and demonstration of achievements;</li> <li>– the ability to monitor one’s own educational progress: participate in digital assessment and receive digital feedback; manage own time and tasks, attention and motivation to study in digital environments;</li> <li>– understanding of the opportunities and problems associated with online learning and the ability to use digital tools to solve them.</li> </ul>
<p>Digital teaching</p>	<p><b>The ability to manage the educational activities of students, support and develop them using digital environments:</b></p> <ul style="list-style-type: none"> <li>– the ability to plan educational activities in a digital environment, taking into account students’ learning styles;</li> <li>– personalized assignment of educational materials;</li> <li>– the ability to organize the selection of educational content in Microsoft Teams channels and tabs;</li> <li>– the ability to view courses from Microsoft and third-party providers;</li> <li>– the ability to organize educational activities of students both independently and in teams;</li> <li>– understanding the educational value of various educational content for teaching, learning and assessment;</li> <li>– understanding of different educational approaches and their application in digital conditions.</li> </ul>
<p><b>Types of educational activity:</b> preparatory work, independent work, training, assessment, reflection</p>	

Table 1.2.5

**Digital creation, problem solving and innovation using Microsoft 365**

Digital creation, problem solving and innovation (creative content production)	
<b>Services:</b> SharePoint, Whiteboard, ClassNotebook, OneNote, StaffNotebook	
Digital creation/Digital creativity	<p><b>Designing and/or creating digital educational content of various types:</b></p> <ul style="list-style-type: none"> <li>– the ability to select tools depending on the type of educational content;</li> <li>– the ability to create and structure content depending on the type of educational activity (interactive instructions, textual methodological recommendations, video materials, digital notes);</li> <li>– understanding the process of digital production of educational content.</li> </ul>
Digital research and problem solving	<p><b>Ability to use digital tools for research and data analysis:</b></p> <ul style="list-style-type: none"> <li>– ability to collect and compare received data, assess their quality, value and completeness;</li> <li>– ability to form conclusions based on processed data and share them using digital methods;</li> <li>– understanding of digital research methods; understanding of various data analysis tools and methods.</li> </ul>
Digital innovations	<p><b>Implementation of new practices of using digital tools in the learning process:</b></p> <ul style="list-style-type: none"> <li>– the ability to adopt and develop new practices of using digital technologies in all types of educational activities;</li> <li>– the ability to use digital technologies in the development of new ideas, projects and opportunities;</li> <li>– understanding of innovation and corporate governance under digital conditions.</li> </ul>
<b>Types of educational activity:</b> preparatory work, presentation of theoretical material, training, collective work, assessment	

and interaction using Outlook, Yammer, Kaizala, Teams, Planner, Project, Bookings, To-do, Lists, Delve, People, OneDrive, Skype, Flipgrid services are presented in Table 1.2.6. The method of their use is described in Paragraph 2.3.

Table 1.2.6

**Digital communication, collaboration and interaction using Microsoft 365 cloud services**

Digital communication, collaboration and interaction	
<b>Services:</b> Outlook, Yammer, Kaizala, Teams, Planner, Project, Bookings, To-do, Lists, Delve, People, OneDrive, Skype, Flippgrid	
Digital communication	<p><b>Ability to communicate effectively using the Microsoft 365 digital environment:</b></p> <ul style="list-style-type: none"> <li>– the ability to design digital communications for various educational purposes and audiences;</li> <li>– understanding the features of various digital tools for communication;</li> <li>– the ability to detect and combat harmful digital messages;</li> <li>– the ability to maintain confidentiality in private communication;</li> <li>– the ability to adhere to corporate communication ethics during educational activities.</li> </ul>
Digital collaboration	<p><b>Ability to participate in Microsoft 365 teams and workgroups:</b></p> <ul style="list-style-type: none"> <li>– the ability to collaborate effectively using shared digital tools and media;</li> <li>– the ability to create joint educational materials;</li> <li>– the ability to use tools for planning joint activities;</li> <li>– understanding the features of various digital tools for collaboration and the ability to select them depending on the task of collective work.</li> </ul>
Digital interaction	<p><b>Ability to interact in digital environments and communities:</b></p> <ul style="list-style-type: none"> <li>– the ability to share relevant, up-to-date educational content in Microsoft Teams chat/channels;</li> <li>– the ability to create digital connections and</li> </ul>

	establish contacts; – the ability to behave safely and ethically in virtual environments; – the ability to plan collective activities to perform a complex task.
<b>Types of educational activity:</b> collective work, feedback, reflection, evaluation	

Under the conditions of e-learning, it is important to support all types of educational activities using cloud tools, the high-quality and effective use of which is possible with the possession of all components of digital competence by the participants of the educational process, namely: possession of ICT; digital literacy; digital creation, problem solving and innovation; digital communication, cooperation and interaction; digital training and development; digital identity and wellbeing.

### **1.3. Formation of digital literacy and ICT skills using Microsoft 365 services**

The organization of distance learning with the help of Microsoft 365 cloud services has a different impact on all elements of the education system, both on teachers and on students. The use of Microsoft 365 allows teachers and students to effectively organize the learning process, since the cloud services of this platform are multifunctional. Possessing digital literacy and using tools depending on the type of educational activity, all participants in the educational process can manage information, support digital data management for academic and professional purposes, develop and deliver visual and multimedia educational content (Table 1.2.2).

OneDrive within a corporate account provides users with 1 TB of cloud space. The use of this service by a teacher is suitable for filling the file storage with various types of educational content and, accordingly, providing access to students. Using the OneDrive service, students and teachers can:

- create educational content (the teacher – various educational materials; students – present the results of their own work, select

educational resources depending on the learning style);

- jointly edit educational materials in real time;
- work collectively with selected users (provide address access for editing or viewing a document);
- share documents in the repository with specific users or exchange links to external resources.

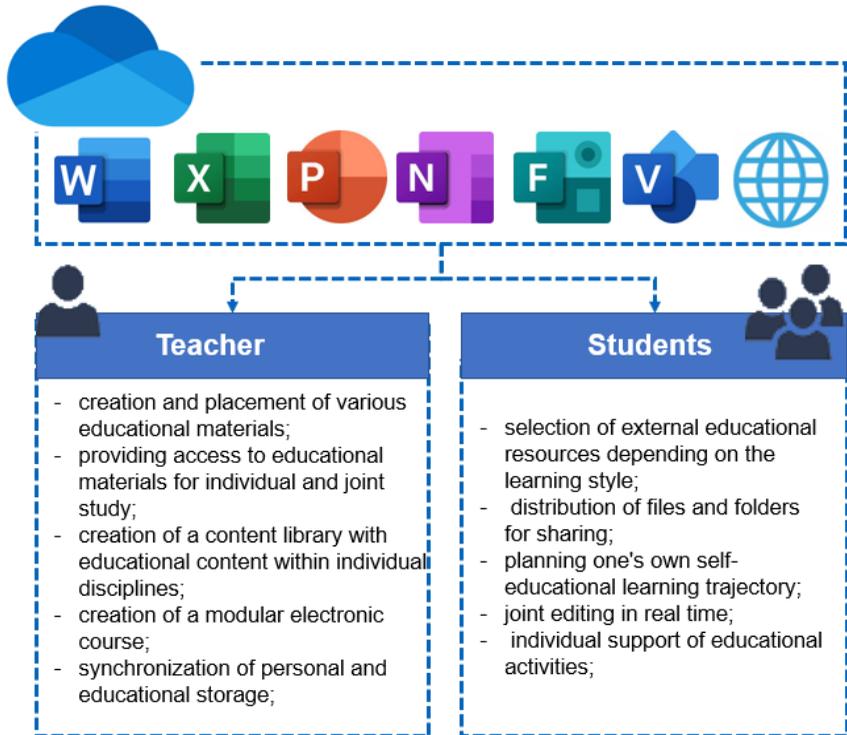
Depending on the type of educational activity, the teacher can plan and design educational activities depending on the type of creation and delivery of educational content, as well as providing the necessary resources to students; organize methodical work, organize online consultations and webinars; create the necessary educational resources depending on the educational content. An example of the capabilities of the OneDrive cloud storage for managing educational activities by both the teacher and the student is shown in Figure. 1.3.1.

The teacher can fill the storage with already created educational materials that are placed on other resources. It is possible to add them to the repository, or to a certain directory placed on it, with the help of links, both to external resources and to files that were previously created or placed on OneDrive. An example of filling the directory in the repository with links to educational materials is presented in Figure 1.3.2.

Students can also use their own file storages to accumulate useful links to external resources, thus organizing their own self-educational activity, deepening their theoretical knowledge and practical skills.

The Word document cloud service allows the teacher to create various educational resources for students with the presentation of theoretical material, methodological recommendations or instructions for performing laboratory tests. A teacher can organize joint work on documents during such an educational activity as training, where students can search for answers to questions, interpret and structure them in an online file accordingly. For quick analysis and processing of information from foreign sources, students can translate text in real time.

The teacher can provide students with templates for writing essays, a report on the performance of laboratory work or reports on educational practice, term papers or graduate papers, so the student will adhere to a uniform style of document design. When the students are performing such activities, the teacher is given the opportunity to

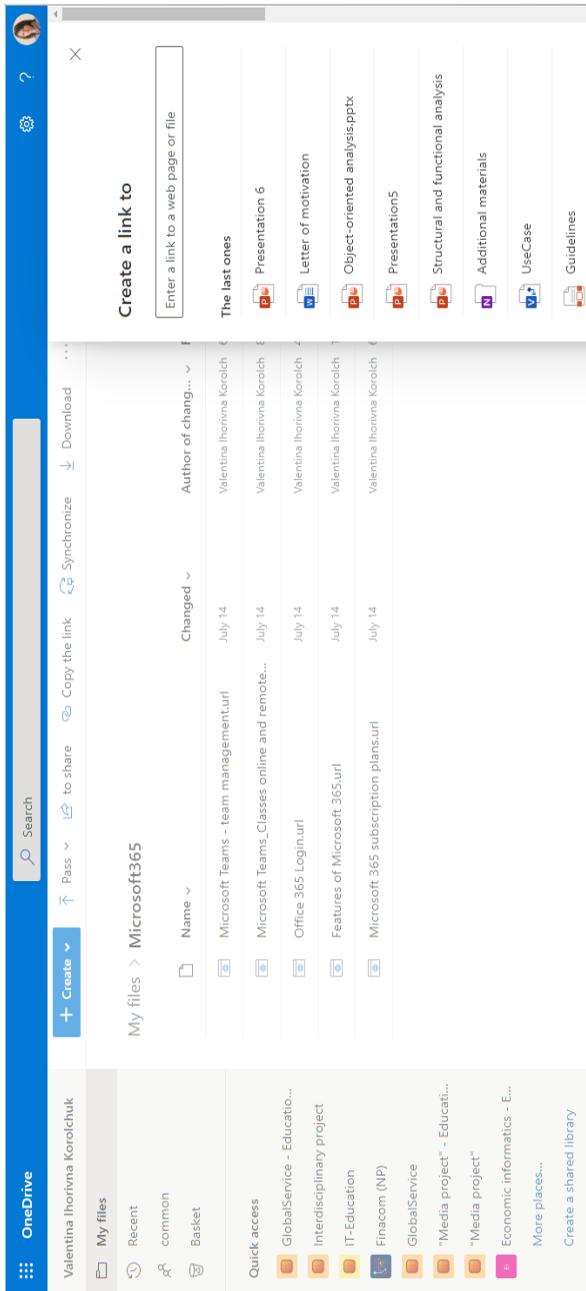


**Figure 1.3.1. OneDrive cloud storage capabilities for managing educational activities**

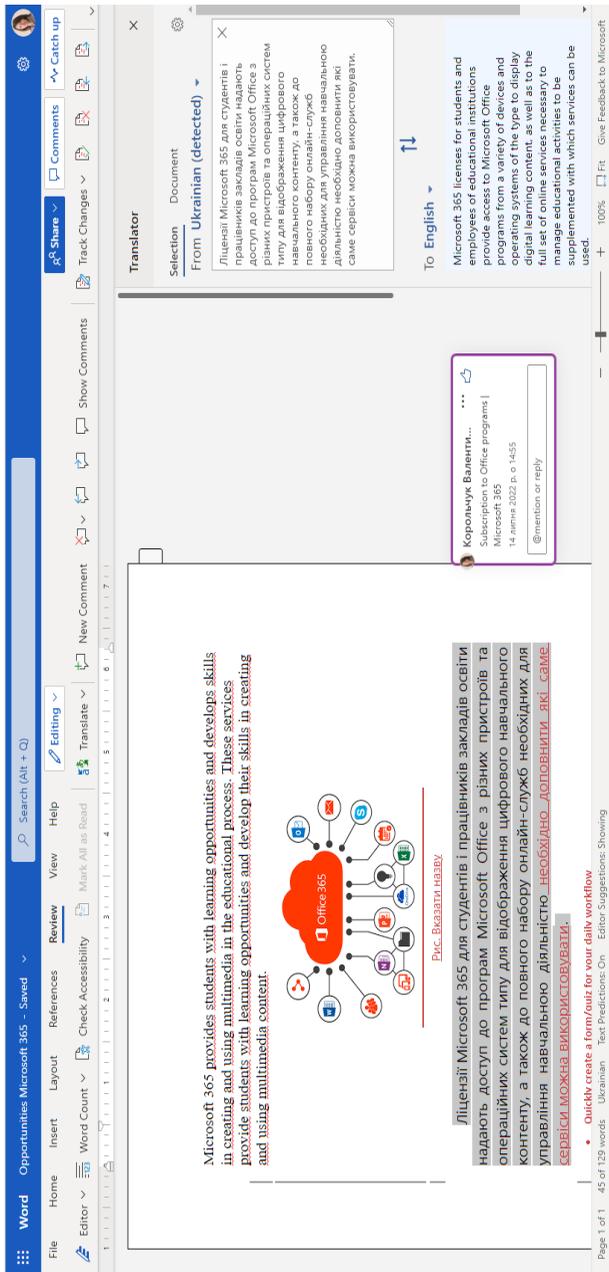
review online, add feedback, comments, or propose ideas directly in the file using notes. An example of using the Word Online service when reviewing a student’s work in real time is shown in Figure 1.3.3.

In this way, it is possible to ensure the interaction of teachers, lecturers and students, as well as groups of students among themselves when performing collective tasks.

To organize such a type of student activity, as preparatory work, reflection or feedback, it is advisable to use a service such as Forms, where you can immediately familiarize yourself with the results in the Feedback tab. To process the results, the teacher can immediately open Excel in the local version, where it will then be possible to make the necessary changes to the corresponding file, process the results (analyze and visualize the received data).



**Figure 1.3.2. An example of a link created on the OneDrive storage**



**Figure 1.3.3. An example of using the Word Online service by a teacher**

During lectures or during laboratory (practical) work, teachers can offer students to share their opinions using Forms and later analyze respondents' answers, adjust the type of presentation of educational content, as well as their content.

The teacher can use the Forms service to conduct module tests and final certifications during distance learning. Tests can be created using different types of questions, for example, it is possible to add videos to some tasks and adjust the automatic assessment accordingly. So, the teacher can see the students' progress and quickly export the answers to Excel for detailed analysis, as well as visualize the data in the form of various charts that are updated in real time, and view automatically generated reports. An example of self-assessment of students using the Forms service before starting the study of the educational discipline "Information Technologies" is shown in Figure 1.3.4.

At the end of the academic semester, based on the results of studying a certain discipline, the teacher can use the Forms service to create a survey (reflection), collect feedback from students about educational content, as well as other information that will help to effectively manage educational activities, create and deliver various types of educational content. Due to the Forms service, the teacher can diversify the student's educational activities with various surveys and tests. In this way, it is easier for students to focus on their studies, and for the teacher to monitor their progress.

Student surveys can be created directly in the new Excel Online workbook. After working with the Microsoft Forms form, the Form1 tab will appear in the book, which displays the results of the survey as answers are received. In this way, the teacher receives the data of the table, which displays the start time, completion time, postal address, name of the respondent (in Microsoft Forms, before sending the results, there is always a warning that the name will be published) and answers to the survey questions.

Within the framework of the organization of such a type of student activity as practical or laboratory work, the teacher can provide access to the Excel Online file for joint performance of the task by students. During the task, students can independently manage their own educational activities or teams, connect other participants, analyze and model data, as well as visualize the obtained results and make appropriate decisions, draw certain conclusions. Figure 1.3.5 gives an

Self-assessment (for IT students) - saved

Forms

Preview Topic

Collect the answers

Reviews 234

### Self-assessment (for IT students)

Question

234 Reviews

03:35 Average fill time

Active State

View the results

Open in Excel

1. Specify the specialty you are studying

More information

Computer science and informati...	100
Software engineering	57
Computer Engineering	47

3. Assess your level of mastery of a text editor \*

☆☆☆☆

4. Show your skills when working with the table editor \*

- I create, format tables, change data formats
- I edit and format data
- I carry out statistical calculations
- I analyze the data, filter, group the raw data in summary tables, create slices
- I build different types of charts and analyze them
- I work with an online spreadsheet editor

Fig. 1.3.4. An example of creating a survey for students (self-assessment)

Excel lab66 - Saved

File Home Insert Draw Page Layout Formulas Data Review View Automate Help Editing

Insert Function Show formulae Calculation Options Automatic Calculate Workbook Calculate Sheet

	A	B	C	D	E	F	G	H	I	J
1	Type of laptop	Level of reliability	Producer	Model	Processor	Hard drive	RAM (GB)	Weight	Price	Link to the store
11	AVERAGE	reliable	Lenovo	Lenovo L340-15	Intel Core i5-9300H 2.4 ITL4	HHD 1000	16	2.2 kr	28 999 rph	AmX6hP0HHzD3AwAQ0Qx6BlaQeAE
12	ELITE	not reliable	Acer	Acer Predator Helios 500	AMD Ryzen 7 2700U (Zen)	SSD 2x-1024	32	3.9 kr	109 999 rph	9s-50p_rh5t7-5z-series/?qclfc=C0KCGQJmm6KUBhC3ARISAC lhwB9p9zYMYMfHqRP711TKU0IWAF_m7H5FN1ahN25VfH ZnwJ6gRRPoaAVZZEALw_wcB
13	BUDGETARY	reliable	Lenovo	Lenovo IdeaPad 3 14ITL6	Intel Core i5-11xxx	SSD 256	8 - 12	1.41 kr	12 861 - 24 687	4kxwH5HMd6GOY_mfHmpJllwGTz4qq0VlBkszvO075J7 lw44A9AZZEALw_wcB
14	ELITE	neutral	Dell	Dell Alienware M17 R4	Intel Core i9-10xxx	SSD 1000	16	2.51 - 3	60 999 - 137 743	flw577qclfc=C0KCGQJmm6KUBhC3ARISAClwzBjhmN2Ojrdz7w lV4BhBjG6eHfWvZVpCpe13Ydmz91A5hsp0P1caAsx6E ALw_wcB
15	ELITE	neutral	Apple	Apple MacBook Pro 2021	Apple M1 Max	SSD 2000	16	1.672	150 - 3 811 \$	qclfc=C0KCGQJmm6KUBhC3ARISAClwzBjhmN2Ojrdz7w 0f6uU1MhV5PKN1HfH4GE6i0_b0cV6u01T1tsAV48EALw wv9B
16	ELITE	neutral	Asus	ASUS ROG Strix SCAR 17	AMD Ryzen 9 5xxx	SSD 1000	64	2.7	106 985 - 139 686	l17-9t_23ps-series/?qclfc=C0KCGQJmm6KUBhC3ARISAClwzB lhwB9p9zYMYMfHqRP711TKU0IWAF_m7H5FN1ahN25VfH ZnwJ6gRRPoaAVZZEALw_wcB

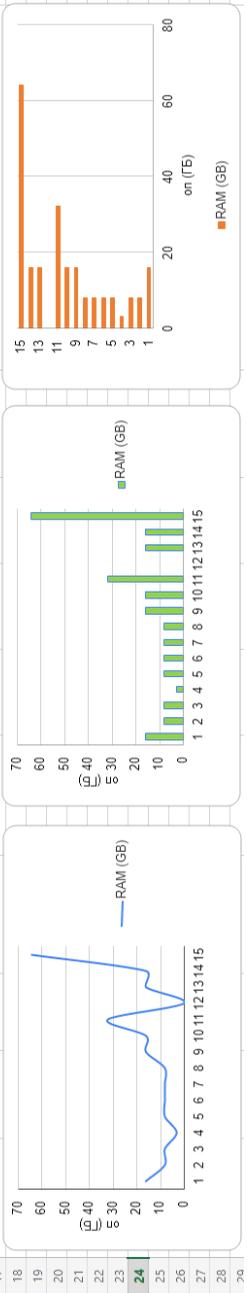
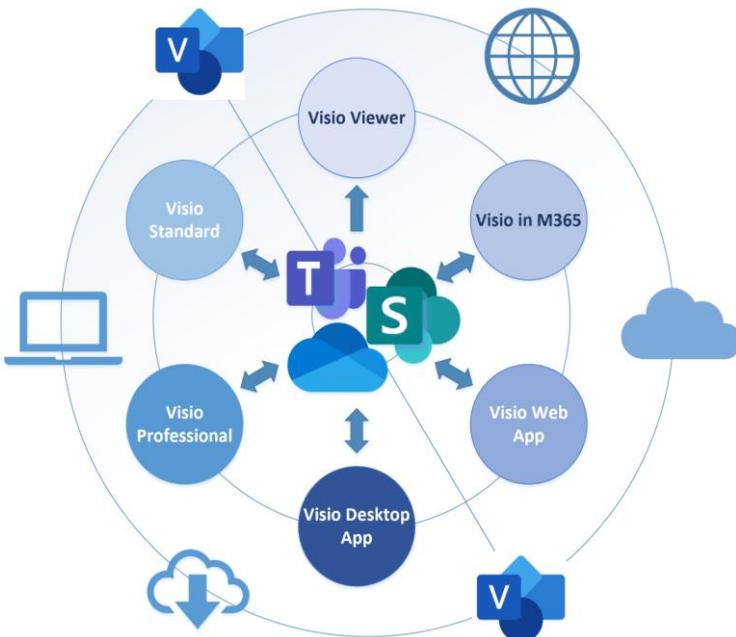


Figure 1.3.5. An example of using content by students in Microsoft Excel

example of providing students with educational content for working with data during the performance of one of the laboratory works within the framework of studying the discipline “Information Technologies” (Part 2) by students obtaining the Bachelor’s degree in the branch of knowledge 12 – Information Technology.

Visualization of information improves students’ understanding of educational material, Visio diagrams in particular can be used to present various content, for example, building a process diagram, network infrastructure, table layouts, organizational charts, visualize the steps of various processes, to demonstrate a sequence of steps or a procedure, business matrices that show the relationship between concepts along two or more dimensions. Today, various versions of Visio are available (Figure 1.3.6), among which there is an online service that is part of the Microsoft 365 cloud platform.



**Figure 1.3.6. Available Desktop and Online versions of Visio [21]**

Visio documents created by a teacher using the desktop version of Visio can be uploaded to the Files folder of the Teams channel and can be viewed by students in Visio Online in read-only mode. If the instructor saves the Visio document to OneDrive or SharePoint Online/Teams, it can be viewed or edited by students with appropriate access rights. Students will have the option to annotate the diagram in Visio and download it as a diagram, PDF file, or image. An example of students' work with diagrams in Visio Online is presented in Figure 1.3.7.

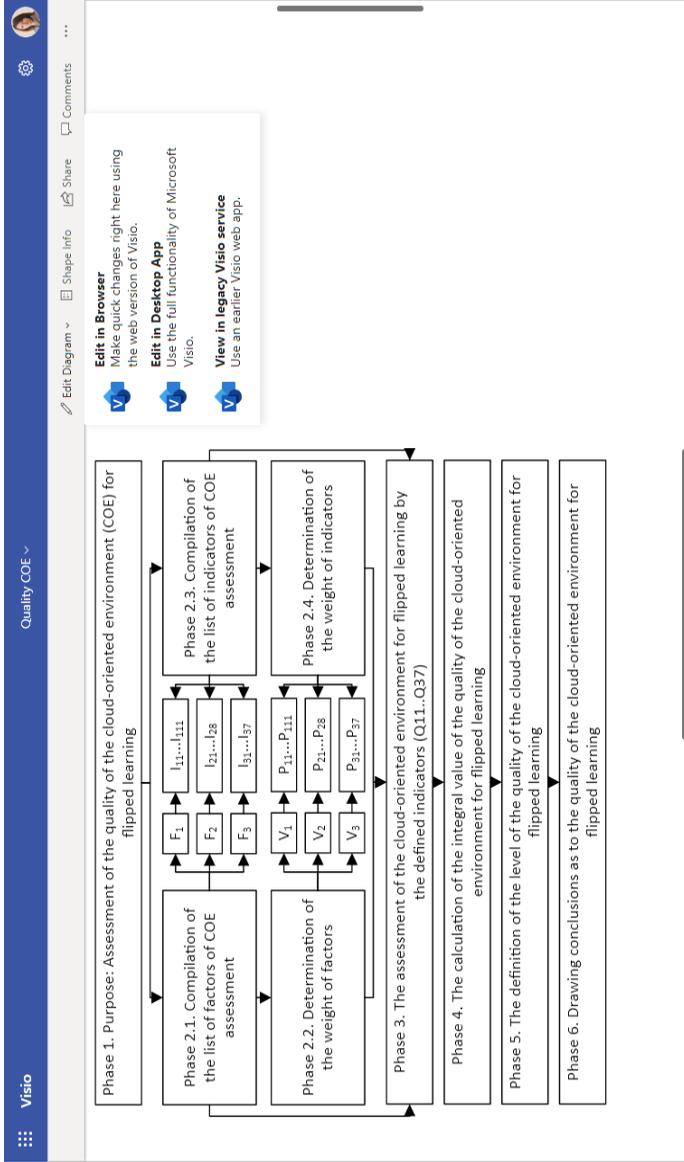
Setting access rights ensures visibility of data shapes, hyperlinks and comments that are present in the file. The built-in JavaScript API makes this tool useful for developing custom web pages in SharePoint Online or Teams services.

Structuring information and creating visual content is also possible using Power BI, with which teachers and students can build intuitive dashboards from various visualizations, such as charts and maps, to understand complex data sets, KPI measures and trackable goals to achieve business intelligence objectives. The integrated use of the Visio web application and Power BI allows you to visually illustrate and compare data such as diagrams and visualizations to assess the overall picture, use operational and business intelligence.

Figure 1.3.8 illustrates the categories of available data sources that can be connected to Power BI.

The teacher or students having access to various sources of data depending on the type of educational activity can:

- having a database that was previously created using Microsoft Access, get additional visual information through data analysis and visualization;
- after receiving tabular data from website pages, process them, build interactive reports and create data visualizations to present educational content;
- analyze data from open sources and use this opportunity to organize training sessions on the possibilities of analysis and visualization of various data;
- getting access to simple and convenient monitoring panels with various types of data, build interactive reports by creating interactive panels and embedding them in various resources and services (for



**Figure 1.3.7. Visio Online service usage for working with graphic content**

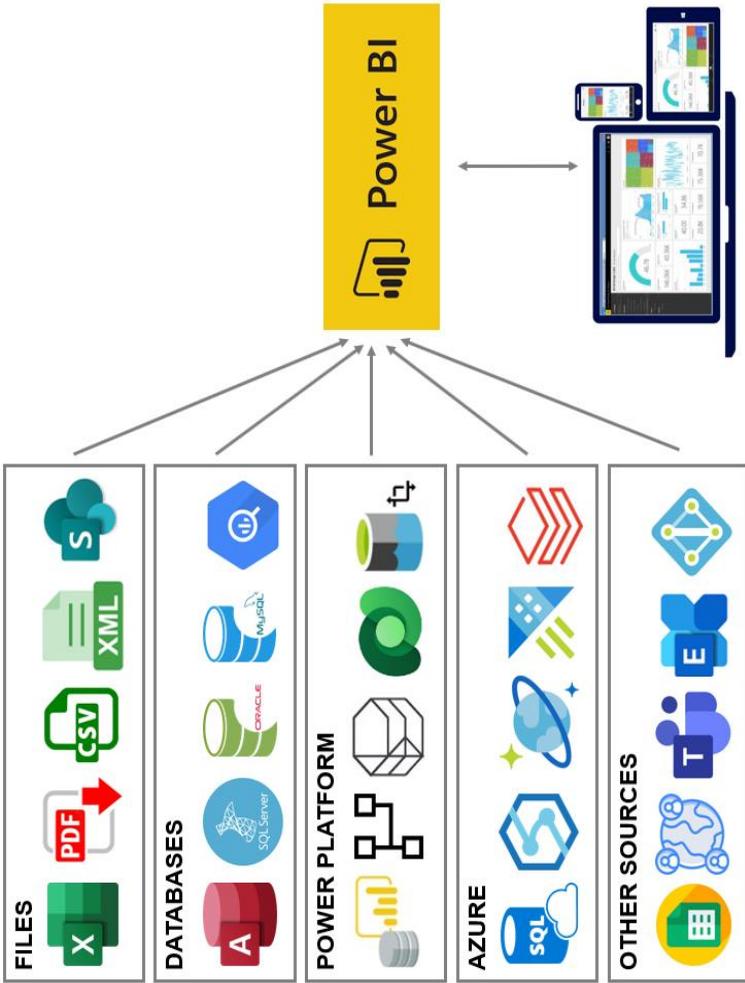


Figure 1.3.8. Power BI data connection sources

example, social communities or as images or dynamic data in the PowerPoint service).

The scheme of the Microsoft Power BI environment for processing data from various sources is shown in Figure 1.3.9.

Reports created in Power BI can be added by the teacher as tabs in Teams or distributed immediately via chat in Teams, and since these reports can contain embedded Visio diagrams, for example, it provides an easy way for the teacher to share useful information with students in the form of interactive panels, visualizations which are updated according to the latest data after updating the corresponding data models.

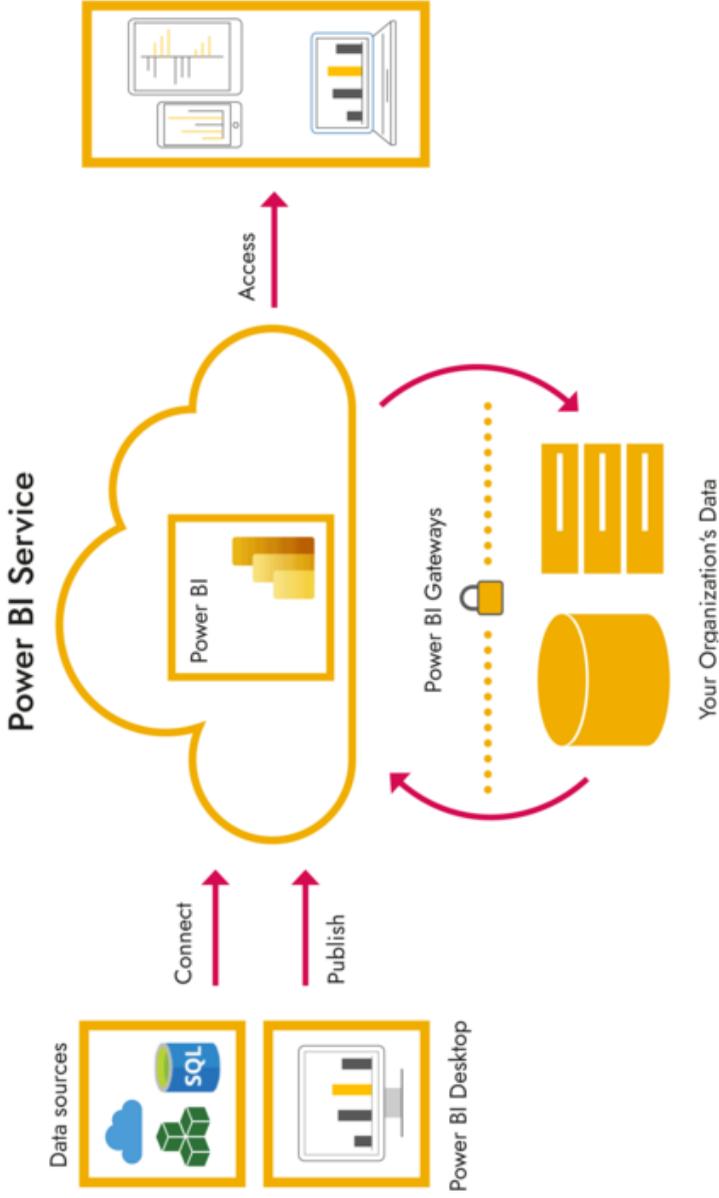
An example of data visualization in Power BI Online and options for distributing this content are shown in Figure 1.3.10.

Additionally, if the educational institution has created, for example, databases by students, then the teacher having appropriate access to them or, upon request, can obtain them from the administrator of the educational portal or the system for managing the educational activities of students, can analyze the success in groups. This will allow teachers to make changes to the planning of activities, presentation and delivery of educational content to meet the needs of end users, thus contributing to the improvement of their level of theoretical knowledge and skills and, accordingly, success in the relevant academic disciplines.

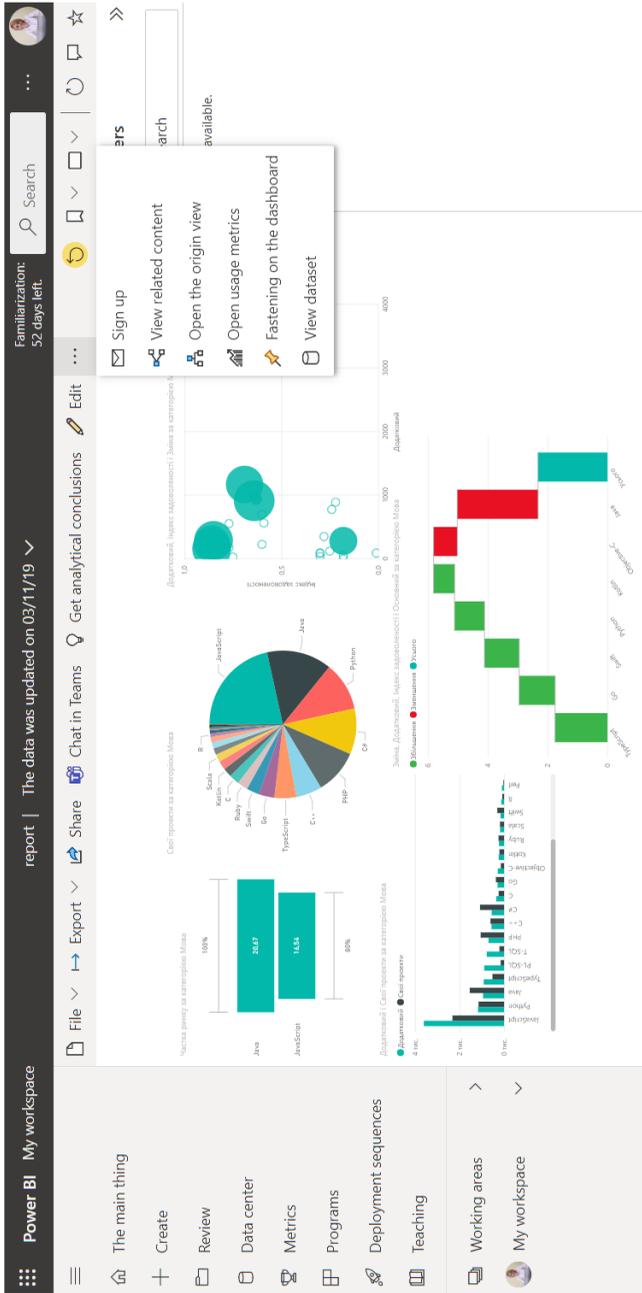
Microsoft 365 provides students with learning opportunities and develops skills in creating and using multimedia in the educational process. These services provide students with learning opportunities and develop their skills in creating and using multimedia content [19].

Based on the research conducted by L. Nasution, it was found that the learning outcomes of students improved after using one of the Microsoft Office programs, namely Microsoft PowerPoint, in the learning process. In this study, it was found that the use of Microsoft Office allows to optimize the teaching and learning process by 100%, while in the control group, the percentage of learning efficiency was only 86.48% [116].

In distance learning, educational materials are often shown to students in the form of PowerPoint presentation files, which are convenient to use on various devices, including mobile phones.



**Figure 1.3.9. Microsoft Power BI environment: inputs, processing and output [21]**



**Figure 1.3.10. An example of data visualization in Power BI Online**

Using the cloud version of the PowerPoint service, the teacher can:

- add various content to PowerPoint and receive appropriate recommendations for the design of slides while creating educational content for lectures, work together on a presentation with students, solve case problems during practical (laboratory) work, add feedback, demonstrate a live presentation. It must be noted, that only the students from one educational institution can join the session (Figure 1.3.11);

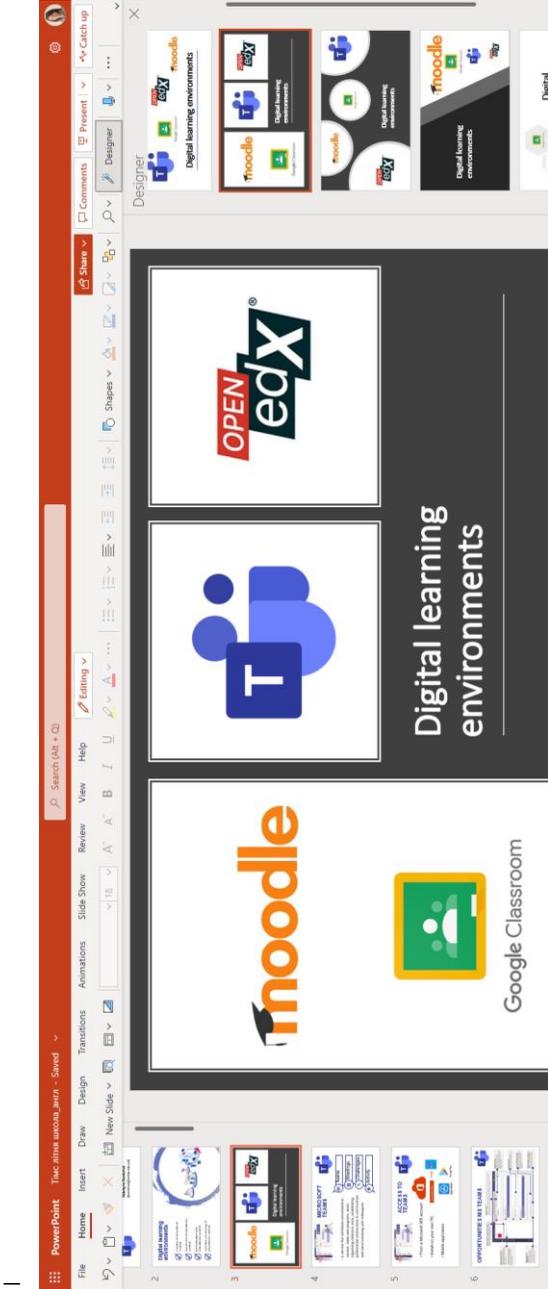
- place the educational material of the relevant academic discipline as a set of files explaining the sequence of studying the material in a PowerPoint presentation file on your own OneDrive storage or in the created shared library of the relevant discipline. At the same time, the teacher can set the access parameters for viewing or editing the file, specifying the date when the access expires or prohibiting the download;

- by placing an online PowerPoint presentation in the Microsoft Teams channel, you can organize its collective processing or filling. During collective work in such a file, the teacher can view the versions, as well as the changes made by each of the students;

- while demonstrating an already created presentation, both the teacher and the students who have access to it have the ability to make notes and comments on the screen using a digital pen to draw the attention of the audience to the necessary element of the educational material;

- if it is necessary to create video content, the teacher using PowerPoint has the opportunity to record a slide show with a video recording and a voice explanation of the material presented on the slides. Exporting such a video allows you to receive educational video content for further publication and distribution to students in the Microsoft Stream cloud service. With the help of Microsoft Forms tests and surveys, interactive feedback forms are set up and learning material is checked, embedding testing after watching video clips, etc.

- using pre-created surveys in the Forms service (for example, a feedback form) at the required time and place in the video, the teacher can embed a link in Microsoft Stream or directly in the presentation in the form of a PowerPoint slide. The last option involves creating the training material as a.pptx file and distributing it via OneDrive files or Microsoft Teams channels.



**Figure 1.3.11.** An example of using a PowerPoint Online presentation

The use of various cloud services when organizing educational activities, developing educational content, namely recording video from the screen in combination with the voice explanation of the teacher, adding interactivity allows you to create a variety of educational video material that students can view at a time convenient for them and from any device.

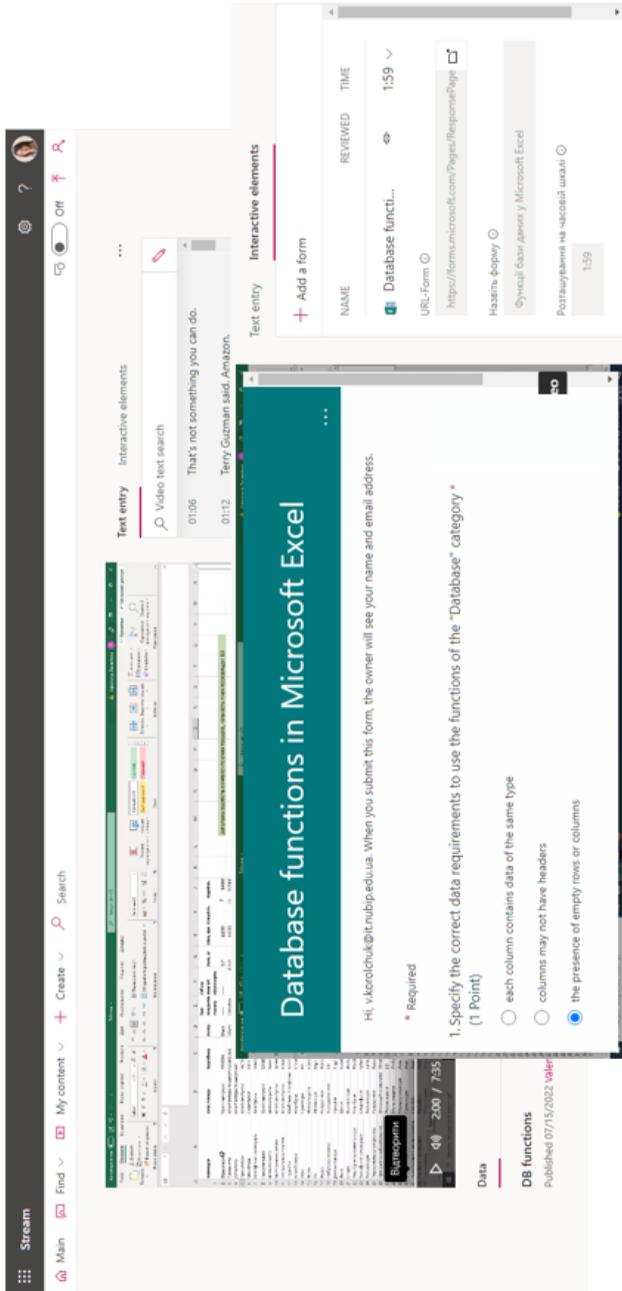
Microsoft Stream uses built-in encryption and authenticated access to educational video content, which ensures the exchange of materials only with the specified target audience (groups of students within the study of a certain academic discipline).

Educational video materials in Microsoft Stream can be published using the channels of the educational institution or in Microsoft 365, in turn, separate channels can be created in the group. Links to videos can also be placed on SharePoint sites in special web parts, closed Yammer social community, as well as in Sway interactive presentations or on OneDrive file storage. In Microsoft Teams, you can publish in the group channel a link to a separate video or a channel from a video, depending on the pedagogical goals (for example, adding videos to the channel by different lecturers or guest speakers), followed by a group discussion using Microsoft Teams chat tools.

Directly in Microsoft Stream, along with the playing video, there is an opportunity to create interactive content, which includes automatically generated titles and elements of interaction with the audience are added using the Interactive elements tab, where you can add a link to a test (survey) created in advance in the Microsoft Forms service. Figure 1.3.12 shows an example of organizing an interactive webinar using Microsoft Stream.

The use of this service for certain types of educational activities (lectures, webinars, materials for independent work, preparing students for educational classes) allows you to integrate interactive elements into the created video content, which contributes to the effective organization of a personalized model of flipped learning, that is, it takes into account the individual needs of each student and his educational style.

N. Grijalva-Borja, V. Espinosa, S. Quinteros and A. Salguero consider Microsoft OneNote to be a useful working tool for various educational institutions, the use of which allows you to easily fill it



**Figure 1.3.12. An example of creating interactive video content in**

with diverse content for laboratory practices in distance learning conditions [45].

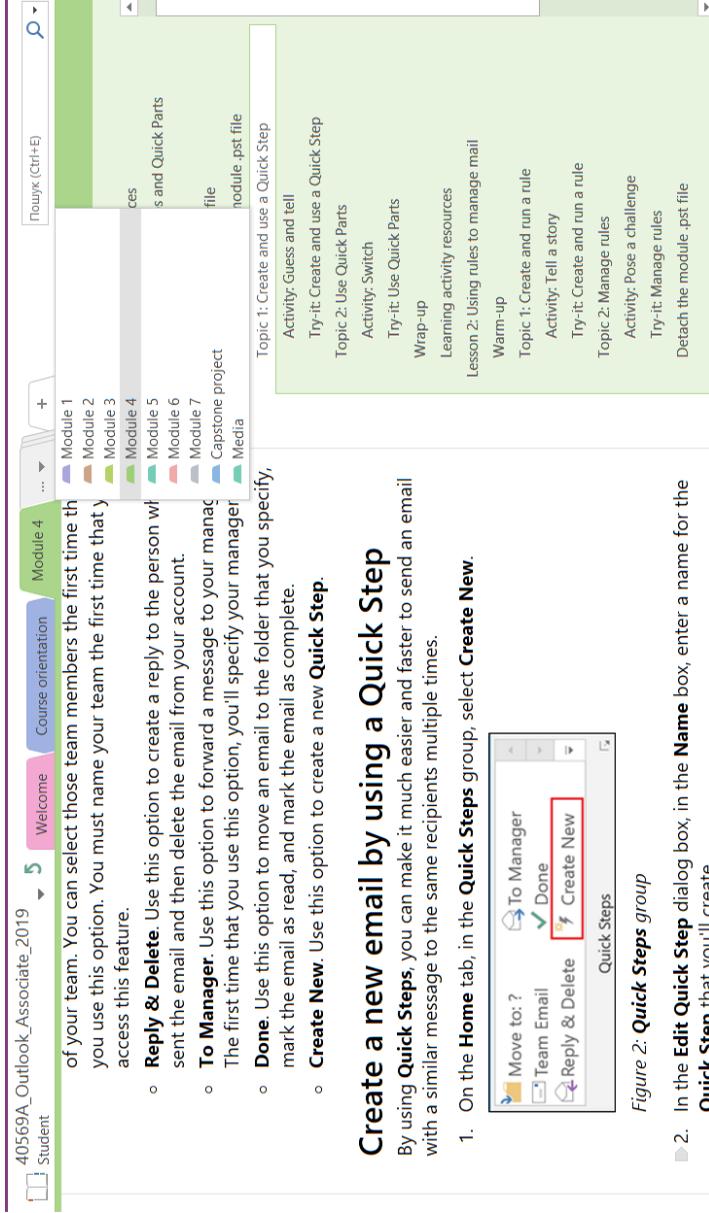
Adopting OneNote in education offers the possibility to interact with students in a much more seamless way across a range of digital platforms. It offers an alternative experience to traditional VLEs, which is ‘on demand’ whereas OneNote can ‘push’ content. There is also the possibility to work collaboratively using the sharing facilities in OneNote, where students and staff can all write on one page [9]. Armstrong C., Llorin J. describe the use of shared Microsoft OneNote “Binders” to create a school environment for sharing, continual formative assessment, information organization [6].

The OneNote service provides the flexibility to store and organize a variety of educational content (text, drawings, digital handwritten texts, audio and video materials, etc.) in one digital notebook. Using this service, the teacher can:

- place course materials in a digital notebook by developing their own content delivery structure;
- provide each student with access to a library with appropriate content;
- create tasks and evaluate students;
- fill the digital notebook with content according to the student’s learning style;
- recommend training courses at Microsoft Imagine Academy to students as informal education, as additional materials.

An example of a training course created in the OneNote service (placed in Microsoft Imagine Academy) is shown in Figure 1.3.13.

Students in current conditions have a clearly defined need for self-education; strive to acquire new knowledge, skills and abilities; each of them knows how to independently determine the goal when searching for the necessary educational information; to plan their own actions regarding the implementation of practical tasks and to solve them in the most rational way, namely, the main skill formed in them is to “learn throughout life.” That is why, having access to the OneNote service, each student can create his own digital notebook for self-education, fill it with various educational content depending on their own learning style.



- of your team. You can select those team members the first time that you use this option. You must name your team the first time that you access this feature.
- o **Reply & Delete.** Use this option to create a reply to the person who sent the email and then delete the email from your account.
  - o **To Manager.** Use this option to forward a message to your manager. The first time that you use this option, you'll specify your manager.
  - o **Done.** Use this option to move an email to the folder that you specify, mark the email as read, and mark the email as complete.
  - o **Create New.** Use this option to create a new **Quick Step**.

### Create a new email by using a Quick Step

By using **Quick Steps**, you can make it much easier and faster to send an email with a similar message to the same recipients multiple times.

1. On the **Home** tab, in the **Quick Steps** group, select **Create New**.



Figure 2: **Quick Steps** group

2. In the **Edit Quick Step** dialog box, in the **Name** box, enter a name for the **Quick Step** that you'll create.

Figure 1.3.13. An example of the Microsoft Outlook associate 2019 training course

Due to the advantages of the Microsoft Imagine Academy (MSIA) program, the teacher can also use it for professional development, which can take place in various areas: productivity, informatics, IT infrastructure and data science, and with the subsequent passing of a professional certification confirming the acquisition of relevant knowledge and skills.

Learning in the COVID-19 pandemic era requires practical teaching materials that are easily accessible to students. Digital teaching materials are alternative solutions to accommodate online learning needs [54]. Teachers must constantly improve their qualifications, as technologies and approaches in the educational process are rapidly changing. The use of Microsoft 365 services allows you to combine a person-oriented approach with collective learning methods, effectively organize blended, inverted or distance learning.

According to [50] Sway is a form of software that can be used in creating products that combine text, sound, video, and images when the presentation is run. Based on this background, a sway is a tool that can be applied in developing teaching materials and can be used as an alternative in online learning during the COVID-19 pandemic. Sway can be used as an online presentation tool that can be applied in various situations and conditions such as research conducted by [134] which can improve the ability of teachers to make digital storytelling, and research from [75] which can improve student presentation skills.

The creation and delivery of various types of content to students with such an organization of the educational process involves the use of the Microsoft Sway interactive cloud service. The functionality of this service allows you to combine short videos (video content) in one tool without publishing them on additional resources, gif animation, you only need to take into account the file size limitation.

Microsoft Sway can be used as a blended learning resource as it provides a possibility to insert content from various resources (Figure 1.3.14).

Using Microsoft Sway, a teacher can quickly and easily create various educational materials (content) on all available devices. As a result, students receive a web resource with educational content that is adapted to any device screen, which the students can view at their convenience and from any device.

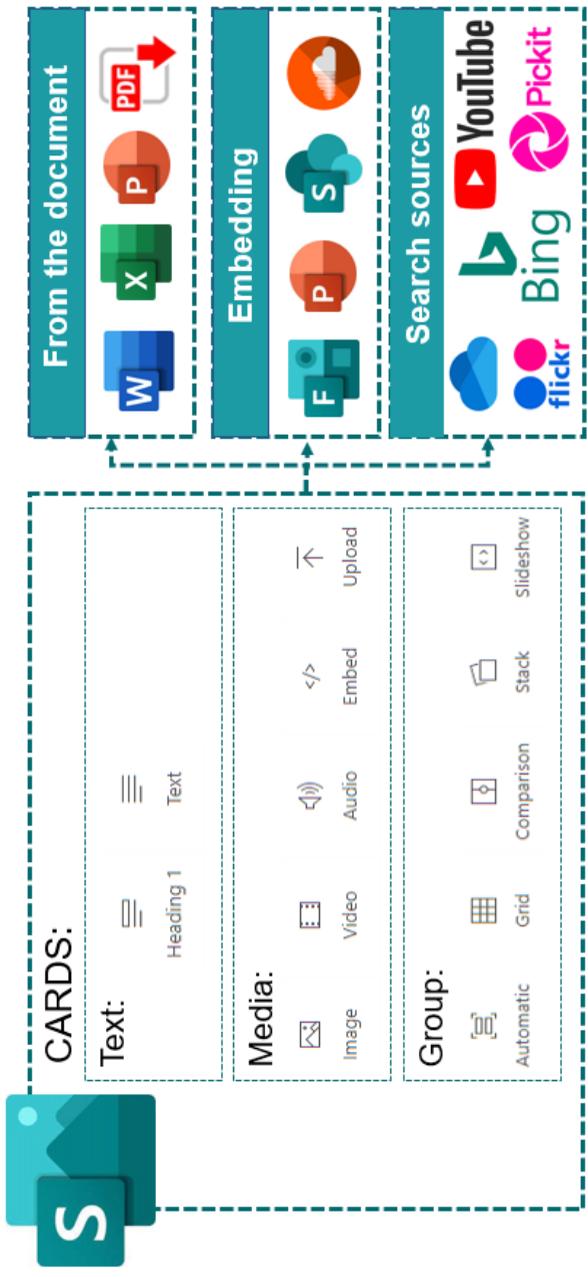


Figure 1.3.14. Integration of various types of content into the Sway interactive service

Microsoft Sway supports the ability to embed Word, Excel, and PowerPoint documents, including individual Excel charts and tables stored in OneDrive or SharePoint, by inserting the embed code of the document into Sway. In this way, Sway can also integrate a wide variety of content (including images, maps, audio- and video content) from several web resources.

It is possible to embed Microsoft Forms surveys and tests in order to create an interactive resource with elements of interaction. In this way, the teacher can form a current or total assessment during the educational activity, for example, during the student's preparatory work, presentation of theoretical material or training.

In order to evaluate the quality and effectiveness of the educational content and the audience's involvement in it, the "Analytics" module is provided, which is presented in Figure 1.3.15.

The teacher can analyze the following indicators of the audience's engagement:

- the number of readers who opened content created in Sway and quickly viewed the content;
- the number of readers who interacted with the embedded interactive content, for better assimilation of the material;
- the number of readers who carefully read the presented material.

After conducting such an analysis, the teacher can adjust the content, options for presenting educational content, and the quality of delivery, with the aim of greater student involvement. This will make it possible to better deliver educational content to students, assessing their satisfaction with the received educational material, taking into account the number of views of this content.

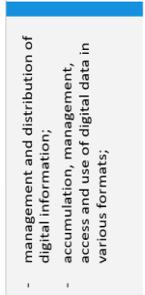
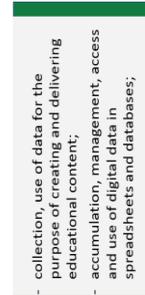
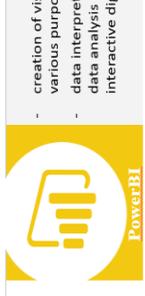
When working with educational content, there is a need to demonstrate it in real time, which allows you to make Teams Meetings. Details about the possibilities of using this service during distance learning are given in the Paragraph 3.2.

Analyzing the work of all the services presented above, each of them can be used by both teachers and students during distance learning. The generalized capabilities of each of them are shown in Figure. 1.3.16.

The availability of a large number of modern cloud tools and resources that can be used for digital learning and development using Microsoft 365 services encourages teachers to change teaching

	05/03/2022 Objective View - an objective way to	121 Total views	11min. Average time spent	54% Average views	56 quickly reviewed 60 quick read 05 carefully read
	04/19/2021 Overview of the IT labor market	001 Total views	< 1min. Average time spent	0% Average views	01 quickly reviewed 00 quick read 00 carefully read
	22/04/2019 Blog post title	001 Total views	< 1min. Average time spent	50% Average views	00 quickly reviewed 01 quick read 00 carefully read
	15/03/2019 CAR4U	002 Total views	< 1min. Average time spent	28% Average views	01 quickly reviewed 01 quick read 00 carefully read
	14/03/2019 Objective View - an objective way to	021 Total views	2 min. Average time spent	53% Average views	10 quickly reviewed 08 quick read 03 carefully read

**Figure 1.3.15. The “Analytics” module in Microsoft Sway**

 <p>OneDrive</p>	<ul style="list-style-type: none"> <li>- management and distribution of digital information;</li> <li>- accumulation, management, access and use of digital data in various formats;</li> </ul>	 <p>PowerBI</p>	<ul style="list-style-type: none"> <li>- creation of visual content for various purposes;</li> <li>- data interpretation using queries, data analysis and reports, interactive digital panels;</li> </ul>
 <p>Word Online</p>	<ul style="list-style-type: none"> <li>- creation of text content for various purposes;</li> </ul>	 <p>Forms</p>	<ul style="list-style-type: none"> <li>- collection, use of data for the purpose of creating and delivering educational content;</li> </ul>
 <p>Excel Online</p>	<ul style="list-style-type: none"> <li>- collection, use of data for the purpose of creating and delivering educational content;</li> <li>- accumulation, management, access and use of digital data in spreadsheets and databases;</li> </ul>	 <p>Visio Online</p>	<ul style="list-style-type: none"> <li>- creation of graphic content for various purposes;</li> <li>- editing, using and delivering educational content in the form of diagrams and charts;</li> </ul>
 <p>PowerPoint</p>	<ul style="list-style-type: none"> <li>- creation of visual content for various purposes;</li> <li>- editing, use and delivery of educational media content;</li> </ul>	 <p>Sway</p>	<ul style="list-style-type: none"> <li>- creation of visual content for various purposes;</li> <li>- editing, use and delivery of educational media content;</li> </ul>
 <p>Teams Meetings</p>	<ul style="list-style-type: none"> <li>- management and distribution of digital information, educational content;</li> <li>- review, analysis and redistribution of educational content;</li> <li>- use and delivery of educational media content;</li> </ul>	 <p>Stream</p>	<ul style="list-style-type: none"> <li>- search, evaluation of digital information and video content;</li> <li>- collection, use of data for the purpose of creating and delivering educational content</li> </ul>

**Figure 1.3.16. Generalized capabilities of Microsoft 365 services when managing various types of data**

methods in distance learning, to switch to more effective methods of teaching students, to manage various types of data, using new information technologies, multimedia tools, services for creating and delivering various types of educational content.

#### **1.4. Digital identity cloud services**

Every participant in the educational process in modern conditions has the right to independently manage their digital identity, thanks to a decentralized approach to user identity management, they can interact with each other transparently and securely, everyone can protect personal data and ensure their confidentiality. Table 1.2.3 gives an example of digital identity formation using Microsoft 365 cloud services.

On the profile page in Delve, the teacher and students can provide detailed information about themselves, their skills and abilities, information about their projects, education, so that users can find other participants in the educational process, communicate and share experiences, and manage personal data in the digital environment (Figure 1.4.1).

Yammer's closed social community is non-destructive and has all the features of a secure social network, robust security and compliance with data protection management and analytics. Such a network can be used to organize joint discussions, understanding the reputational benefits and risks associated with digital participation in virtual environments and user recognition procedures in various cloud services. An example of a teacher's profile in the Yammer social community is shown in Figure 1.4.2.

The People service allows you to recognize the presence of users in cloud services, by viewing their profiles in the contact list, and to manage your online activity, as well as that of other users of the digital environment. Each participant of the educational process can monitor his activity in groups of the digital environment, as well as other users with whom he works in this group. Thus, both students and teachers are able to monitor activity during the performance of various types of work, such as independent work, as well as which programs the team members collaborated with during its performance, and which files were placed (Figure 1.4.3).

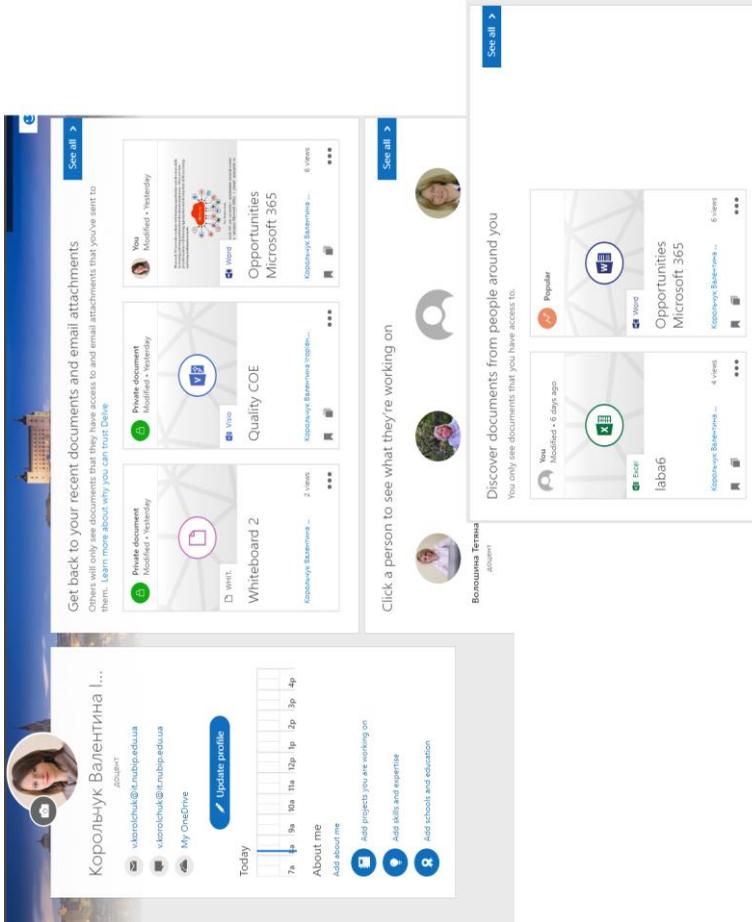


Figure 1.4.1. An example of a teacher's digital profile in the Delve service

**Valentyna Ihorivna Korolchuk**

**Search communities**

Recommended | All of them

[A tape of stories](#)
[Share this](#)
[Discussion](#)
[Create a community](#)

**Certification training**  
51 participants  
Voloshka Tetiana Volodymyrivna, Bulbasko Oleksandr, Dmytrovych and Semeniyuta Inna Leonidivna - participants

[Join the community](#)

**IT NUBIP**  
Faculty of Information Technologies of the National University of Biosciences and Nature Management of Ukraine.  
Participants: 9  
Tetyana Volodymyrivna, Voloshina, Svitlana Khandoshynska and Nina Mazuruk are participants

[Join the community](#)

Figure 1.4.2. User profile in the Yammer social community

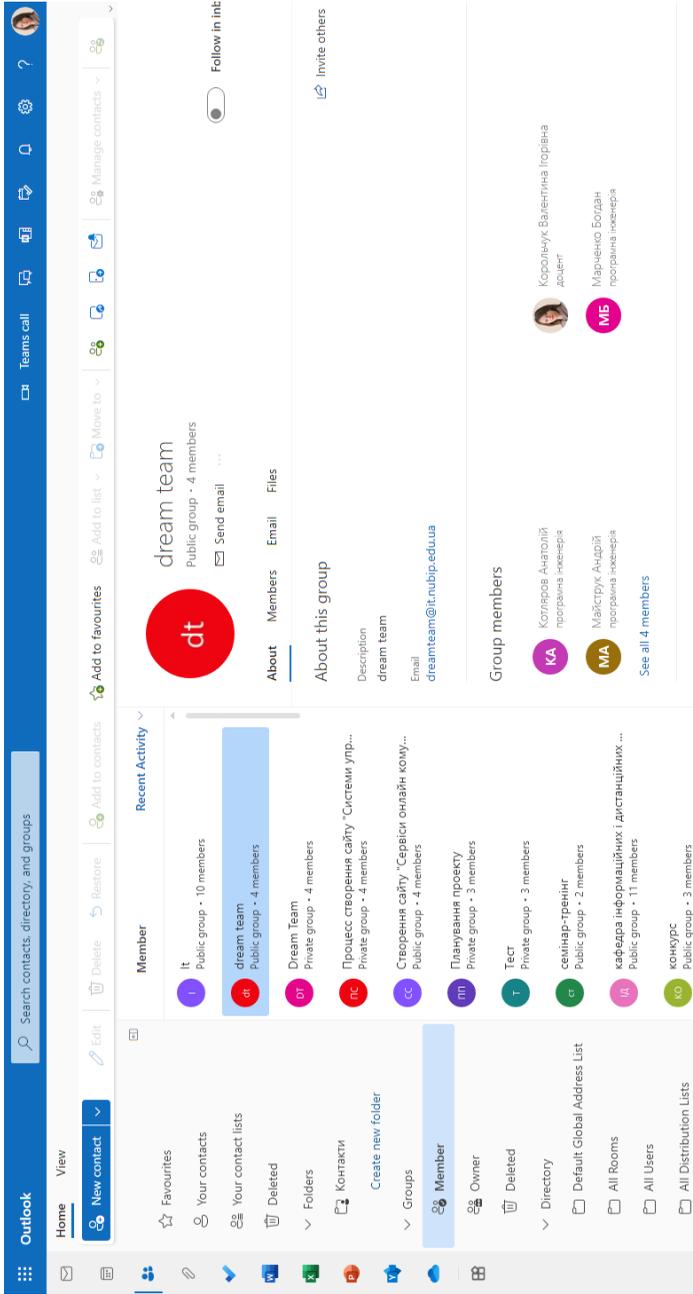
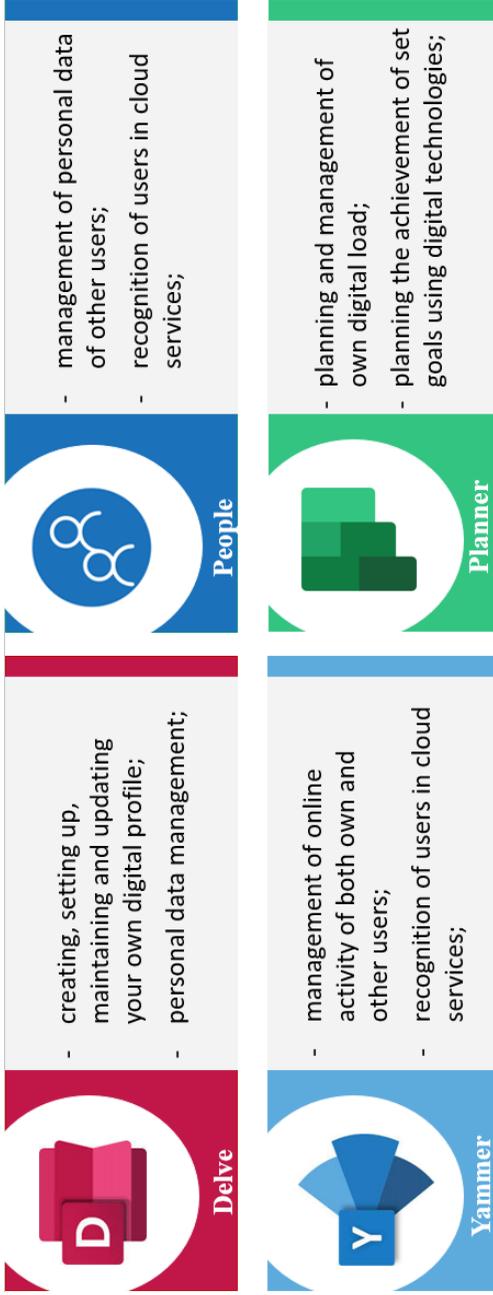


Figure 1.4.3. Monitoring the users' online activity using People service

To manage the digital learning load, participants in the educational process can use the Planner service, which will allow setting tasks to be completed both by the teacher and by the students themselves. Independent planning by students of their own educational activities allows them to manage their own educational activities, and also contributes to the achievement of the educational goals set by students.

The generalized capabilities of using Microsoft 365 services for digital identity and well-being are presented in Figure 1.4.4.

Accordingly, using Delve, Yammer, People and Planner tools, participants in the educational process can manage personal data presented in the digital environment, create, configure and update their own digital portfolio, recognize users in cloud services, and plan and manage their own digital workload.



**Figure 1.4.4. Possibilities of digital identification using Microsoft 365 services**

## **CHAPTER 2. THE MICROSOFT 365 AS A TOOL FOR ORGANIZING E-LEARNING**

### **2.1. Microsoft 365 services for organizing e-learning**

The development of information and communication technology is helpful to teacher and students in teaching and learning process in the pandemic era. Technology can improve the quality of media for teaching and learning activities. E-learning is one example of innovation in education that is beneficial to facilitate the teacher and students in distance learning during Covid19 pandemic [106]. The effectiveness and quality of distance learning depends on the organization of various types of educational activities, the creation, methodical quality and delivery of various types of educational content, as well as on the pedagogical skill of teachers to use various tools for the organization of e-learning participating in this process.

The recommendation of Susilo, Adi., & Suhardi, Deddy Ahmad is that it is necessary for educational institutions to carry out measures aimed at improving the quality of distance learning, including the strengthening of counseling by the teacher, the need to increase the ICT competence of teachers and their involvement in practice, the need to increase potential for quality provision of educational services to all interested persons, as well as training on the use of standard programs in Moodle and Microsoft 365 to complement each other [129].

The pedagogical mastery of each teacher includes a new vision of intellectual communications, which transforms communication and meetings for all facets of the educational process, as well as the selection of successful solutions and tools for digital learning and development of each participant in the educational process.

Educational content and other capabilities of Microsoft 365 integrated services during the organization of distance learning for teachers can be supplemented with various educational materials from Microsoft Viva (Microsoft 365 Training, Microsoft Learn, LinkedIn Learning), constantly improving their qualifications, developing, in particular, digital competence. Each participant in the educational process can manage self-assessment activities using the To-Do and Calendar services. Table 1.2.4 provides opportunities for digital

learning and development using Microsoft 365 cloud services.

The To-Do service can be used not only for planning digital collaboration (more details in Para. 2.3), but also for planning their own educational activities and monitoring the educational progress of each student. But planning educational activities is important not only for each individual student, but also for teachers. Using the To-Do service, teachers can plan training, preparatory or independent work of students in the digital environment, taking into account their learning styles. When students perform collective independent work, the teacher can monitor the results of the students' work and adjust the students' educational activities accordingly.

Due to the embed calendar in Outlook, teachers can plan working meetings or consultations with students immediately from email, taking into account their educational schedule. This calendar is fully integrated with email, contacts and other Microsoft 365 tools, which allows it to be effectively used both for planning personal educational activities and for collective implementation of educational projects.

When planning educational activities, it is possible not only to create meetings and events, but also by inviting other users to the meeting, to choose a time during which all invited participants of this event are free (Figure 2.1.1).

With the help of this tool, it is possible to plan educational activities not only for the teacher and student individually, but also to use it to plan the distance learning schedule of a separate group or the entire faculty by the dean's office. This will allow you to view the schedule for a separate group of users, as well as copy and move meetings between different groups, when planning training sessions or events for several groups of students at the same time.

The digital environment of Microsoft Teams allows you to organize preparatory work and independent work, training, evaluation, reflection of students. In such an environment, teachers have the opportunity to plan learning activities, organize the selection of learning content in channels and tabs, organize learning activities of students both independently and in teams, and students can select and use digital learning content and use integrated digital tools for organization, planning and reflection training (more details in Paragraph 3.1).

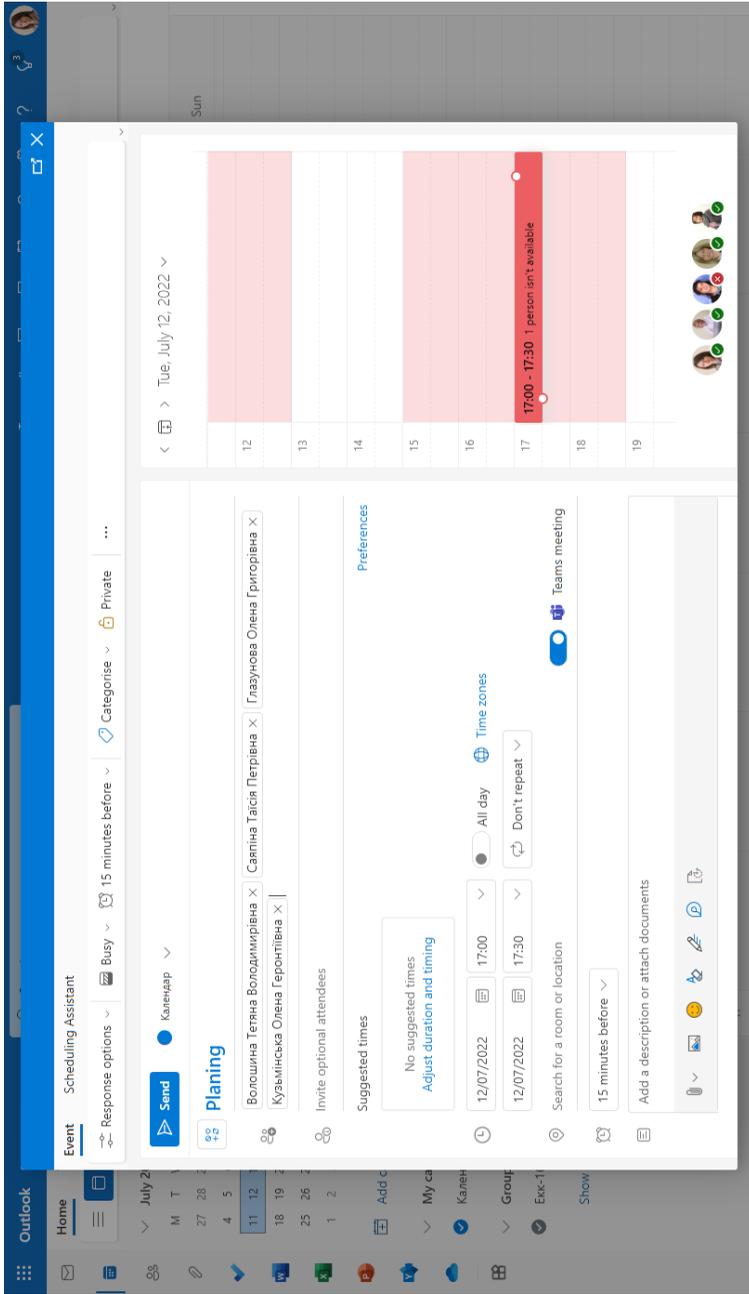


Figure 2.1.1. An example of using the scheduling assistant in Outlook Calendar

In educational institutions under the conditions of distance learning, in addition to the organization of the educational process of students, it is necessary to constantly improve the qualifications of such employees as: technical staff, teachers, administration. That is why it is necessary to provide for the organization of webinars and trainings for all participants of the educational process. For the effective organization of such events, you can use a variety of educational content that is available in Microsoft Viva Learning on various devices. By default, the following training materials are available in Viva Learning: LinkedIn Learning, Microsoft Learn and Microsoft 365 Training.

LinkedIn Learning is one of the educational online platforms that offers a wide selection of video lessons and various online training. Each employee of an educational institution can develop his technological skills in the chosen direction using personalized recommendations or courses taught by experts in the relevant field. Figure 2.1.2. gives an example of one of the online courses on the educational platform LinkedIn Learning.

The Microsoft Educator Center cloud platform [66] allows teachers to deepen knowledge by taking interactive courses, obtain relevant professional certificates and find programs, which will help each teacher achieve their respective goals through professional development. Educators can attend a series of webinars on best practices, tips and tools for distance learning. Figure 2.1.3. is one of the examples of a guide to working with Microsoft 365 tools.

Teachers can also join the Everyday Real Learning (ERL) open community. Microsoft Education has created an open global Microsoft Teams community for academic institutions to support distance, hybrid or online learning.

To obtain additional in-depth knowledge and skills regarding the use of Microsoft 365 in the educational process, both students and teachers can get help and relevant educational materials from all services of the cloud platform using the available educational materials of Microsoft 365 Training (Figure 2.1.4).

Generalized capabilities of services for e-learning are presented in Figure 2.1.5.

LEARNING Learning Search skills, subjects, or software Start free trial

All topics / Technology / Cloud Computing / Cloud Administration

Setup Reports Health Admin centers Exchange

**Microsoft Office 365: Administration (Office 365/Microsoft 365)**  
 With David Effassy · Liked by 2,628 users  
 Duration: 2h 48m · Skill level: Intermediate · Released: 3/11/2020

Contents

- Introduction
- 1. Managing Office 365 General Settings
- 2. Managing Office 365 Email Services
  - ▷ Get familiar with Exchange admin center 5m 39s
  - ▷ Choose the recipients in Exchange Online 6m 27s
  - ▷ Managing Exchange Online user mailboxes 9m 14s
  - ▷ Exploring Office 365 groups 4m 11s
  - ▷ Creating groups and dynamic distribution lists in Exchange Online 6m 56s
  - ▷ Manage Exchange Online resource

**Figure. 2.1.2. An example of an online Microsoft Office 365 course [129]**

MICROSOFT LEARN EDUCATOR CENTER

# Office 365 for education

Build collaborative classrooms, connect in professional learning communities, and connect with colleagues with popular applications like Teams, Outlook, Word, PowerPoint, Excel, OneNote, School Data Sync and more.

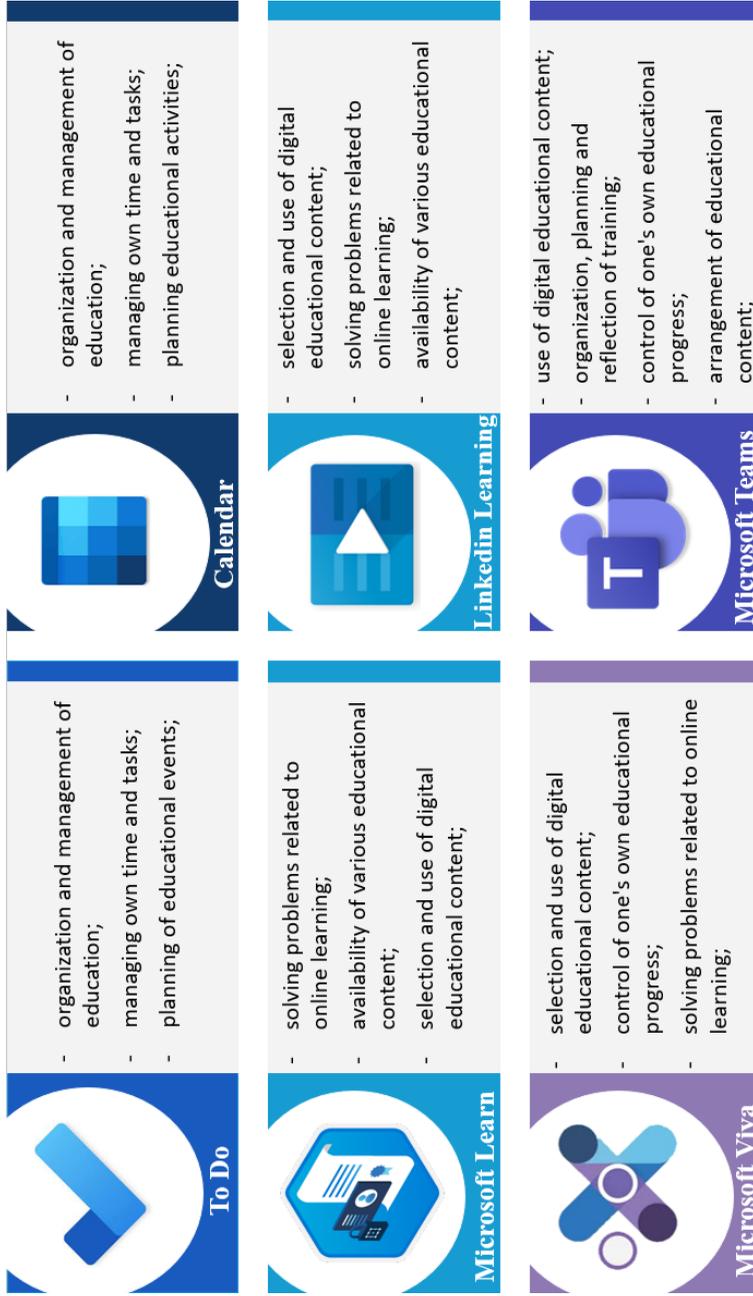
[Browse all Office content](#)

 <p><b>TRAINING</b></p> <p><b>Explore training on Microsoft 365</b></p> <p>Get going quickly and easily with training videos, templates, quick starts, and tips for using Office and Microsoft 365.</p> <p><a href="#">Get started</a></p>	 <p><b>SUPPORT</b></p> <p><b>Explore our guide for remote teaching and learning in Office 365</b></p> <p>Resources to support classroom management and student engagement with Office 365 Education.</p> <p><a href="#">Learn more</a></p>	 <p><b>DOCUMENTATION</b></p> <p><b>Discover our deployment guides for IT admins</b></p> <p>This guide is designed for IT admins looking for the simplest way to move their platform to the cloud, manage security, and access analytics.</p> <p><a href="#">Learn more</a></p>
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**Figure. 2.1.3. An example of the Office 365 for education guide**

The screenshot displays the Microsoft 365 admin center interface. At the top, there is a navigation bar with 'Microsoft 365 admin center' and a search bar. Below this, a left-hand navigation pane lists various administrative tasks such as 'Main page', 'Users', 'Active users', 'Contacts', 'Guest users', 'Deleted users', 'Teams and groups', 'Invoicing', and 'Installation'. The main content area is titled 'Help and training materials for Office programs' and includes a sub-heading 'Get help and tutorials for all Microsoft 365 apps.' Below this, there are three featured articles: 'Training for administrators', 'Advanced deployment and help guides', and 'Training for users'. A right-hand sidebar provides quick links to 'Access', 'Defender', and 'Delve deeper', each with a brief description of their functions.

Figure 2.1.4. Microsoft 365 training courses [100]



**Figure 2.1.5. Opportunities for digital learning and development using Microsoft 365 services**

The value of self-education, the possibilities of digital learning and development, the development of interest in acquiring new knowledge about cloud services and the possibilities of their application, the awareness of learning goals, the emerging need for continuous self-improvement are possible through the use of Microsoft 365 services, which allow to expand the access of students and teachers to a wide pool of resources; give the ability to choose tools to perform various tasks; provide opportunities for professional certification and for the development of soft skills for future use.

## **2.2. Design and creation of digital content, problem solving and innovation using Microsoft 365 services**

Participants in the educational process in the distance learning process must have constant access to various tools for managing educational activities within the educational institution, home or other locations. The Microsoft 365 platform combines the core Microsoft Office applications for desktop devices with cloud services including SharePoint, Whiteboard, ClassNotebook, OneNote, StaffNotebook, which enable digital research and problem solving to design and create diverse educational content, as well as implement new distance learning practices to help students to work almost anywhere and at a time convenient for everyone. Production of new knowledge is one of the approaches that contribute to increasing the ability of both teachers and students to innovate, produce new knowledge and obtain appropriate results from it. Teachers who use this approach, in particular in distance education, must be able to plan and conduct educational activities (preparatory work, presentation of theoretical material, training, collective work, assessment) aimed at achieving these strategic goals using Microsoft 365 digital tools (Table 1.2.5).

Adrian Ellison and Mauli Arora describe in their research the experience of using Microsoft Office 365 services for team-work so that students can combine social learning with their academic study. The authors focus on attracting students to SharePoint-based portal design [3]. Bruce Worobecand, Robert Bryant cover in their works the issue of motivation for developing a SharePoint site for use in computer science courses [8]. Laura Atkins and Carey Cole describe the concept of collaboration on content sharing, feedback and iteration

by means of using Microsoft SharePoint; the instructor can guide students how to use it [64]. The e-environment model based on Microsoft SharePoint is developed and the method of using Office 365 cloud services in a single e-environment for organizing group project work of students is given [39].

A group SharePoint site is created automatically, for example, when a Microsoft Teams group is created, and provides the entire group with access to the site content. For example, a teacher can use such a site to store files and organize joint work with them, or to create and manage news information. The group site home page provides links to important group files, programs, and web resources, and you can see recent site activity in the activity web feed. An example of the use of the SharePoint service for management of organizational, scientific and educational activities by teachers of the department is shown in Figure 2.2.1.

The SharePoint site helps to gather all the information together, organize it so that new content appears in large quantities from various data sources necessary to ensure the main learning objectives (this can be information integrated also from other Microsoft 365 services or external resources, for example, various social communities). To expand the possibilities of working with information on the SharePoint site, the teacher can add web pages for connecting to an external social network, for example, Twitter with certain parameters for receiving targeted information, video content from Microsoft Stream.

The University of West London (UWL) has harnessed the potential of a Cloud-based suite of collaboration tools (Microsoft Office 365, offered free of charge to higher education institutions) to create a personalised, interactive, social platform to both improve the learning experience and to enable students to combine social learning with their academic study [30]. The e-environment model based on Microsoft SharePoint is developed and the method of using Office 365 cloud services in a single e-environment for organizing group project work of students is given [36].

SharePoint is mainly designed for creating sites where students can connect to sites and change their content, add different content, add news (text, links, videos, etc.) directly from the main SharePoint page or from the group site (Figure 2.2.2).

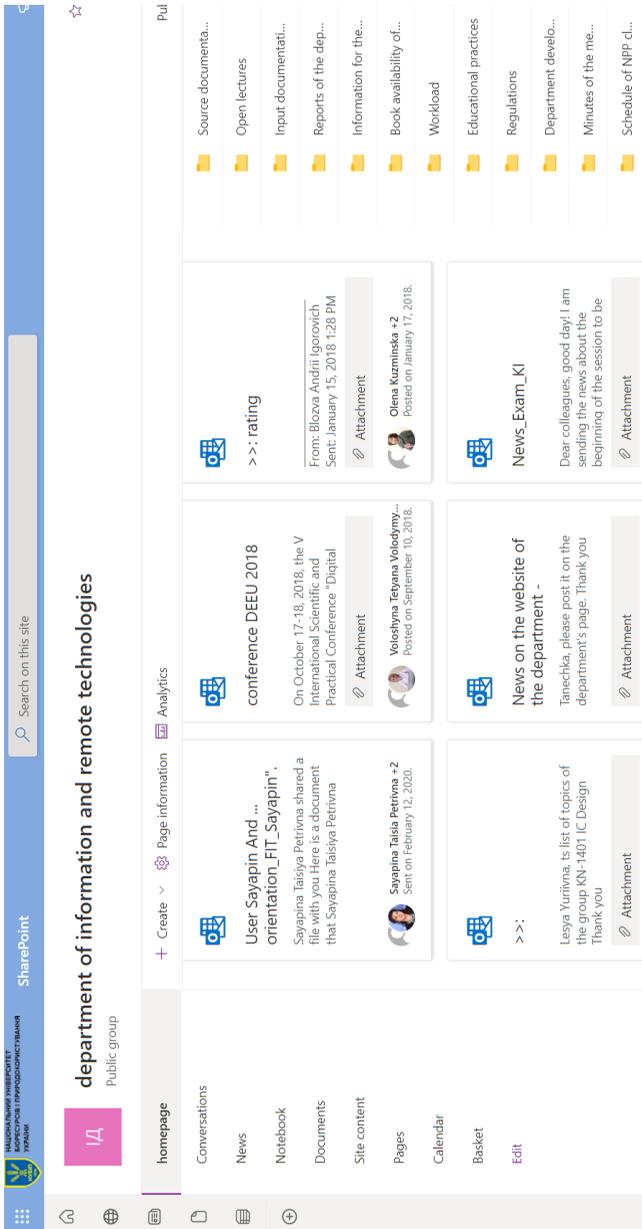


Figure 2.2.1. An example of using SharePoint within the department

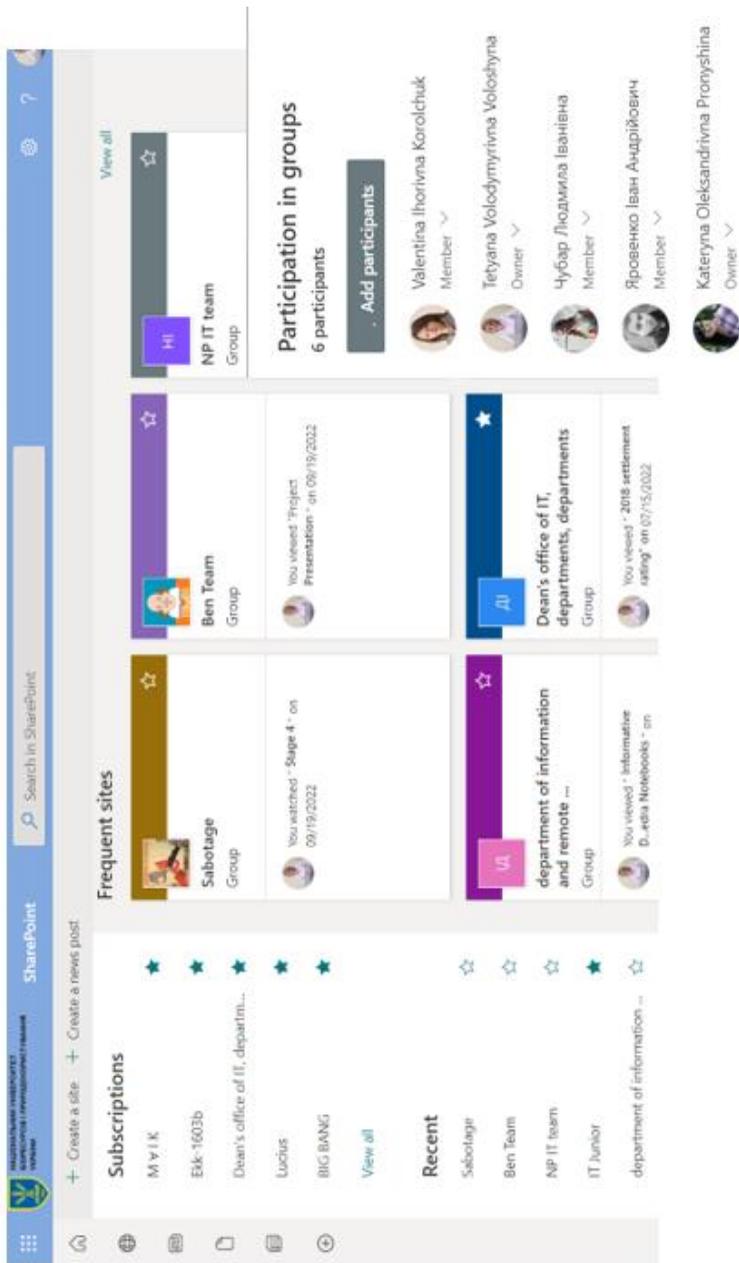


Figure 2.2.2. An example of using SharePoint sites by students

Each posted news item can be commented on individually, or joint commenting can be organized for the purpose of discussing certain research or solving case problems. Students can use the SharePoint service to create their own portfolios, for example as a result of a course project or educational or industrial practice. Also, while carrying out certain scientific research, a team of students under the guidance of a teacher can create sites to provide shared access to files of various formats, present the results of their work, and disseminate information about the group's activities. Using page analytics, the teacher can analyze interested audiences in the posted content and adjust the content of the developed material accordingly.

The integration of the two services, SharePoint and Microsoft Teams, allows you to supplement and expand their capabilities, both for storing various types of information and for organizing joint work, establishing communication, that is, it is a learning environment for acquiring new knowledge. Thus, the teacher can design and create various types of digital content, introduce new practices of using digital tools in various types of educational activities, such as: preparatory work, presentation of theoretical material to students, training, organization of collective work and assessment. Site news (or group site) can simultaneously be published in a Microsoft Teams group for further discussion with students and organization of joint work. From the site, you can directly send a news digest personally to each member of the group, as well as to the Microsoft Teams channel for joint work.

The quality of electronic, distance and blended learning directly depends on the creation and delivery of educational content. Visualization is important for understanding the main natural processes in various spheres of activity, for research and problem solving; therefore it is an integral part of the educational process for both the teacher and the student. Visualization acts as an intermediate link between the creation of digital content and, accordingly, the result of training or scientific research. Whiteboards for visualization are special services that perform the functions of a regular whiteboard with virtual control and can be integrated with other platforms for video conferencing and shared screen viewing to ensure collaboration during distance learning. It is the Whiteboard service that allows the teacher to organize online learning through visual collaboration

(research) in real time. Teachers can also conduct interactive lectures or lab (practical) work using a whiteboard where students can add their own content or respond to what others have added. The Whiteboard tool can be used by students to carry out group projects, because all participants can work together, generate and visualize new ideas and use a creative approach to work with notes, figures, templates, etc., conduct brainstorming, while the teacher can observe students, the progress of project execution, leave their own feedback and recommendations.

The content of such a visual whiteboard can be saved as a file with shared access, for example, the whiteboard can be exported to OneNote or demonstrated during a video conference in Teams Meetings, thanks to which students can process the learning material even after the class is over.

Whiteboard enables the teacher to plan training sessions or consultations, conduct discussions with students who are members of scientific societies, assign tasks for independent work to individual students or study groups. When planning various types of educational activities, the teacher can place various types of educational content in advance (presentations, text instructions, diagrams, images or ready-made templates) for familiarization, discussion or joint filling by students (Figure 2.2.3).

The content of such a visual board can be demonstrated during a video conference in Teams Meeting or saved as a file with shared access, for example, by exporting the board to OneNote, due to which students can process the educational material even after the end of the class.

OneNote digital notebooks, in addition to the already described functionality, enable all participants of the educational process to organize digital notes in a convenient way, setting the necessary structure for their storage. To collaborate on new ideas, project opportunities, or collectively produce learning content, teachers can use StaffNotebook to organize collaboration and set up a private workspace for each of them. The digital ClassNotebook will allow you to organize a digital course with a content library, in which all the necessary educational content will be distributed to students, a workspace for each student to check their individual achievements, as well as a collaboration area for discussing and solving joint tasks.

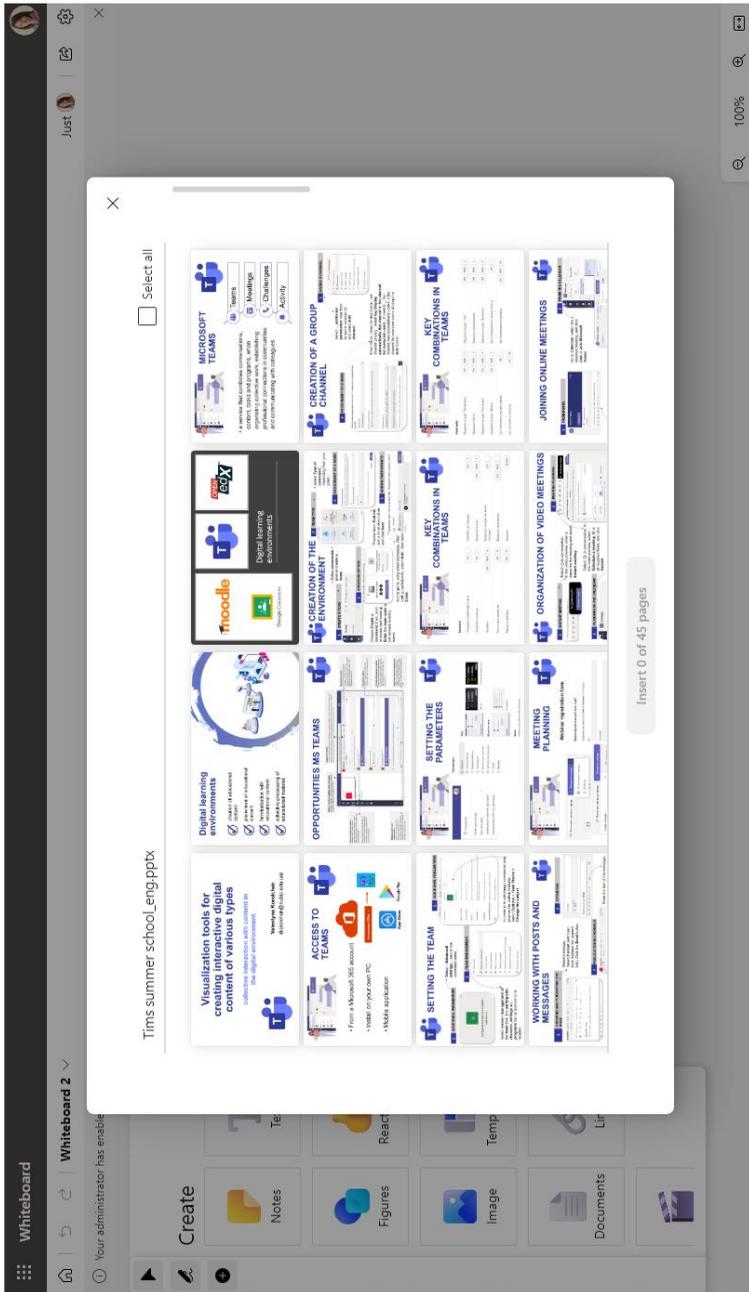


Figure 2.2.3. An example of placing educational content on a whiteboard

Types of digital notebooks and the possibilities of their use are presented in Figure 2.2.4.

Generalizing capabilities of Microsoft 365 tools for creating, solving problems and innovations is presented in Figure 2.2.5.

The use of various digital tools to create educational content makes it possible to eliminate the disadvantages of distance learning, as teachers are able to present the necessary digital content in a structured form and deliver it to students using a digital tool. In this way, students will be able to access the necessary educational materials anywhere using personal devices.



**Figure 2.2.4. Features of Microsoft 365 digital notebooks**

**Whiteboard**



- collective processing of materials;
- data collection and comparison;
- processing of received data and their distribution using digital methods;
- development of new ideas, projects and opportunities;

**Digital notebook**



- creation of digital notes and structuring of educational content in them;
- dissemination of educational content using digital methods;

**SharePoint**



- digital production of educational content;
- structuring and delivery of various educational content;
- distribution of files, data, news and resources;
- optimization of teamwork;

**Figure 2.2.5. Generalized capabilities of Microsoft 365 services for creating digital content**

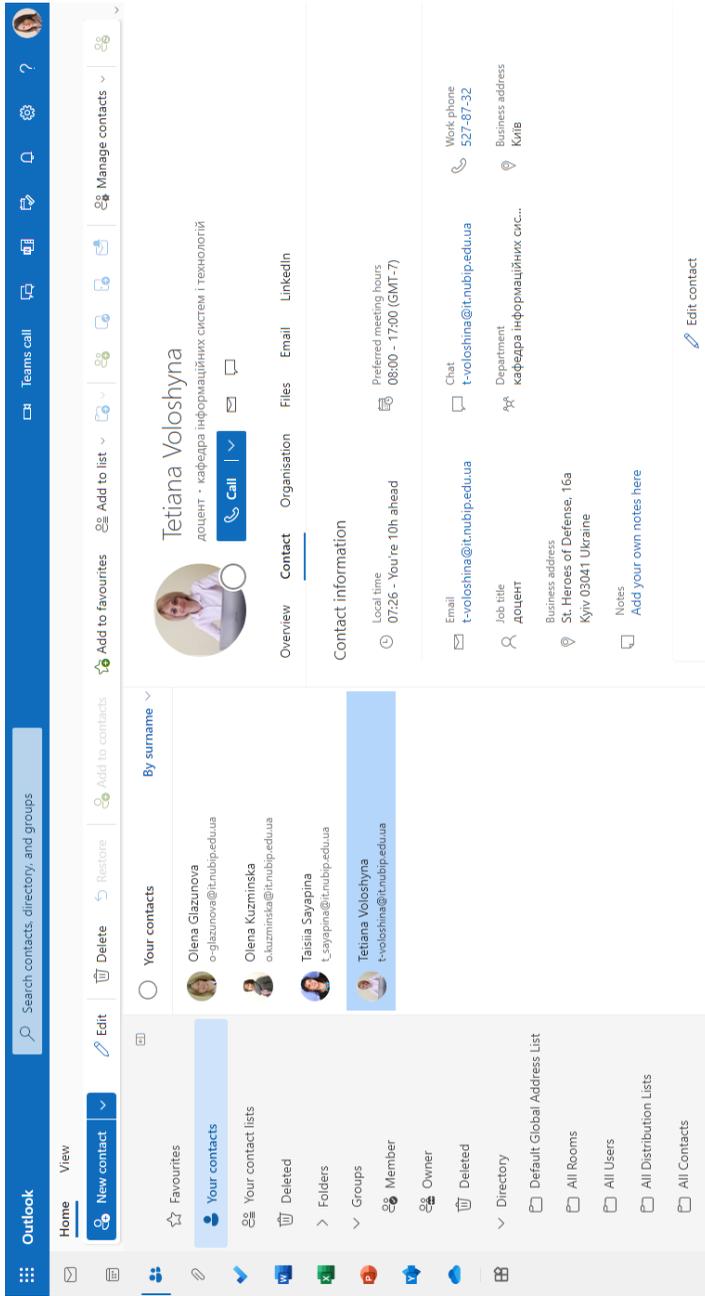
### **2.3. Microsoft 365 services for building competence in digital communication, collaboration and interaction**

Microsoft 365 A1 Plus for employees and students of educational institutions provides an opportunity to promote effective communication, cooperation, interaction, teamwork and provides simple and safe management of educational activities of university students (Table 1.2.6). The tools included in Microsoft 365 allow teachers and students to communicate, interact and collaborate in real time. S.Suprianto claims that it is possible to design an e-learning environment only with the help of one package of Office 365 programs and, accordingly, to establish effective communication and cooperation between the participants of the educational process [100]. The development of speaking skills using Microsoft Office 365 as a learning tool during the Covid 19 pandemic is considered in their study by Z. Misnawati, E. Nofriati [137].

Microsoft Teams as a collaborative knowledge building platform and revealed that it was suitable for messaging, file sharing and collaborative authoring [17].

Microsoft 365 is not only access for students and teachers to Microsoft Word, PowerPoint and Excel Online services, but in addition, it is a cloud platform designed to support online communication and collaboration, in particular within academic institutions.

The People service allows you to organize a book of contacts with whom there is frequent communication, interaction or cooperation during the management of educational activities. In this way, you can create both a separate contact for interaction and a group of users. When viewing a contact added to the list, it is possible not only to view information about them, but also their main contact information, contacts of the given user's organization, files you are working on together, recent emails and their attachments. That allows both the teacher and the student to monitor the interaction with other participants of the educational process and filter the necessary files (Figure 2.3.1).



**Figure 2.3.1. An example of tracking interaction with contacts using the People service**

Based on the Delve service, you can deploy personalized training. The capabilities of the Delve service allow you to find information about the participants of the educational process and the documents they are working on (analyze the number of views and who made the last changes). An example of such cooperation between a teacher and students using the Delve service is shown in Figure 2.3.2.

The teacher can add the necessary explanations for working with educational content to the closed Yammer social network without leaving the Delve service, thus effective interaction and communication with students will be established. If the student needs to ask a question, the teacher's profile page gives an opportunity to send an email with a request or immediately start a chat for quick interaction.

Due to the Delve service, the teacher can create blackboards for each academic discipline and, accordingly, deliver various types of educational content to students (Figure 2.3.3).

Students can also create a board within the scope of group work, where all project documents will be collected for sharing related documents and after completing it, they can quickly return to the necessary materials.

When interacting in a digital environment, users need to organize and establish communication channels. Such a channel can be Outlook email, which will provide an opportunity not only to communicate with the participants of the educational process, but also to plan and organize joint work. The use of this tool by the teacher will allow students to send educational materials placed both on their own device and on the OneDrive cloud storage, attaching them to the mail (Figure 2.3.4).

If necessary to organize interaction with recipients, the teacher can add Loop components to the letter, which will allow students to send a list of tasks, an agenda or ask questions.

The integration of additional programs allows the teacher, by embedding in the email:

- deliver to student's visual educational content, built in Power BI;
- conduct a survey created using Forms;
- share content or the result of joint work, using monday.com.

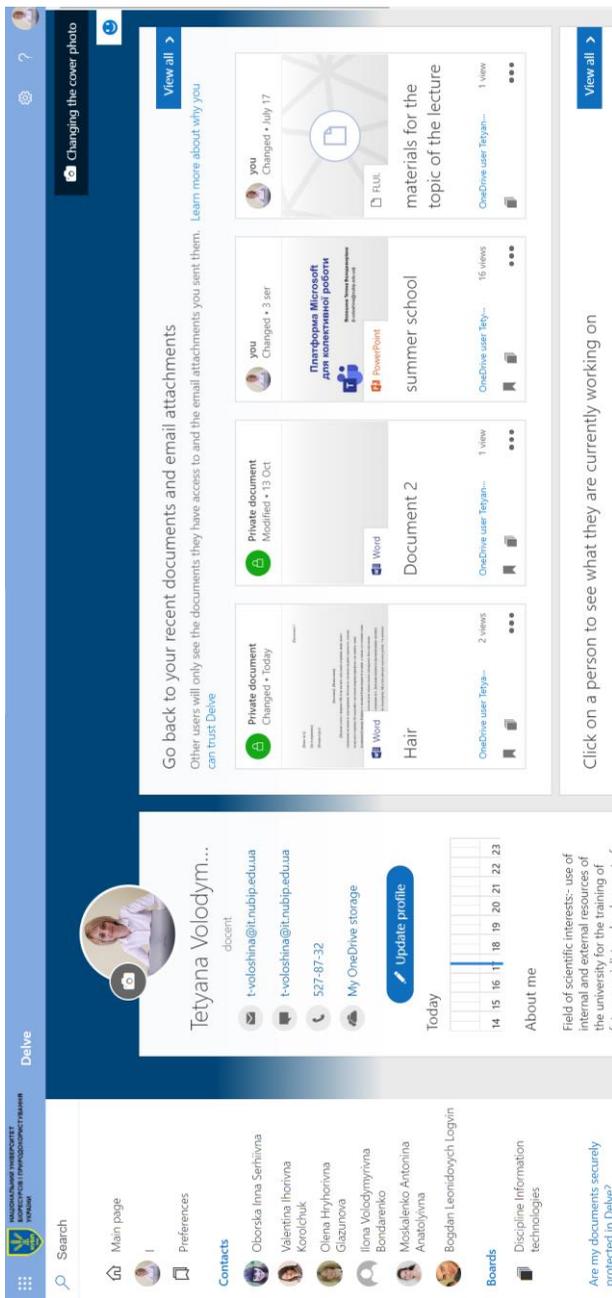
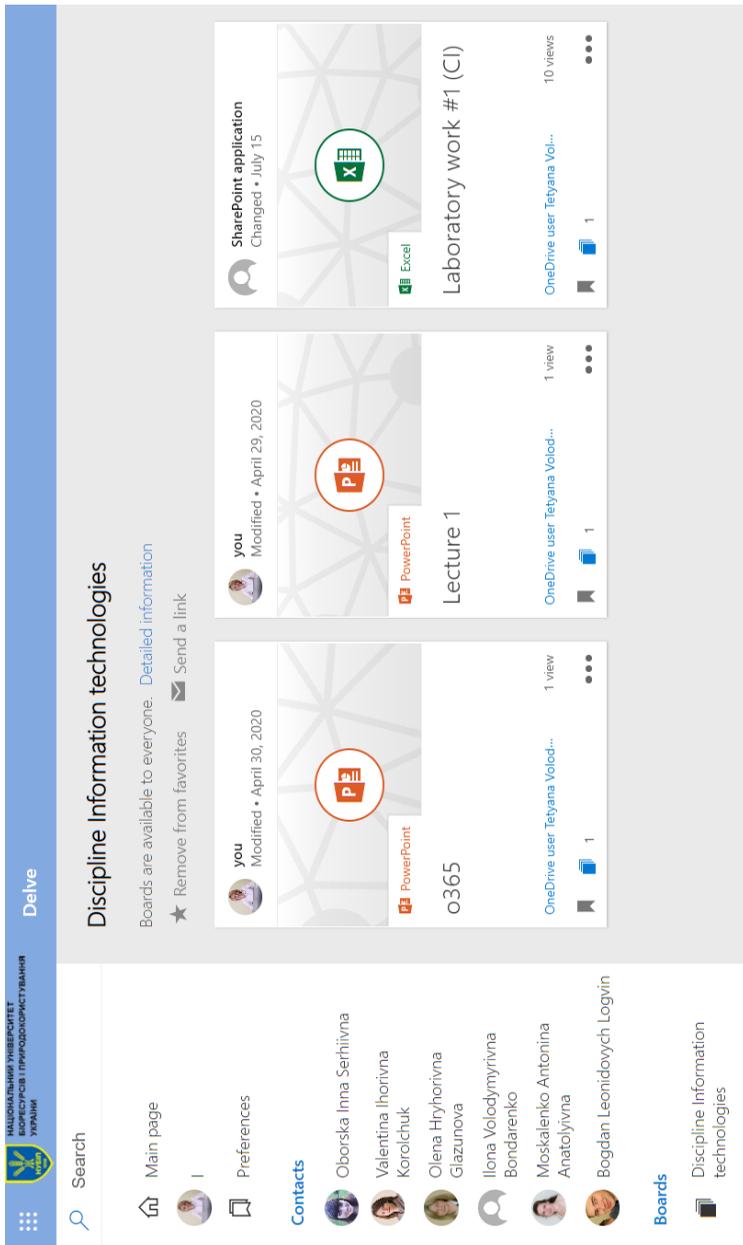


Figure 2.3.2. An example of collaboration using the Delve service



**Figure 2.3.3. An example of the educational content delivery in the Delve service**

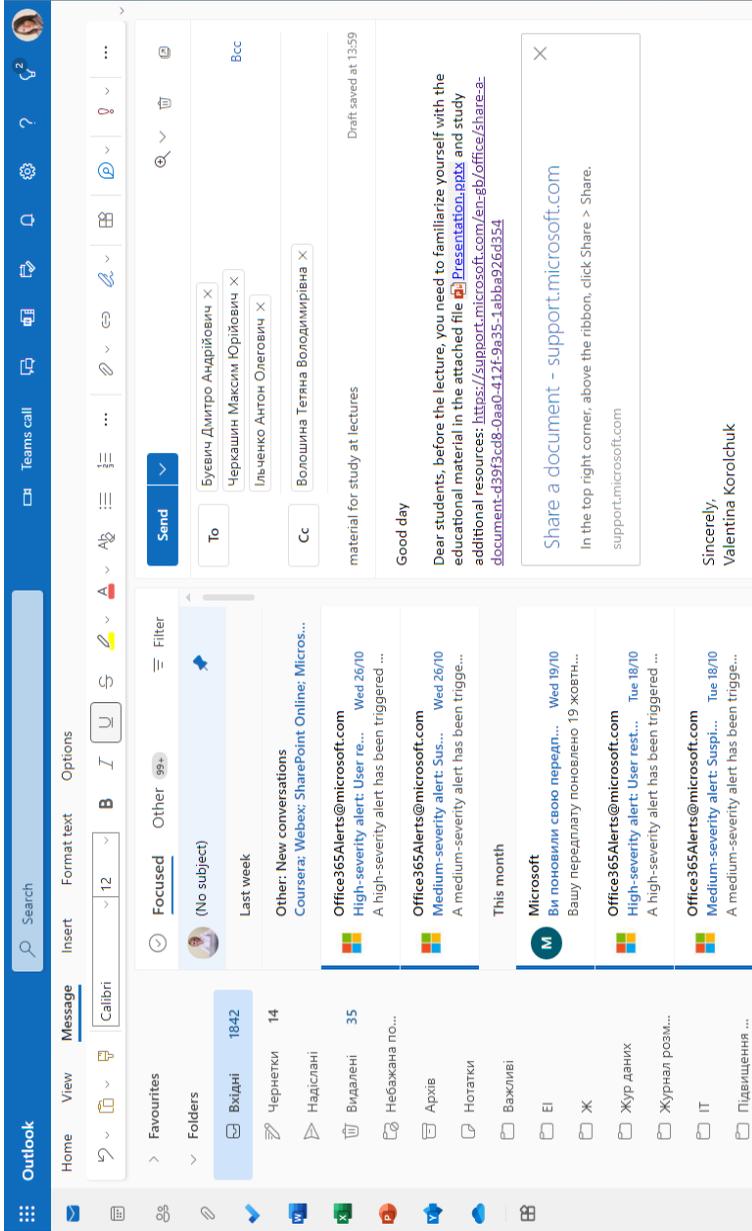


Figure 2.3.4. An example of the educational content delivery in the Outlook service

The To-Do cloud service is a convenient tool for creating a to-do list that helps teachers and students plan various types of educational activities. In To-Do, you can track deadlines for tasks, add reminders, specify deadlines (Figure 2.3.5), add notes to tasks, and personalize each task list with different topics.

This tool simplifies task management and increases the productivity of each participant in the educational process, their interaction during task planning, due to integration with other Microsoft 365 services (Outlook, Calendar, People) and intelligent algorithms. For example, integration with Outlook simplifies work with tasks, as they are automatically synchronized with To-Do and are available from any device for all participants of the educational process.

In contrast to the formation of a regular to-do list in the To-Do service, Planner allows you to visually design and structure all the tasks of participants in the educational process, depending on the type of educational activity, as they can be displayed in sections that are related, for example, to a specific topic or content module . In Microsoft Planner, each task can have a start or end date, the teacher and students can view all scheduled tasks in the integrated calendar using the Schedule tab (Figure 2.3.6).

Each plan in Microsoft Planner includes a dashboard where both the teacher and students can analyze the completion of planned tasks based on their status or membership in the plan. An example of such a distribution of tasks between students and teachers and a change in the statuses of their execution (to be completed, in process, completed) is shown in Figure 2.3.7. In this way, an overview of all current and completed tasks of participants in the educational process is stored.

In the Diagrams tab, you can also view a visual representation of the progress of tasks, analyze the status of execution (not started, in progress, delayed and completed) of each of them, view the priority (urgent, important, medium, low) of the assigned tasks and view the activities of each participant in the educational process (Figure 2.3.8).

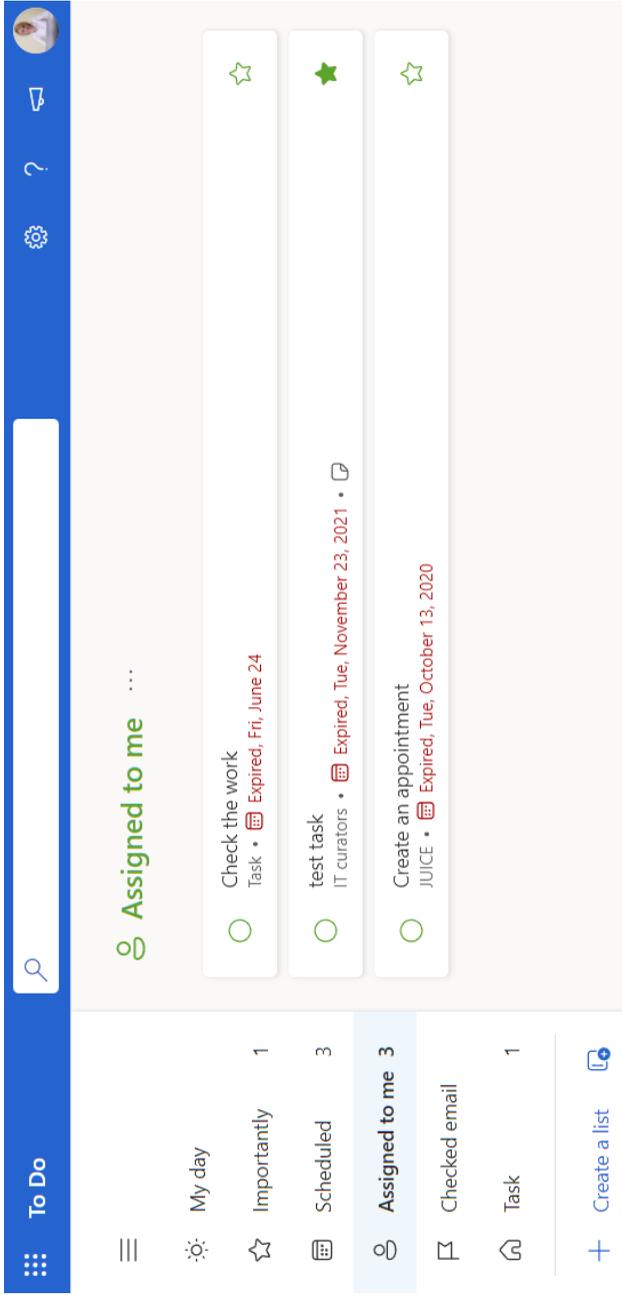


Figure 2.3.5. An example of using the To-do service

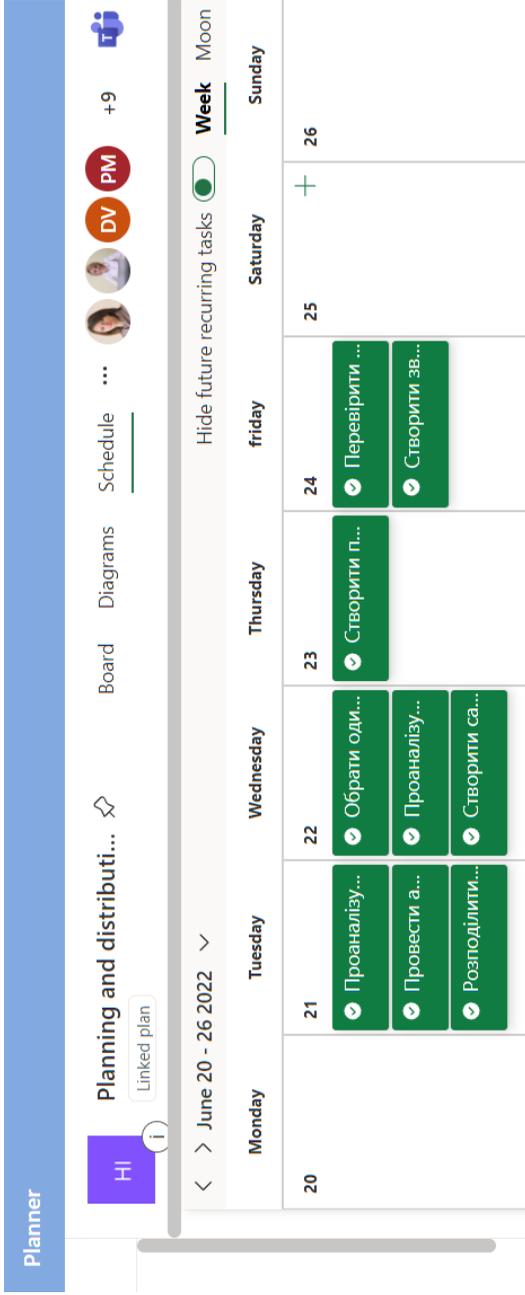
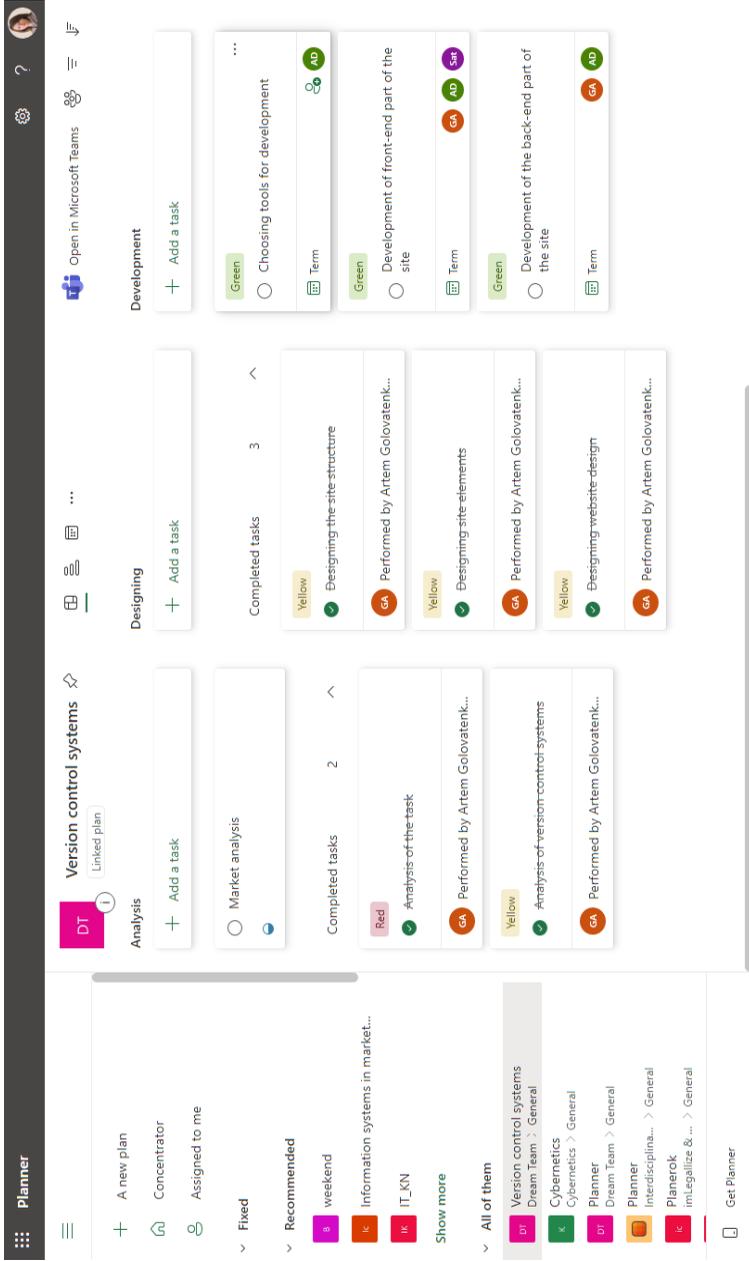
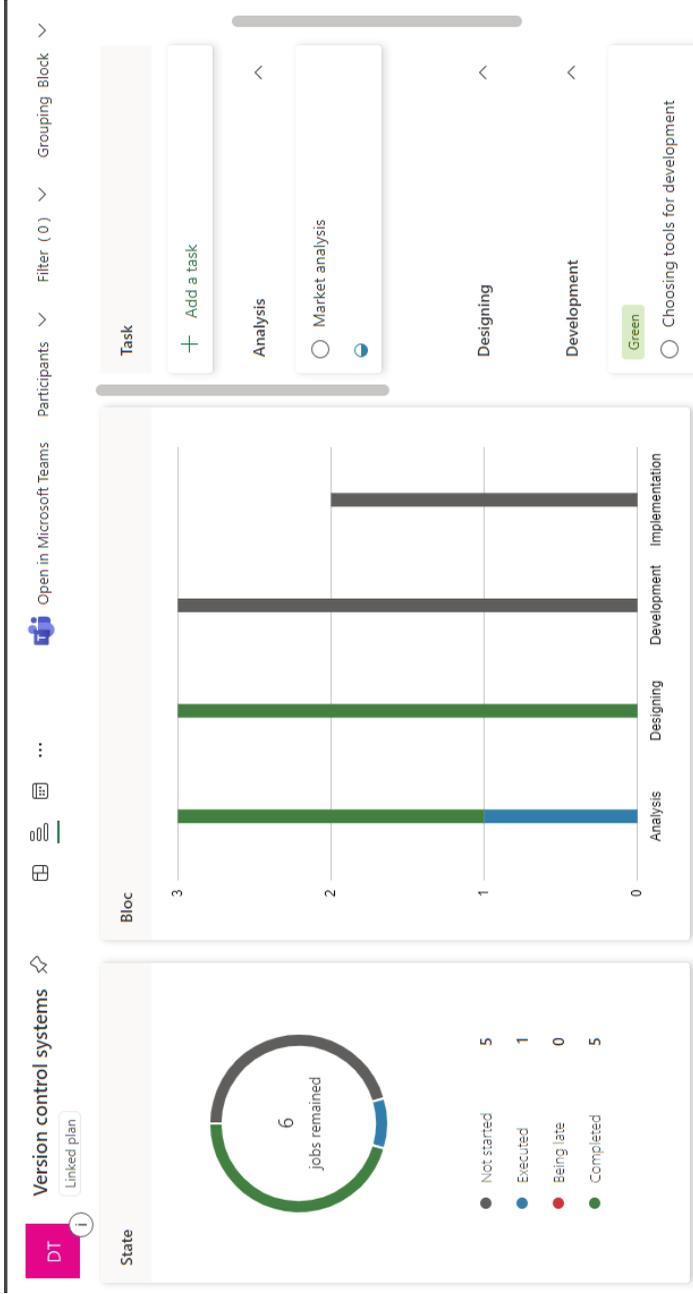


Figure 2.3.6. An example of displaying tasks in the Planner service calendar



**Figure 2.3.7. Assignment of tasks and change of statuses in the Planner service**



**Figure 2.3.8. An example of a visual presentation of the tasks progress**

In this service, the teacher can plan tasks for students, each of which can be supplemented with different educational material for familiarization before the start of classes or for deepening the acquired knowledge during a lecture or laboratory (practical) work. Thus, the students first familiarize themselves with methodical instructions or theoretical information, follow links to available educational resources. Accordingly, using the Planner service, a student can also build their own learning trajectory.

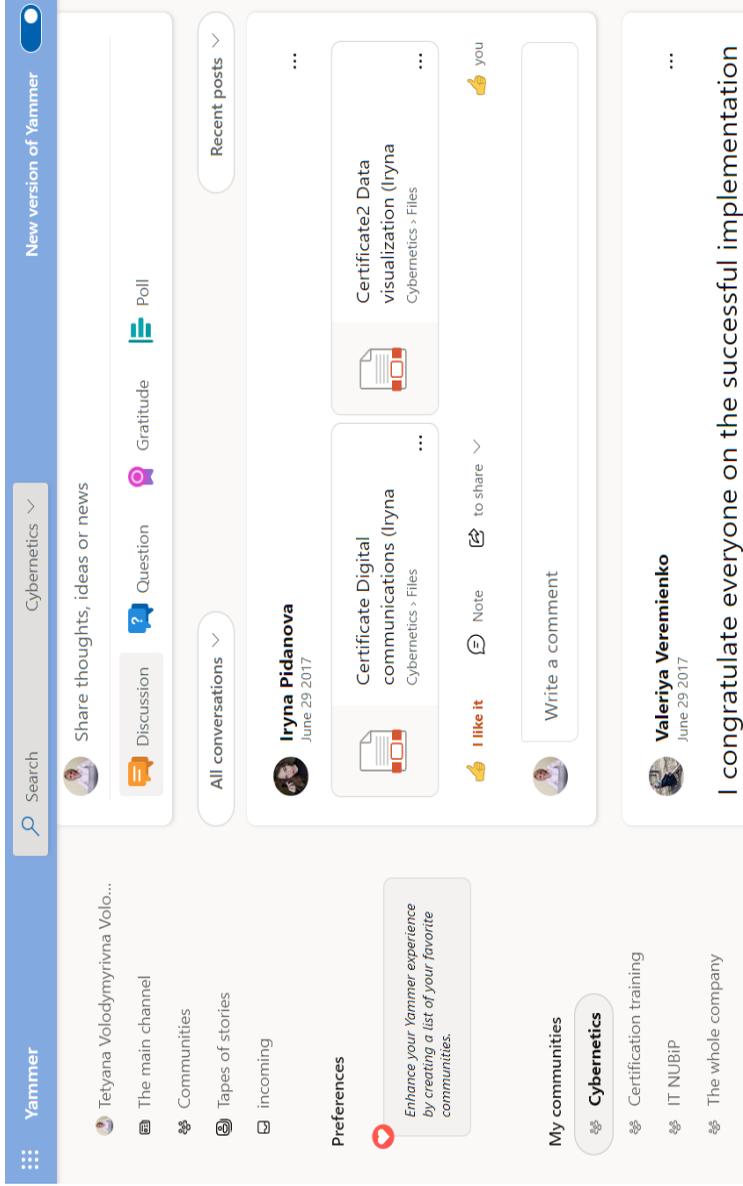
When organizing various types of educational activities, the teacher must pay special attention to the combination of various communication tools, which would allow distance, personalized and adaptive learning, aimed at the personality of the student with the possibility of working in groups of any size and collective learning.

It is possible for the teacher to organize the educational process for a wider audience (external users), so it is advisable to use the private social network Yammer and the possibility of organizing external closed networks in it. In this service, the teacher and students can set up effective communication by sending announcements with formatted text, videos, surveys, questions, praise and images in gif format in the created community. Students can use Yammer as a closed community, share educational content and their own achievements in self-education. Ways of user interaction in the Yammer service are shown in Figure 2.3.9.

If the teacher needs to organize interactive cooperation between several academic groups with the involvement of external speakers (stakeholders), integrating various educational resources, it is advisable to also use the closed social network Yammer.

The teacher can evaluate the involvement in the student community with the help of statistics, analyzing the number of views and likes added to different types of learning content.

Effective communication is the basis for engaging students in various types of educational activities during distance learning, thus, it is important for the teacher to create a channel for communication in real time. Kaizala is a secure messaging and work management application for both teachers and students that allows you to collaborate with other users on and off your corporate account.



**Figure 2.3.9. An example of using the Yammer service by students**

While managing educational activities using this tool, it is possible to create groups to organize the learning process within the framework of studying a separate discipline. When the students are connected remotely, the teacher can send and receive instant messages from them, coordinate tasks, mark attendance, use special tools to interact with the team remotely. Such created interaction tools will automatically be placed in the group chat, for example: announcements, scheduled meetings, reminders, which you receive from the Calendar, surveys of various types, quizzes, lists of tasks, as well as training for the team. As part of such training, resources can be created to process the materials of a separate topic. When filling the educational resource with content, the teacher can add audio- and video content, images, documents, text materials, as well as questions to check the learning of the material by students (Figure 2.3.10).

The chat function in Microsoft Teams allows for threaded conversations, helping you keep brainstorming sessions, video conferences, and other meetings in one place that are easy for students to revisit later (See Paragraph 3.2 for more details).

One of the elements of digital interaction in educational activities is the planning of collective performance of complex practice-oriented tasks. Using the Project service, students can create projects in the form of a SharePoint task list, while all team members working on a given task and corporate projects can create and edit tasks, if more control over the project is needed. Using corporate projects for educational purposes, the teacher can control, monitor and approve all assigned tasks.

The use of this service allows you to monitor the execution of projects with the help of powerful dynamic planning tools that take into account the time for execution, the appointed executors and the efforts spent.

With the help of Power BI visualization tools, it is possible to create interactive dashboards that will allow you to view and visualize the overall status of projects and tasks within each of them, as well as detailed information about them. An example of project management using Project is presented in Figure 2.3.11.

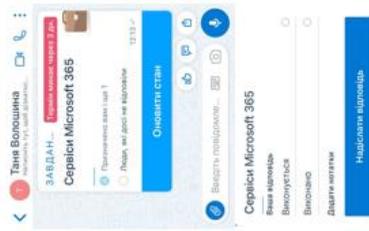


Kazaila

### Chats



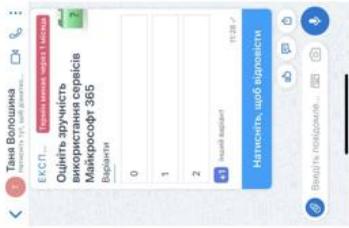
### Task



### Meetings



### Poll



### Learning



Figure 2.3.10. Types of content to distribute with the Kazaila service

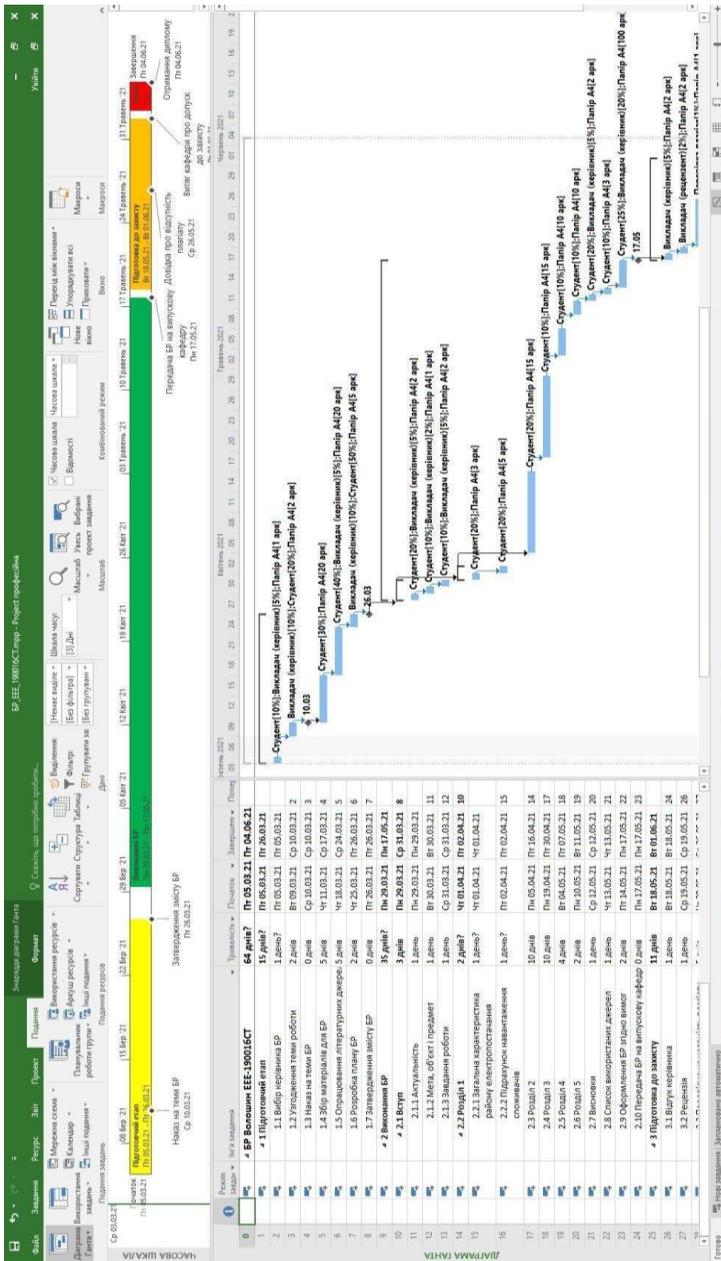


Figure 2.3.11. An example of using Project by students

Use the Bookings scheduling tool to send appointment reminders to each participant in the educational process to organize online interaction. Microsoft Bookings is integrated with Microsoft 365 Calendar and Teams, which helps the teacher to quickly find free hours and schedule consultations with students at a time convenient for them.

The teacher can conduct the meetings scheduled in Microsoft Bookings virtually due to the Microsoft Teams service (for more details, see Paragraph 3.2). For each meeting reserved as an online meeting, a corresponding link is created that each student can join from virtually anywhere. Microsoft Bookings is also available as an app in Teams, where you can create calendars, add participants, schedule new appointments, and host meetings right in Teams.

The Bookings service helps reduce planning time, which allows to simplify the management of educational activities. When planning each meeting in the form of an online meeting (for example, a training session), a corresponding link is created, by which everyone can join from almost anywhere. Thus, with the use of this tool, it is possible to plan and manage interaction between teachers, students and staff. Using this scheduling, students have the option to book a consultation at a time when the instructor is free, allowing all users of the meeting to track all changes made to meetings.

Lists service is an information tracking application in Microsoft 365 that allows both students and teachers to work more productively and interact anywhere and with anyone. Each template includes a predefined list structure, layout of the form and formatting options at both the list and detail view levels to help users get started quickly. After selecting a template, users get a preview of what the list will look like, along with some sample data. For example, when a teacher chooses the “Content Planner” template (Figure 2.3.12), he receives a ready-made list layout with set formatting in the appropriate window, thus allowing him to plan, schedule and manage various types of content.

This service also allows students to customize lists according to their own preferences in order to more efficiently organize various events, solve problematic situations during collaborate work, monitor the work of each participant, transfer information and visualize data together with their team in a single environment.

Lists

Search

### Content Planner

Plan, schedule, and manage content with this template. Filter out items that are due soon, or get notified when authors turn in their drafts.

Content title	Description	Author	State	Draft deadline: ...	Publis
Announcements about Microsoft Lists	First Microsoft Lists announcement by Seth Patton, GM, Microsoft 365	Andriy Panasenko	Readiness for pub...	6/9/20 9:00 a.m	6/16/20
New features of Microsoft Teams	The article describes the many new features of Microsoft Teams that will open up great opportunities for developers.	Victoria Shumentko	Draft needs appr...	6/9/20 0:00	6/18/20
Make a list and check it twice	New episode of "Intrazone" podcast	Yaroslav Bagrii	Scheduled	7/28/20 0:00	8/11/20
Lists program launch video	Inspirational video about the extraordinariness of "Lists"	Egeniy Olynyk	Readiness for pub...	6/12/20 0:00	6/20/20

Use a template

Cancel

Travel order

Work progress tr...

Content Planner

Gift ideas

Expense tracking

Back

Figure 2.3.12. The “Content Planner” template in the Lists service

When users interact to perform joint tasks, it is necessary to organize the environment for sharing the results of their work. One of the tools that allows this to be done is the OneDrive cloud storage, using which, when performing a group project, students can use folders and shared libraries to create an environment structure and fill it with the necessary content (for more details see Paragraph 2.3). For collaboration in such a repository, both teachers and students can share both the entire environment and individual files in it, providing access to the necessary data to other users. Granting such access is possible both for viewing and for editing. By inviting the user to cooperate in this way, an email will be automatically sent to him with a link to access this document or folder.

If necessary, you can share a set of video content for a specific group by placing it in a separate team or channel, in which case this set of video content will be available only to members of the Microsoft Teams group.

Another platform that can be used by a teacher during distance learning is Flipgrid. Both students and teachers having a Microsoft 365 account can use them for this platform as well. Flipgrid is a video discussion tool that helps educators get video content from every student, creating a social learning environment. Instructors can create grids that act like bulletin boards to facilitate video discussions with students during online classes. On each grid, they can ask questions, prompts, or activities, called threads, where students post video responses, including their own screen recordings. This tool can be added as a tab and the teachers then can organize interaction with students working in Teams. The advantage of such a service is that, in addition to using it in Teams or in a web browser, students and teachers can download Flipgrid on their own devices. In asynchronous learning, Flipgrid can be used to keep track of students' attendance, that is, the teacher asks them to answer a certain prompt on the schedule of training sessions to mark their presence in class.

Flipgrid could easily be integrated into an existing Moodle LMS framework that is smartphone ready. Flipgrid has provided ways for a teacher to set up activities with the aim of prompting students to communicate with each other inside and outside of the classroom [56]. Flipgrid was recognized as a low-stakes platform that helped students hone their public speaking skills [69]. As well, using Flipgrid helped

to bring more UDL (Universal Design for Learning) into the classroom by allowing students to also engage in verbal discussions, not only text-based ones [32].

Flipgrid's functionality is based on two types of navigation options, namely the educator dashboard (requiring the creation of a Flipgrid educator account) and member view (requiring a join code or custom link). The platform employs grids and topics. A grid created for a course houses the topics (discussions) [43]. Taylor and Hinchman [133] point out that Flipgrid can be utilised, among other purposes, as a tool for both group discussion and assessment. Asynchronous video-based discussions have affordances that can address some of the constraints of asynchronous text-based discussions, using Flipgrid for asynchronous video-based discussions in fully online courses [109].

Using this tool, the teacher can make recordings from the screen for recording screencasts, methodological recommendations for performing laboratory (practical) work, instructions. If the teacher already has recorded video files on their own device, they can also import them into Flipgrid. An example of a screen recording by a teacher using the Flipgrid tool is shown in Figure 2.3.13.

In the educational process, both the teacher and the student can use the Flipgrid tool for various purposes, for example, students can share their thoughts, communicate with colleagues, thanks to the easy-to-use Flipgrid interface. The teacher can form a task, the results of which the student must present in the form of video material, that is, if they can present it in a short video, then they have learned the material better than if they had passed a multiple-choice or other type of test. Figure 2.3.14 provides options for using the Flipgrid tool by all participants of the educational process during the following options for interaction: discussions, work with various types of content, and reflection.

The created video content can not only be demonstrated in the presented tools, but also used and embedded in the creation of other educational content using the Microsoft 365 services presented in Figure 2.3.15.





## Usage ideas

### Discussions

- Teacher:**
- create a prompt for discussion;
  - engage the audience;
- Students:**
- share their ideas and thoughts;
  - participate in the interactive;

### Work with content

- Teacher:**
- delivers educational content;
  - moderates video reports;
- Students:**
- document practical training;
  - participate in research projects (submit proposals, represent the field of research)

### Reflection

- Teacher:**
- provides students with feedback;
  - organizes formative; assessment
- Students:**
- respond to video content;
  - share ideas;

Figure 2.3.14. Options for using the Flipgrid tool

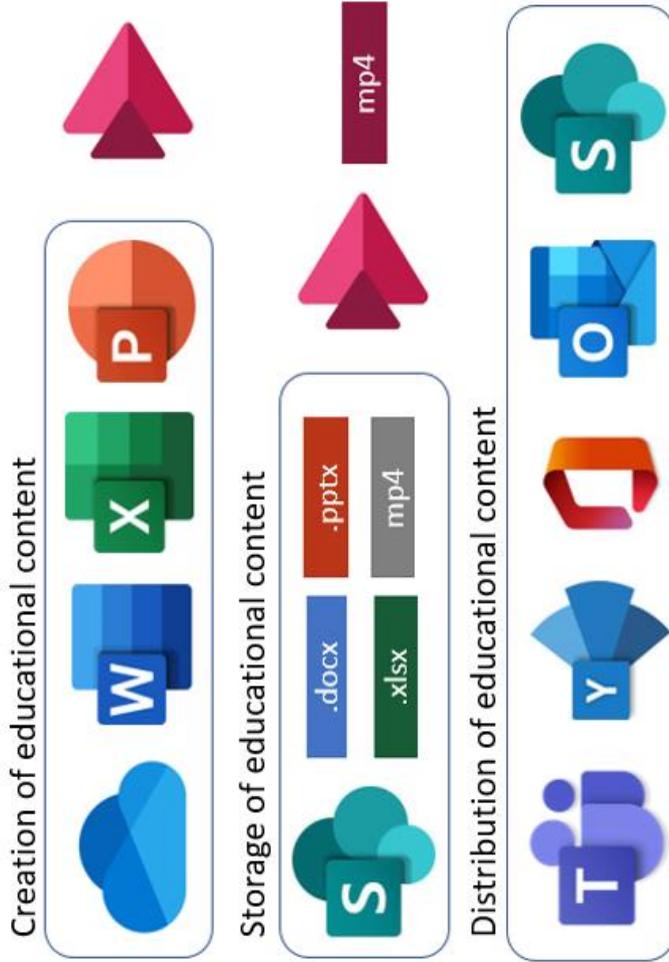
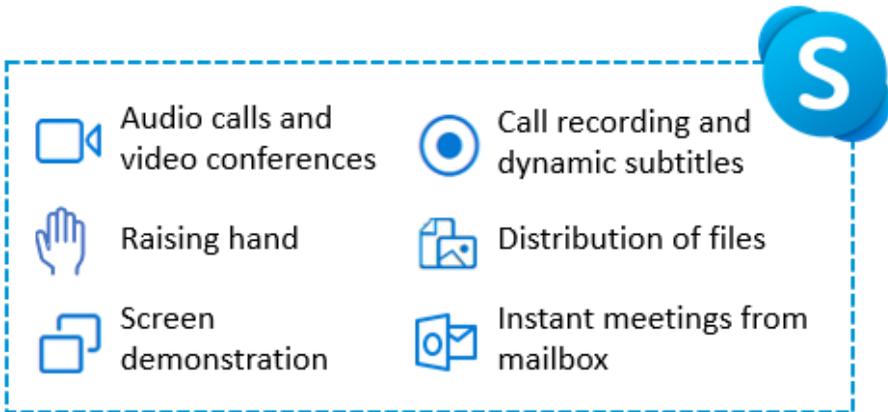


Figure 2.3.15. Embedding of video content in Microsoft 365 services

The use of video in the educational process is possible not only in asynchronous mode. During distance learning, the teacher conducts online classes, according to the approved schedule, using video conferencing tools. Skype and Teams Meetings are such services that allow you to schedule a meeting, conduct classes online, and also provide viewing access to educational content.

Skype provides various educational opportunities for all participants in the process (Figure 2.3.16). For teachers, it is possible to hold both online meetings and organize classes in a remote format. Students can communicate with other students, expand their knowledge and interact while preparing for classes or discussing collaborative tasks. Using Skype allows students to share projects, improve their language skills, exchange information about educational content, or present completed work. Skype also enables students and faculty to take virtual tours of historic sites, engage with authors and researchers, and participate in conversations with audiences around the world.



**Figure 2.3.16. Skype capabilities for distance learning**

Skype allows you to schedule online classes, video conferences, or hold an instant meeting, which even participants who do not have an account or are not logged in to their own account will be able to join. If you need to make an instant audio call, you can make it directly from your Outlook mailbox.

During such meetings, the teacher can demonstrate educational

content to students through shared screen viewing. Students can present the results of work in this way. An example of a screen demonstration during a Skype meeting is presented in Figure 2.3.17.

During video meetings, the teacher can make a recording of the lesson, for its further distribution to students. In this way, the presented materials will be available to students for re-processing. Dynamic subtitles allow you to convert the teacher's voice presentation of the material into text. The use of such subtitles allows students to choose a more convenient option for processing the presented material (audio or text). When discussing the presented material, students can raise a virtual hand, which allows students to respond to the presented material or ask questions to the teacher.

By arranging Skype group chats for organizing video meetings, teachers can share a variety of educational content with students in the chat window. Thus, students will be able to access educational content from any device using Skype.

Generalizing capabilities of Microsoft 365 tools for communication, collaboration and interaction are presented in Figure 2.3.18.

Therefore, feedback, effective communication and interaction, real-time cooperation of all participants of the educational process play a key role in e-learning, which affects the results of student learning and the quality of the organization of various activities of both the teacher and the student.



 <p><b>Delve</b></p>	<ul style="list-style-type: none"> <li>- communicating with other users directly from your profile page;</li> <li>- review of joint documents;</li> <li>- search for users by skills, projects, education;</li> </ul>	 <p><b>People</b></p>	<ul style="list-style-type: none"> <li>- establishment of digital connections and contacts;</li> <li>- recognition of users in cloud services;</li> </ul>
 <p><b>To Do</b></p>	<ul style="list-style-type: none"> <li>- shared access to the online list of tasks;</li> <li>- planning of joint activities;</li> <li>- setting deadlines;</li> </ul>	 <p><b>Lists</b></p>	<ul style="list-style-type: none"> <li>- collection, use of data for the purpose of creating and delivering educational content;</li> <li>- the possibility of customization according to the needs of the team;</li> </ul>
 <p><b>Outlook</b></p>	<ul style="list-style-type: none"> <li>- private and corporate communication;</li> <li>- designing digital communications for educational purposes;</li> <li>- organization and planning of joint work;</li> </ul>	 <p><b>Kazalla</b></p>	<ul style="list-style-type: none"> <li>- private and corporate communication;</li> <li>- designing digital communications for educational purposes;</li> <li>- organization and planning of joint work;</li> </ul>
 <p><b>OneDrive</b></p>	<ul style="list-style-type: none"> <li>- real-time collaboration;</li> <li>- common space for storing educational materials;</li> <li>- exchange of files, educational content, etc.;</li> </ul>	 <p><b>Yammer</b></p>	<ul style="list-style-type: none"> <li>- establishment of digital connections and contacts;</li> <li>- content discussion and communication with colleagues;</li> <li>- involvement of experts, with the help of external cooperation;</li> </ul>
 <p><b>Planner</b></p>	<ul style="list-style-type: none"> <li>- planning joint activities using digital tools;</li> <li>- visualization of team activity reports;</li> </ul>	 <p><b>Bookings</b></p>	<ul style="list-style-type: none"> <li>- establishment of digital connections and contacts;</li> <li>- planning joint online meetings;</li> <li>- reserving a meeting time;</li> </ul>
 <p><b>Teams</b></p>	<ul style="list-style-type: none"> <li>- effective collaboration using shared digital tools and media;</li> <li>- creation of joint educational materials;</li> </ul>	 <p><b>Project</b></p>	<ul style="list-style-type: none"> <li>- cooperation planning;</li> <li>- allocation of resources, analysis of the scope of work and tracking of the team's progress;</li> <li>- simultaneous updating of tasks by all team members;</li> </ul>
 <p><b>Flipgrid</b></p>	<ul style="list-style-type: none"> <li>- creation and moderation of video reports;</li> <li>- sending reactions and feedback;</li> <li>- organizations of effective interaction;</li> </ul>	 <p><b>Skype</b></p>	<ul style="list-style-type: none"> <li>- discussion of tasks in real time;</li> <li>- sharing content for joint discussion or creation;</li> </ul>

**Figure 2.3.18. Possibilities of communication, collaboration and interaction using Microsoft 365 services**

## **CHAPTER 3. ORGANIZATION OF ONLINE MICROSOFT TEAMS-BASED TRAINING**

### **3.1. Architecture of a hybrid educational environment on the Microsoft Teams-based platform**

In the conditions of the armed aggression of the Russian Federation against Ukraine, which has turned into a full-scale war, Microsoft Teams has expanded the possibilities of distance learning, storing research data of teachers and students, as well as providing access to the placement and use of various types of educational content. To support e-learning, a teacher needs to create an appropriate environment for the study group or flow of students. Microsoft Teams usage has grown to 145 million daily active users since the pandemic began [88]. Empirical evidence suggests that student-content interaction can influence learner satisfaction with the virtual learning environment [58]. Research evidence suggests that Microsoft Teams facilitates interactive learning, effective discussions and fosters interaction between students and instructors, and that it has created a peer learning culture [62].

The article considers the issue of creating and utilizing a hybrid cloud-oriented environment for training future specialists in higher educational establishments. It solves the problem of designing and creating such an environment, which will provide effective development of students' professional competencies as well as soft skills [34].

A. Rojabi's research showed that online learning using Microsoft Teams is classified as something new for students, but such interaction and learning environment motivates students to participate in online learning, as a result, it is easier for them to perceive educational material presented by a teacher [4].

The article proposes a technology for the development and implementation of a hybrid cloud-oriented learning environment for the electronic support of interdisciplinary projects in the educational process of future IT specialists. To organize such a project, a model of hybrid cloud-oriented learning environment was designed. The components of such an environment are as follows: competence, communication and technology. Based on the developed model, a Microsoft Teams-based cloud environment for project teamwork was

created. It integrated all the necessary services for the implementation of an interdisciplinary project [41].

Bergman [13] evaluated the usability of Microsoft Teams using a qualitative method. The study included participants who were selected to be as close as possible in profile to the researchers' intended end-users of Microsoft S Teams. Each participant was given post-test interviews after every test. The product and thinking aloud methods were used. It means that, while using Microsoft teams, the participant will continuously think out loud to identify how the users view the product and to know the misconceptions they might have. Results showed that there were usability problems during the log-on process. Sharing files and calling features of Microsoft Teams were regarded as top strengths. In summary, the perceived usability of Microsoft Teams in the study was high [13].

Microsoft Teams is a cloud-based digital hub that provides functionality for distance education, including meetings, file management, and other functions into a single LMS. It is available for free for educational institutions, and a paid subscription is also available for more functionalities [15], [103].

Microsoft Teams is said to foster synchronous and asynchronous communication which are critical for distance or remote learning [111]. Therefore, it is argued that Microsoft Teams can be used within formal, non-formal, and informal education and that it supports remote education [47].

A. Sobaih, A. Salem, A. Hasanein and A. Elnasr presented in their study the learning experience and feedback of students on the use of Microsoft Teams as a single distance learning platforms during COVID-19 [125].

Teachers can organize a virtual learning environment by implementing specific strategies for each element of hybrid (distance) learning according to Microsoft recommendations (Table 3.1.1) [52].

Microsoft Teams can be the basis for creating a hybrid (distance) learning environment, as it allows the teacher to communicate with their students during Teams calls, create and post educational content, assignments, share resources, organize online classes and promote effective interaction and collaboration. The architecture of such an educational environment for hybrid (distance) learning based on Microsoft Teams is presented in Figure 3.1.1.

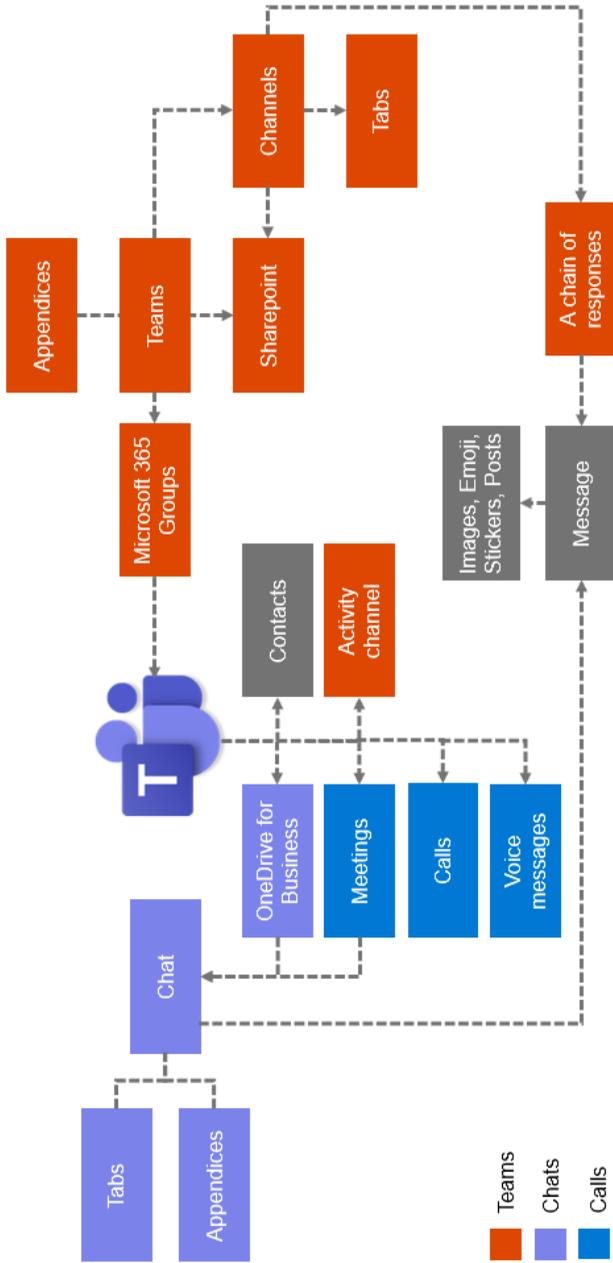
*Table 3.1.1*

**Strategies for each element of hybrid (distance) learning**

<b>An element of hybrid (distance) learning</b>	<b>Implementation strategies</b>
Learning environment	<ul style="list-style-type: none"> <li>– choose the type of educational environment that will correspond to different categories of participants in the educational process;</li> <li>– create an environment for a specific learning group;</li> <li>– select and configure technical means to optimize work with calls in Teams;</li> <li>– introduce students to the use of subtitles during Teams calls;</li> <li>– create, configure and populate a digital notebook in Teams to deliver educational content;</li> <li>– create an organizational structure of the environment with appropriate channels;</li> <li>– add important resources, such as tabs;</li> </ul>
Design and delivery of educational content taking into account the type of educational session (synchronous / asynchronous)	<ul style="list-style-type: none"> <li>– develop and implement universal design guidelines for creating content to personalize it;</li> <li>– select the necessary Microsoft 365 tools for designing and delivering educational content;</li> <li>– develop a variety of educational content to ensure the educational process in synchronous and asynchronous modes;</li> <li>– create video content for asynchronous classes, training and self-study materials and upload them to Stream;</li> <li>– use multimodal methods of interaction to deliver educational content to participants in the educational process;</li> </ul>

Engagement and interactivity	<ul style="list-style-type: none"> <li>– determine the necessary channels of interaction and involvement that will be effective for all participants in the educational process;</li> <li>– to monitor the activity of students in order to increase their involvement in the educational process;</li> <li>– add interactive elements to educational content for better interaction of students during synchronous and asynchronous classes;</li> <li>– involve students in independent planning of educational activities in order to manage their own digital educational workload;</li> <li>– offer students problem-search tasks to solve;</li> <li>– encourage student initiative and choice.</li> </ul>
Assessment and feedback	<ul style="list-style-type: none"> <li>– provide feedback and review using video communication, comments, notes on the results of completed tasks independently and in teams;</li> <li>– plan formative assessment in order to measure the student’s educational progress, regarding the assimilation of a separate topic, content module, material of the discipline;</li> <li>– carry out a final assessment of submitted work results and passed test tasks to measure the level of learning content by students.</li> </ul>

Using Teams, a teacher can create classes for students to work together, and teachers can join professional learning communities and communicate with colleagues, share experiences and implement new learning technologies. The creation of uniform procedures for communication, creation and delivery of educational content, organization of various types of educational activities during distance learning provides students with a predictable structure of educational materials, which allows them to focus on learning, and not on the selection and learning of new tools. To create such a digital environment for the interaction of participants in the educational process, Teams offers, at the stage of its creation, to choose the type



**Figure 3.1.1. The architecture of the learning environment based on Teams**

of teams (Figure 3.1.2) that will cooperate in it. The purpose of teams in Teams is to bring together a group of people who collaborate with each other to accomplish assigned tasks. Teams can be created for specific tasks (for example, the implementation of a collective project), for a discipline on an ongoing basis, reflecting all educational material and tasks, in accordance with the working curriculum, or for a specific structural unit (for example, a department or faculty), to plan its activities.

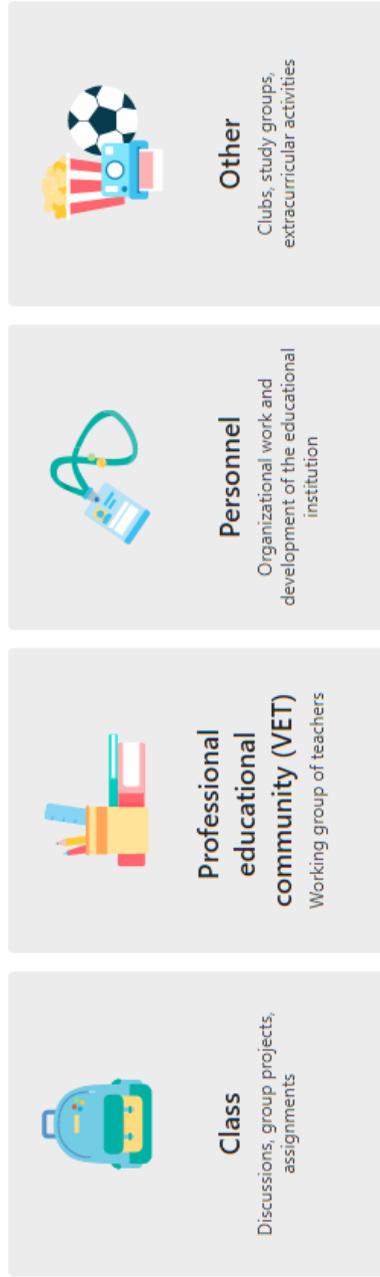
Each of the presented (Figure 3.1.2) types of teams allows you to organize a digital learning environment in accordance with educational goals.

The “Staff” team type allows you to create an environment for managing the organizational work and development of an educational institution or its structural subdivision (for example, a faculty or department). In such a team, it is possible not only to post content for shared use, but also to organize communication between participants, posting announcements, planning personal and joint activities of all members of such a team, holding joint meetings and staff meetings.

The “Professional Education Community” team type allows an environment for a group of teachers who meet regularly to share experiences and collaborate, with the goal of improving teaching skills and student academic performance. Using this type of command in Teams Office 365 allows you to establish cooperation more effectively, since each member of such a team has the opportunity to track not only his own achievements and work results, but also that of other teachers.

The “Class” team type is intended for the management of educational activities, as it has a unique functionality for both teachers and students. The use of this type of team allows teachers to organize an electronic course within the framework of studying a discipline or a separate educational module, in which it is possible not only to place educational content, but also to assign tasks to be performed and evaluate them, to plan and conduct online classes in the form of a meeting (for more details see Paragraph 3.2), organize group work of students.

The “Other” team type is used when it is necessary to organize a digital environment for study groups or small group activities on the implementation of professionally oriented projects.



**Figure 3.1.2. Team types in Teams**

The comparative characteristics of the command types are presented in Table 3.1.2.

Table 3.1.2

**Team types in the Teams environment**

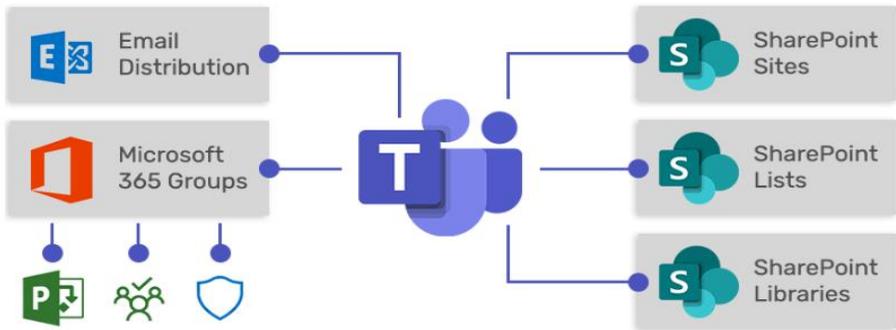
<b>Class</b>	<b>Professional learning community (PLC)</b>	<b>Staff</b>	<b>Other</b>
<b>Team description</b>			
educational environment (for cooperation between teachers and students)	collaborative environment of a group of teachers	environment of organizational work management in an educational institution	environment for cooperation in interest groups and clubs
<b>Team owners and members</b>			
administrators, teachers, and students create teams with students as members	teachers are both the owners and participants	team owners are managers who add employees as members	both students and teachers can create and add members to teams
<b>Permissions</b>			
administrators and teachers moderate student conversations and post permissions	all team members have the same permission to post messages	only managers can manage posting options	team members have the same read and publish permissions, which can be changed if necessary
<b>Functions</b>			
<ul style="list-style-type: none"> <li>– notebook for the class</li> <li>– tasks</li> <li>– conversations</li> <li>– files</li> <li>– video and audio calls</li> <li>– chat</li> <li>– pinning new tabs</li> </ul>	<ul style="list-style-type: none"> <li>– OneNote notebook</li> <li>– conversations</li> <li>– files</li> <li>– meetings</li> <li>– video and audio calls</li> <li>– chat</li> <li>– pinning new</li> </ul>	<ul style="list-style-type: none"> <li>– notebook for personnel</li> <li>– conversations</li> <li>– files</li> <li>– meetings</li> <li>– video and audio calls</li> <li>– chat</li> <li>– pinning new</li> </ul>	<ul style="list-style-type: none"> <li>– OneNote notebook</li> <li>– conversations</li> <li>– files</li> <li>– meetings</li> <li>– video and audio calls</li> <li>– chat</li> <li>– pinning new tabs</li> </ul>

with documents or sites	tabs with documents or sites	tabs with documents or sites	with documents or sites
<b>Learning objectives</b>			
<ul style="list-style-type: none"> <li>– assigning, tracking and checking tasks</li> <li>– export of marks</li> <li>– cooperation and communication in the classroom</li> <li>– placement of ads</li> <li>– conducting tests and surveys</li> <li>– group work</li> <li>– providing access to various content and its arrangement</li> </ul>	<ul style="list-style-type: none"> <li>– cooperation within professional communities of teachers</li> <li>– communication - placement of ads</li> <li>– shared access to work results</li> <li>– organization of virtual or personal meetings</li> <li>– work in small groups</li> <li>– providing access to content and its arrangement</li> </ul>	<ul style="list-style-type: none"> <li>– supervision of personnel and performance of administrative tasks</li> <li>– communication</li> <li>– placement of ads</li> <li>– shared access to content and reports based on work results</li> <li>– organization of virtual or personal meetings</li> </ul>	<ul style="list-style-type: none"> <li>– joint work and communication with team members</li> <li>– placement of ads - sharing content</li> <li>– organization of virtual or personal meetings</li> <li>– work in small groups</li> </ul>

Accordingly, all types of Teams created in Teams allow users (teachers and students), diverse educational content and tools for effective joint collaboration.

Microsoft Teams is supported by Microsoft 365 groups, that is, if a teacher creates a team in Teams, a Microsoft 365 group is automatically created with all its components: inbox, shared calendar, SharePoint document library, shared OneNote digital notebook, SharePoint group site, and planner. The components of the Microsoft 365 group belonging to the Microsoft Teams cluster are shown in Figure 3.1.3.

Group members use the Inbox component to communicate via Outlook, as this folder contains the e-mail addresses of all registered participants within the educational institution, and it is also possible to additionally configure the receipt of messages from people outside a certain institution. The interaction of participants in the educational process during distance learning using Outlook and Teams services

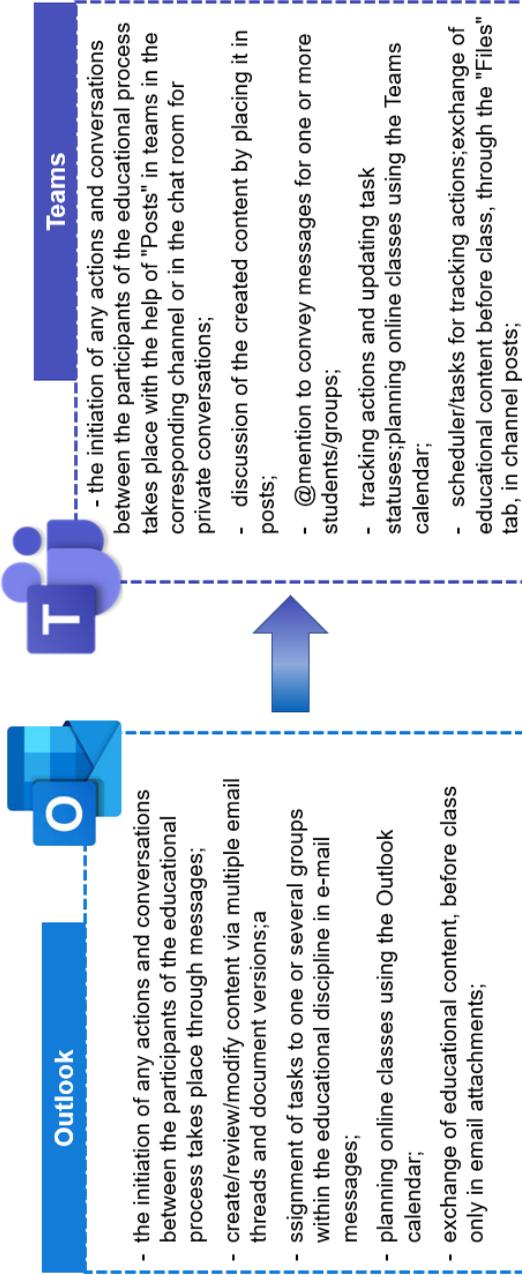


**Figure 3.1.3. Microsoft 365 group components belonging to the MS Teams cluster [84]**

is presented in Figure 3.1.4.

Participants of the educational process can use the Group calendar to plan meetings and group tasks. The SharePoint document library is the central space for storing and sharing files between group members, delivering various types of educational content. The teacher can deliver educational content to students using a shared OneNote digital notebook. In turn, the students of the group can collect ideas in this service, accumulate data for conducting various types of research. The SharePoint group site can be used as a central repository for collecting information, links to external resources and group content, saving various types of educational content. The teacher can use the Planner to assign and manage individual or project tasks for group members. More details about the use of each of the components of the Microsoft 365 group to manage various types of educational activities are described in Paragraph 3.2.

When creating a team channels can be automatically created or added (separate sections in the team). In these channels, conversations can be organized by topics, modules, academic disciplines, collective projects, or any other category determined by the teacher. Accordingly, all team members can have open conversations in Teams channels, as they are open to all connected participants. Additional channels can be added manually by the user.



**Figure 3.1.4. Educational interaction using Outlook and Teams**

Each type of team includes a “General” channel, which is used by any team as a space to post announcements, introduce members, and share a variety of content that is newly added or frequently used. This channel can be available both for general use by all team members, and only for viewing content, posts and announcements posted by the teacher (to be used exclusively for informational purposes). If it is necessary to organize collaboration environments for a separate category of students (for example, a separate academic group studying a discipline or a team working on a group project), it is possible to organize a separate channel for each of them. In this way, students will be able to view both the content of the “General” channel and a separate channel within the team to which they are attached. An example of the use of channels within one team is presented in Figure 3.1.5.

When transitioning to hybrid (distance) learning, educational institutions are forced to design learning environments, create virtual learning spaces for teachers and students, for example, using Microsoft Teams. Teams is an ideal tool for ensuring continuity and flexibility of learning as a digital hub for a hybrid learning environment; Microsoft Teams allows teachers to communicate with students through Teams calls, create and collect assignments, share resources and facilitate student collaboration, whether or not are they personally present in the auditorium or connected remotely. The capabilities of Microsoft Teams tools for personal and virtual interaction between teachers and students are listed in Table 3.1.3.

When transitioning from a hybrid learning environment created or already available in an educational institution, teachers should evaluate its functionality and available tools for designing and delivering diverse educational content, taking into account synchronous or asynchronous interaction between distance learning subjects.

The screenshot displays the Microsoft Teams interface during a meeting. The top navigation bar includes 'Microsoft Teams', a search bar, and a profile icon. The meeting title is 'Economic informatics > Megachelyx ...'. Below the title, there are tabs for 'Participants', 'Parameters', and 'Analysis'. The 'Participants' tab is active, showing a search bar and a list of participants. The participants are categorized into 'Owners (1)' and 'Participants and guests (4)'. The 'Owners' list includes one participant: Valentina Ihorivna Korolchuk, Owner. The 'Participants and guests' list includes four participants: Sakerivch Andrii Serhiyovych (Member), Dovigan Vadim Romanovych (Member), Anastasia Serhiivna Kovale... (Member), and Oleksandr Maksymovich Se... (Member). The bottom of the screen shows the meeting controls, including 'Channels' (General, limo, Marketing, Megachelyx, Success, dream team, Soft, Team, YOUNGER) and various meeting tools like Activity, Chat, Teams, Task, Calendar, Challenges, and File.

Figure 3.1.5. Using channels in the digital environment

Table 3.1.3

**Microsoft Teams: digital hub for the hybrid learning environment [89]**

<b>Personal interaction</b>	<b>Microsoft Teams tool</b>	<b>Virtual interaction</b>
<ul style="list-style-type: none"> <li>– daily interaction;</li> <li>– conversations</li> <li>– dialogues and questions</li> </ul>	<p>Posts tab</p>	<ul style="list-style-type: none"> <li>– students and teachers can interact with each other (Posts tab);</li> <li>– teachers can ask students questions for discussion during the week;</li> <li>– students can ask questions about the content or assigned tasks;</li> <li>– students can communicate and share their own ideas;</li> </ul>
<ul style="list-style-type: none"> <li>– conducting lectures;</li> <li>– screen demonstration;</li> <li>– cooperation;</li> <li>– discussion</li> </ul>	<p>Teams Meetings</p> <ul style="list-style-type: none"> <li>– Raise your hand;</li> <li>– Chat;</li> <li>– Share Screen;</li> <li>– Whiteboard</li> </ul>	<ul style="list-style-type: none"> <li>– students and teachers can join the Teams call for remote classes and online consultations;</li> <li>– students can use the Raise your hand feature or the Chat window to ask questions, share their thoughts, or respond to the teacher’s questions;</li> <li>– teachers can use Share Screen or Whiteboard to offer visuals to support content delivery;</li> </ul>
<ul style="list-style-type: none"> <li>– delivery of educational content to students;</li> <li>– promotion of cooperation between students</li> </ul>	<p>Files tab</p>	<ul style="list-style-type: none"> <li>– teachers can share read-only content and resources in the Learning Materials folder on the Files tab;</li> <li>– students and teachers can work together on Word, PowerPoint and Excel, Visio files available in the Files tab, offer comments to the File; each file has a built-in chat function (the ability to discuss the contents of the file)</li> </ul>

<ul style="list-style-type: none"> <li>– distribution of educational materials and additional e-resources to students;</li> <li>– creating a workspace for students;</li> <li>– promoting cooperation between students</li> </ul>	<p>Class Notebook tab</p>	<ul style="list-style-type: none"> <li>– teachers can share content and resources for reading and learning in the Notebook content library, as well as create workspaces for students to complete assignments;</li> <li>– students can collaborate on joint projects or share resources with each other in the Digital Notebook collaboration space;</li> <li>– students have an individual workspace where they can take notes, document learning materials, and complete assignments;</li> </ul>
<ul style="list-style-type: none"> <li>– distribution of assignments to students;</li> <li>– uploading completed works;</li> <li>– providing feedback on their work</li> </ul>	<p>Tasks tab</p>	<ul style="list-style-type: none"> <li>– teachers can distribute and collect assignments using the Tasks tab, attach a OneNote page for students to fill in with links or other files; students can submit the results of their work in response to the Task, and teachers can review the work and provide feedback instructors can either allow students to refine work based on feedback or grade it;</li> </ul>
<ul style="list-style-type: none"> <li>– notification of task assessment results</li> </ul>	<p>Grades tab</p>	<ul style="list-style-type: none"> <li>– students can read the assessment results on the Grades tab;</li> <li>– teachers can view an individual assessment or the results of tasks performed by a group of students;</li> </ul>
<ul style="list-style-type: none"> <li>– creation of educational centers and/or organizational materials and resources for students</li> </ul>	<p>Channels</p>	<ul style="list-style-type: none"> <li>– teachers can create a structure for their virtual learning environment with the help of channels, organizing them by weeks, topics or tasks;</li> <li>– teachers can create private channels for students to collaborate on collective projects, create virtual</li> </ul>

		learning centers with channels and direct students to specific channels for meetings, questions or communication;
– monitoring of student activity	Insights	– educators can view real-time data on student engagement in assigned discussions, meeting participation, and assignment completion;
– lectures; demonstrations	Microsoft Stream	– teachers can upload educational video content and demonstrations to the Stream channel, and then add the channel as a tab in Teams;
– quizzes; – surveys	Microsoft Forms	– teachers can connect the Forms test to educational. videos, create surveys using the Forms quiz; – collect information from students using surveys that can be added as a tab or shared in a conversation on the Posts tab.

### **3.2. Organization of synchronous interaction in Microsoft Teams**

The transition towards digital pathology and an extensive selection of video conferencing platforms have helped provide continuity to education even during the COVID-19 pandemic [5]. During synchronous interaction, teachers and students are involved in simultaneous learning in a single digital learning environment. With synchronous learning, teachers plan online meetings with students according to the class schedule and conduct training sessions, providing e-content according to the working educational discipline, which is important for participants in the educational process. The learning sessions take place in the same way as it happens when students meet face-to-face in classrooms. With the help of online tools that are available in the educational environment of the educational institution, students perform and send tasks to the teacher, in turn, teachers provide feedback on completed tasks to students, establish feedback with them, conduct additional classes with those students who need additional consultations, providing appropriate educational content for additional processing.

The use of Microsoft 365 services in the educational process for conducting video meetings and recording video content is one of the methods that can be used to improve the effectiveness of distance learning during the Covid-19 pandemic.

Microsoft Teams application allows users to create a ‘real-time’ meeting that has online post-class lecture video recording feature, share the teaching materials like lecture notes, articles or additional exercises, and it provides a chat relay for direct communication. In addition to that, it has a function to create the online quizzes that automated marking, which eases a user to check his or her answer [84].

Research by Mohammad Ali, Khan Mohammed Zaid, Sudhir A. Shegunshi found that teachers and students consider Zoom and Microsoft Teams effective tools for online learning [95]. Microsoft Teams is an effective virtual leaning platform because of its quality, user friendliness and functionalities [1].

In his research, D. Karthikeyan analyzed Microsoft Teams from the perspective of undergraduate students. The author’s research showed that Microsoft Teams supports and easily fulfills the key aspects

related to learning and acquiring knowledge from the perspective of students, and also points to gray areas where user-friendliness can be improved when organizing different types of educational activities of participants in the educational process [24].

The components of online learning in the Microsoft Teams environment, which are determined in the research by I. Sarerusaenye Ismail, Shahrinaz Ismail to be the most useful in the learning process, are: (1) a meeting after recording; (2) form of quizzes; (3) flexible window chat; and (4) generic links using Microsoft (MS) programs. These four components have a significant impact on the learning process of participants in the educational process, which can be divided into five components: (1) easy-to-understand instructions; (2) time management; (3) no delay in submitting course evaluations; (4) improve student understanding (self-study); and (5) an effective manner of discussion and communication [118].

Creating video content in the form of streaming video, which will be processed by students in asynchronous mode, allows you to prepare educational video materials, screencasts, educational vlogs, video lectures, webinars, etc. Video streaming has become the easiest and most affordable way to view video content hosted for students in digital learning environments or on streaming services. Sharing already created video content in Teams, Microsoft 365 applications such as SharePoint, Microsoft Teams and Yammer is possible using Microsoft Stream. This tool is integrated with Microsoft 365 groups (for more details see Paragraph 1.2), which allows each group to have its own channel on which educational video content will be placed, which will further simplify content management among educational groups.

Microsoft Stream uses embedded, encrypted video with authenticated access, ensuring content is only shared with the intended audience. Videos can be viewed easily and safely on any devices and screens of any size, regardless of the location of each participant in the educational process.

The use of interactive capabilities of Microsoft Teams in combination with educational video materials of Microsoft Stream allows you to build an effective digital learning environment of an educational institution, accessible from all types of devices (including mobile). Such an environment can be organized on the basis of

Microsoft Teams and individual Microsoft Stream videos, a Microsoft Stream video channel or YouTube.

The use of streaming video in the educational process in combination with the capabilities of Microsoft Teams allows to:

- organize the educational process according to the “flipped” learning model, in which students familiarize themselves with the content of the presented educational content at a convenient pace, from any device and place for a deeper study of the content, followed by interactive interaction with all sides of the educational process;
- increasing student involvement in the learning process using interactive elements, sound and feedback to convey the topic with the acquisition of skills that can be used in the course of research, joint work and solving problem-oriented tasks;
- increasing students’ motivation;
- the development of both student autonomy and the expansion of opportunities to work in a team (group);
- organization of mobile training.

The combination of a series of videos, designed in the form of a video channel of a discipline, a separate topic, etc., with the possibilities of organizing interactive interaction through Microsoft Teams allows you to consider complex practice-oriented tasks.

Filling the video channel with educational video content may depend on the learning style of students, the pace of processing the material or the results of processing a separate topic.

Microsoft Teams uses several ways to conduct online meetings, namely: meetings, webinars and live broadcasts. A teacher who acts as an organizer during a webinar or broadcast has additional control over the event. During distance (blended) learning, the teacher can choose different types of interaction between the participants of the educational process: ensuring two-way interaction by organizing webinars, and for managing questions and answers - broadcasts. These different types of interaction have different restrictions on the number and functionality of participants in these events. Table 3.2.1 provides an overview of the three main types of meetings that are recommended for different numbers of participants and the organization of interaction methods between them.

*Table 3.2.1*

**An overview of the main types of meetings organized in Teams**

<b>Meeting type</b>	<b>Number of participants</b>	<b>Interaction type</b>	<b>Authorization support</b>
Meetings	up to 10,000 participants	<ul style="list-style-type: none"> <li>- the first 1,000 participants are given the same educational process opportunities for organizing interactive interaction;</li> <li>- other participants are given the opportunity to view</li> </ul>	absent
Webinar	up to 10,000 participants	<ul style="list-style-type: none"> <li>- if the number of participants does not exceed 1,000, they are provided with fully interactive opportunities;</li> <li>- customized interaction with the audience;</li> <li>- you can appoint the speakers</li> </ul>	present
Events in real time	up to 10,000 participants	<ul style="list-style-type: none"> <li>- broadcasting for large audiences;</li> <li>- moderated questions and answers for interaction with the audience;</li> <li>- you can specify organizers and speakers, including invited speakers;</li> <li>- support for extended capabilities of the working environment</li> </ul>	absent

Meetings hosted in Teams support audio and video, and allow screencasting for an audience of up to 1,000 people and view-only for over 1,000 participants. Students do not need to have a corporate account to join, i.e. log in. Participants can join directly from the calendar invitation via the “Join Meeting” link or by voice call, if available. The teacher can use this type of meeting in Teams to consult students on performing laboratory (practical) work, writing term papers or theses. The teacher can invite specialists from various fields of activity in accordance with the defined topic of the meeting, at which experienced specialists will act as speakers. The teacher, who will act as the organizer, can adjust the parameters of the meeting and determine which functions to enable. In addition to regularly scheduled meetings (consultations), participants can create meetings according to the study group channel, which allow all team members to see that meetings are taking place, join them, or use the chat for communication. Channel meetings allow the teacher to quickly invite all students of the team to the scheduled meeting.

The teacher can organize Microsoft Teams video events, which allow planning and conducting events that are broadcast to a large audience of students on the Internet. Such video events can be created in two ways: (1) using the Teams tool and inviting speakers and student participants to join the discussion from their own devices; (2) using an external hardware and software encoder via Microsoft Stream.

Another option for organizing meetings during distance learning with students is holding webinars, where the role of each participant is clearly defined (Figure 3.2.1).

The main difference between webinars and Teams meetings is that webinars support pre-registration and collect participant activity data. A teacher can use Teams Webinars to host online meetings to share content, video, and audio content. In turn, students have the opportunity to view the offered educational content and, if necessary, ask the lecturer questions. During the webinar, students can actively participate in the discussion by reacting, posting messages in the chat, or answering survey questions. Students cannot share their own audio, video or other educational content.



## Webinar Roles

administrator	teacher	student
<ul style="list-style-type: none"><li>- plans meetings according to the schedule;</li><li>- creates a webinar;</li><li>- configures parameters;</li><li>- creates a registration form; adds teachers, guest speakers;</li><li>- configures parameters of interaction with the audience;</li><li>- manages and owns the webinar recording</li></ul>	<ul style="list-style-type: none"><li>- presents live audio and video;</li><li>- extends the screen during the webinar;</li><li>- moderates questions and answers;</li><li>- organizes interaction with the audience;</li><li>- delivers educational content in a recording</li></ul>	<ul style="list-style-type: none"><li>- gets access via a link or an event in the calendar;</li><li>- views live audio and video content;</li><li>- participates in the discussion via chat; asks questions in the chat;</li><li>- views the received content in the record</li></ul>

Figure 3.2.1. Roles of participants during webinars

Teachers can also arrange, plan and deliver real-time events for large audiences. Such interaction with the audience during meetings involves managing questions and answers from engaged participants. Figure 3.2.2 shows the distribution of roles in events organized in real time. In Yammer and/or Microsoft Stream, broadcasts allow the teacher to schedule activities even for a larger number of participants.

Live events using Microsoft 365 take live video streaming to a new level. Such events encourage communication throughout the lifecycle of teacher-student interactions before, during, and after such events. A teacher can create a live event wherever their audience, team or community is with Microsoft Stream, Teams or Yammer.

Teams allows all participants in the educational process to collaborate in chat, phone calls, meetings and live events. Students can view the event live or recorded in Yammer, Teams, or Stream, and interact with faculty or guest speakers through a moderated Q&A or Yammer conversation. The process of holding events in real time using Microsoft 365 services is presented in Figure 3.2.3.

Prior to the beginning of the academic semester, representatives of the dean's office (administrator) or a teacher can personally plan a schedule in the Calendar service by adding a Teams meeting, inviting students from the contact list (Figure 3.2.4) or organizing an educational environment in Teams to schedule a meeting directly in the team channel. The scheduled meeting in Teams will be posted both in the Calendar of each team member and in the posts of the channel.

A teacher can organize a meeting with students through the Outlook service, namely a Call from Teams using three available connection options: (1) download Teams (work or study account); (2) continue in the same browser; (3) open Teams (work or University account). Figure 3.2.5 shows an example of creating a meeting in Outlook by a teacher.

After you create or update a live event, add presenters and students (by adding team members), the meeting will appear in your Outlook calendar and Teams calendar. In this case, the participants of the educational process have the opportunity to view both their own scheduled meetings and the meetings to which they have been invited, as well as react to such invitations: confirm their participation or reject such an invitation (Figure 3.2.6).



## Roles in the event in real time

administrator	teacher	student
<ul style="list-style-type: none"><li>- plans the event according to the schedule;</li><li>- creates an event in real time;</li><li>- adds the organizer user as a member of the event working group;</li><li>- adds speakers to the event in real time;</li><li>- sets event recording</li></ul>	<ul style="list-style-type: none"><li>- presents a variety of live content;</li><li>- spreads the screen in real time;</li><li>- moderates questions and answers;</li><li>- adds co-rapporteur;</li><li>- manages the stream of live events</li></ul>	<ul style="list-style-type: none"><li>- receives a link to the event in the channel;</li><li>- watches the live broadcast of the event;</li><li>- receives the content in the recording;</li><li>- views the recording of the event at a convenient time</li></ul>

Figure 3.2.2. Distribution of roles in live events

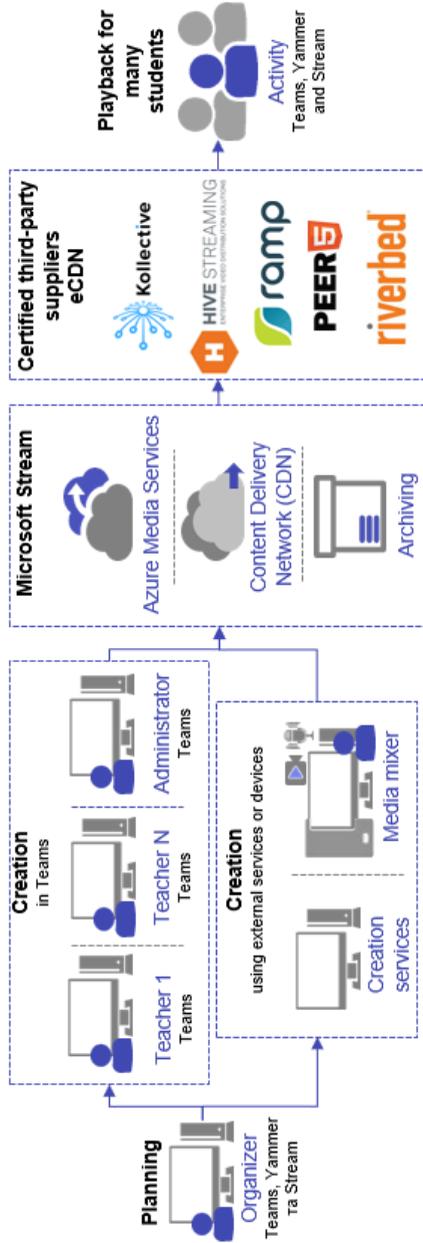


Figure 3.2.3. Conducting live events using Microsoft 365 services

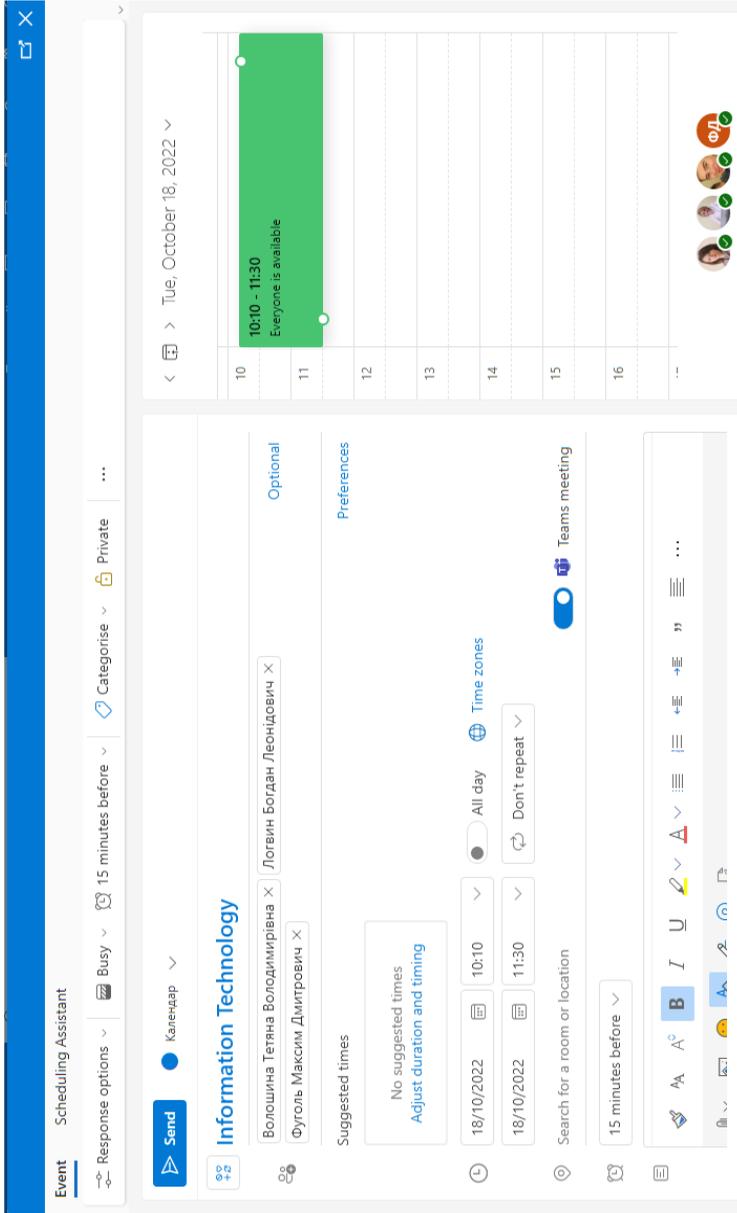
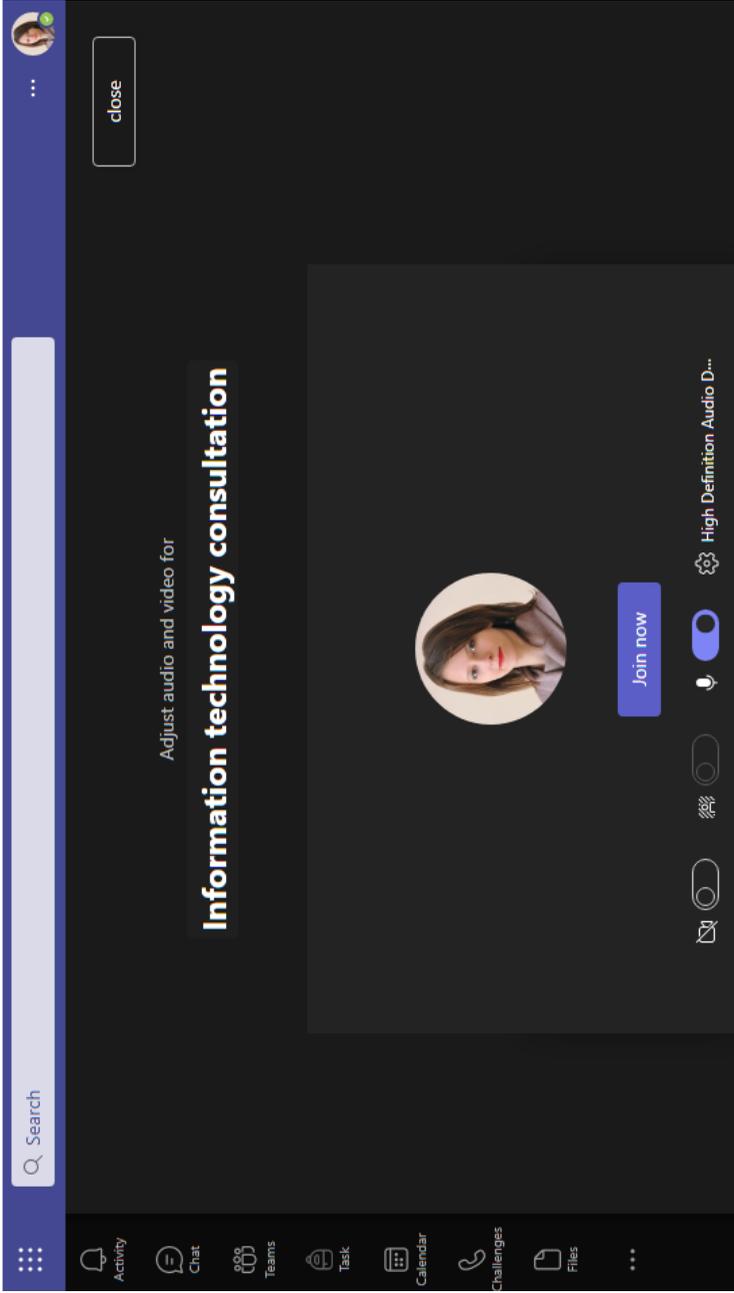


Figure 3.2.4. An example of scheduling a meeting in the Calendar service



**Figure 3.2.5. An example of creating a meeting in Outlook**



**Figure 3.2.6. Display of scheduled events in the Teams calendar**

When planning such a meeting in the group channel, the teacher can send an invitation to the event via email to all participants, or students who are attached to this channel will receive a notification in the channel posts. The teacher can also add notes to each training session (scheduled meeting) in advance for students to get acquainted with it.

During various online meetings, the participants of the educational process can use the screen demonstration function and provide access to certain educational content. All the participants of the meeting can demonstrate their own screen, a certain window or an online whiteboard. During the demonstration, teachers can familiarize students with the necessary educational material or organize its collective processing using an online board. More details about the use of Whiteboard for managing students' educational activities are presented in Paragraph 2.2.

For re-viewing the educational content that was shown to students during the educational session, with the prior consent of the participants of the educational process, it can be recorded by the administrator or the teacher. Such a video recording will be available to all Teams members in chat posts. During such a video lesson, the teacher can share their desktop to discuss a certain material or present a PowerPoint presentation, a handwritten text on a OneNote digital notebook page, demonstrate the search for a solution to a given problem, or any other file on their own device.

When organizing live events, you can use any source for video, due to the capabilities of the Teams tool. To do this, you can use several means of capturing video content, one on each device used by the administrator or teachers, and change the camera, choosing the active video to broadcast in Teams to students (Figure 3.2.7).

Moreover, if during an online meeting a teacher needs to show data from an HDMI web feed that uses multiple desktops or other equipment fitted with multiple cameras and audio sources, then one environment in Teams will suffice: you either enter an event created in Teams using a capture card or key; or join directly via RTMP an event created using an external application or device (Figure 3.2.8).

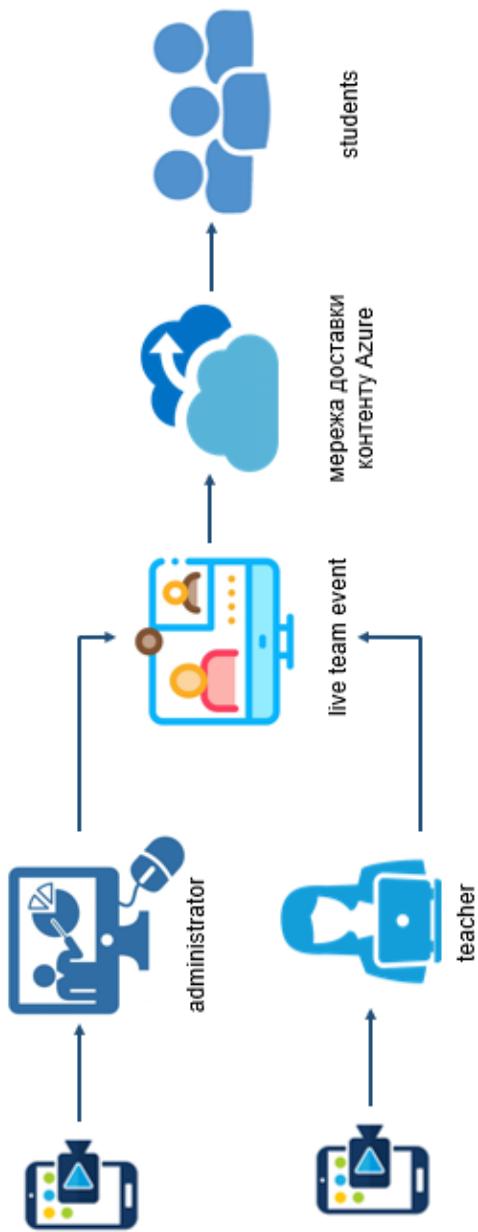
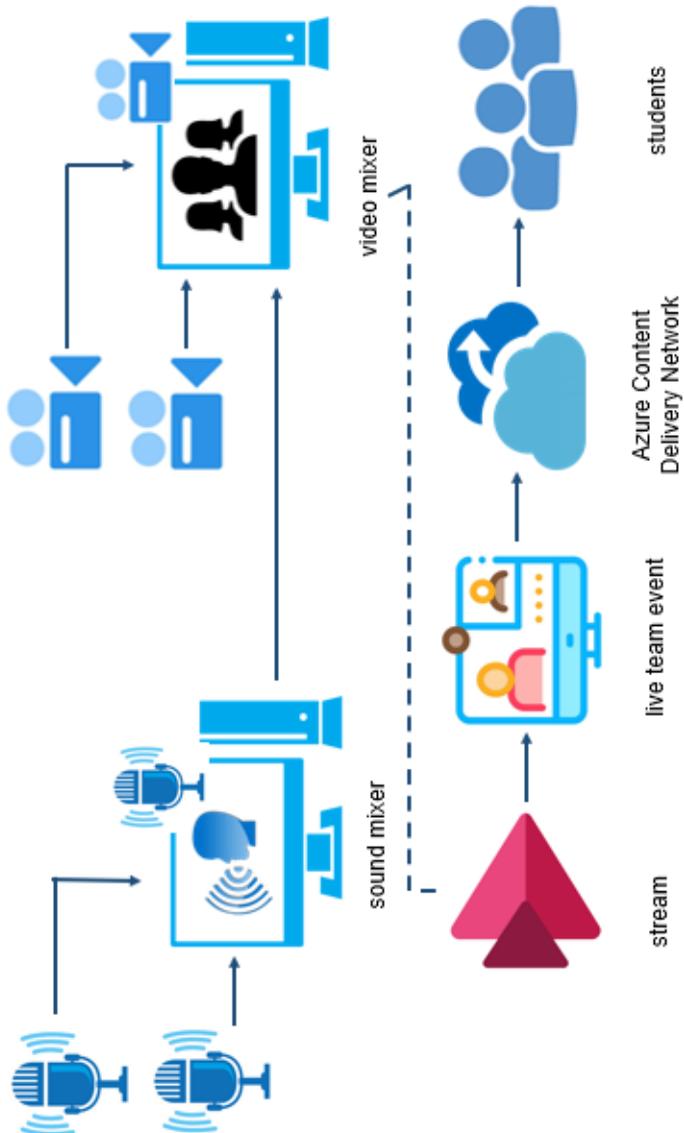


Figure 3.2.7. Creating a broadcast in Teams



**Figure 3.2.8. Creating a broadcast using external devices**

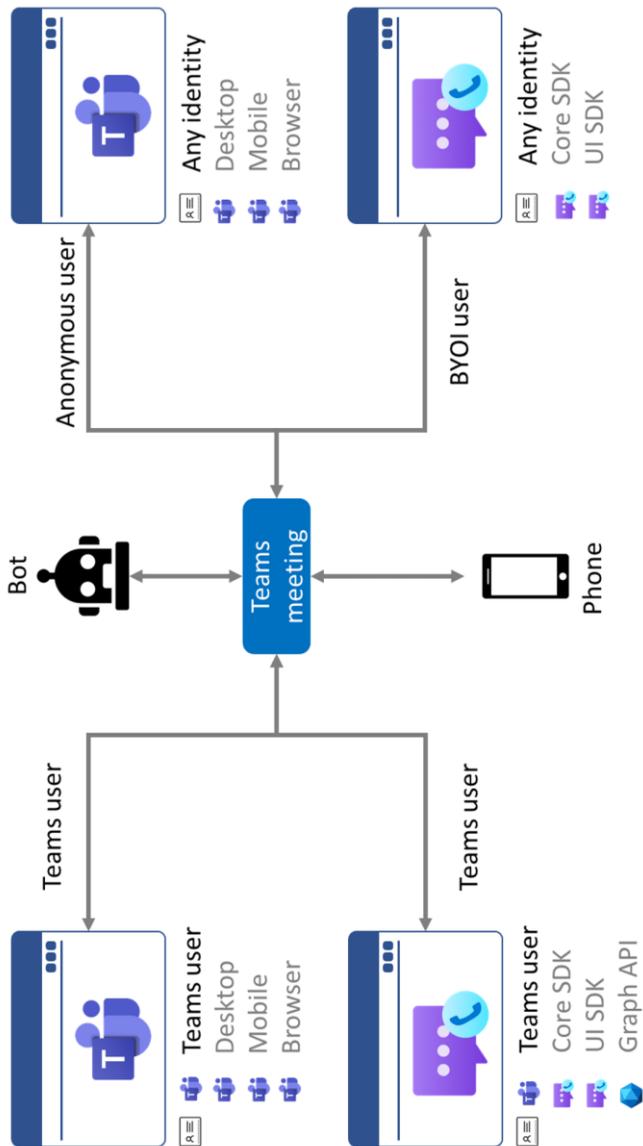
There are several options for participants in the educational process to join a meeting organized in Teams (Fig. 3.2.9): (1) as authorized users of Teams (includes desktop, mobile and web clients of Teams); (2) as unauthenticated anonymous users; (3) through Communication Services user applications, when the users use the BYOI authentication model, i.e. create their own identity; (4) through special Communication Services applications as Teams users using the Teams authentication model.

Using the identity authentication model, the Communication Services program allows Teams users to join calls with other users of this service from different devices (Figure 3.2.10).

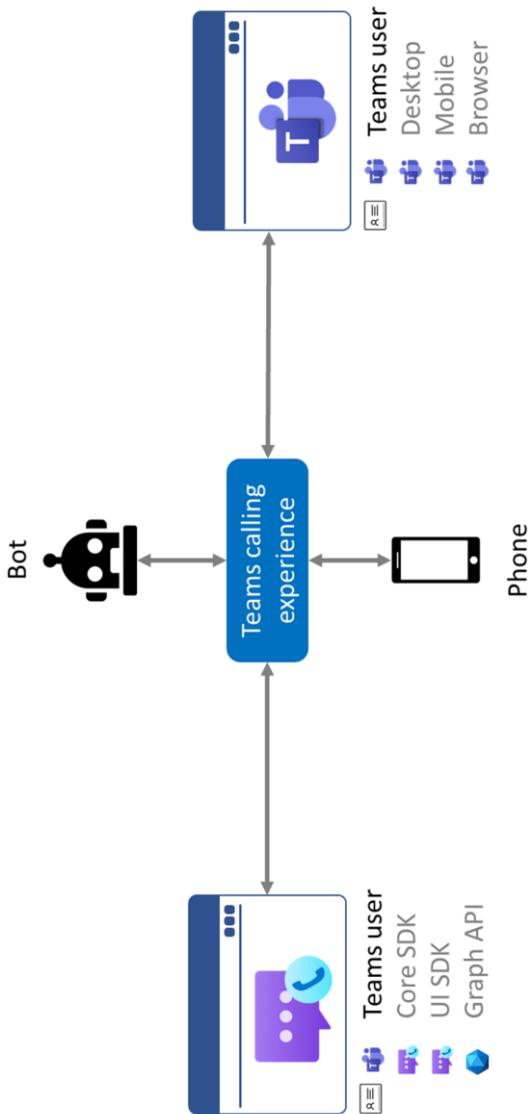
After the end of the video meeting, a report about its visit will be available in the channel posts. In such a report, the administrator and teacher can view both the number of participants who attended the meeting, the start and end times of the meeting, as well as information about the joined participants: personal data, time of joining, duration of connection, etc.

An instructor can create a meeting room (or session) and generate a password to share with all students via email or invitation code. Regular classes can be lectures, lessons, discussions and others. Each meeting room has different authorized access. This study suggests creating an independent meeting room for assignments and discussions. This type of room will be an effective platform for the administration and management of a large number of students at the same time. In addition, the lecturer can start uploading any documents and lecture slides a week before the exact date of the meeting in the publications section via Microsoft Teams. Here, all students who join the meeting room can download and view it at any time. Microsoft Teams offers an automatic recording function in the meeting function, so all session recordings can be directed to the student's email [89]. The study scheme using Microsoft Teams in Figure 3.2.11.

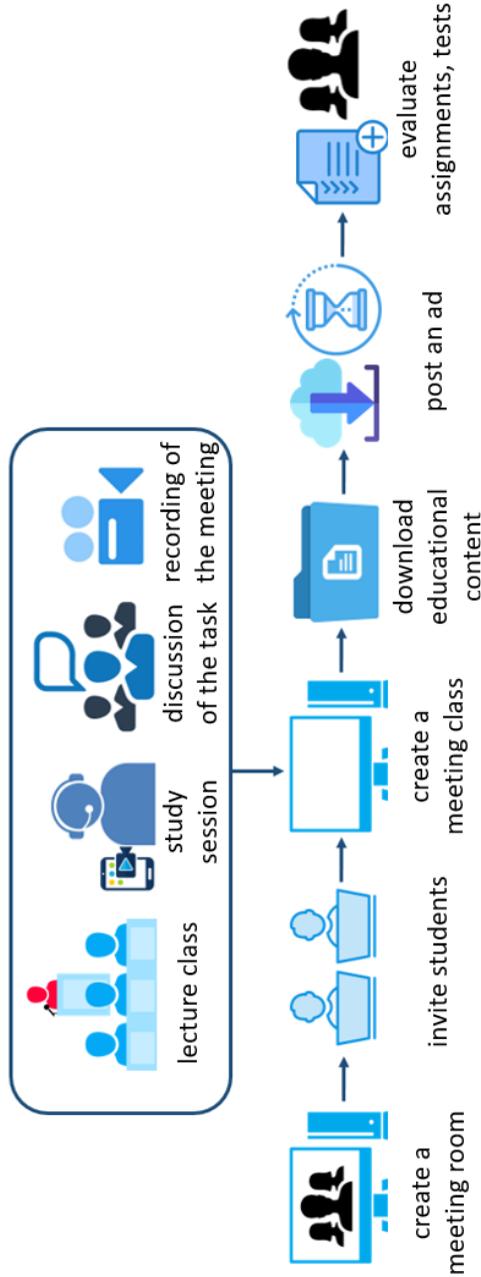
The use of video communications during distance learning is possible using not only one tool, but integrating several to provide all the necessary functionality. Microsoft Teams can be integrated with Cisco cloud services that allow you to organize video meetings (Webex Meetings) and calls (Cisco) using video devices (Cisco Webex Devices), shown in Figure 3.2.12.



**Figure 3.2.9. Ways to join a Teams meeting [82]**



**Figure 3.2.10. Teams call schemes [82]**



**Figure 3.2.11. The study scheme using Microsoft Teams**

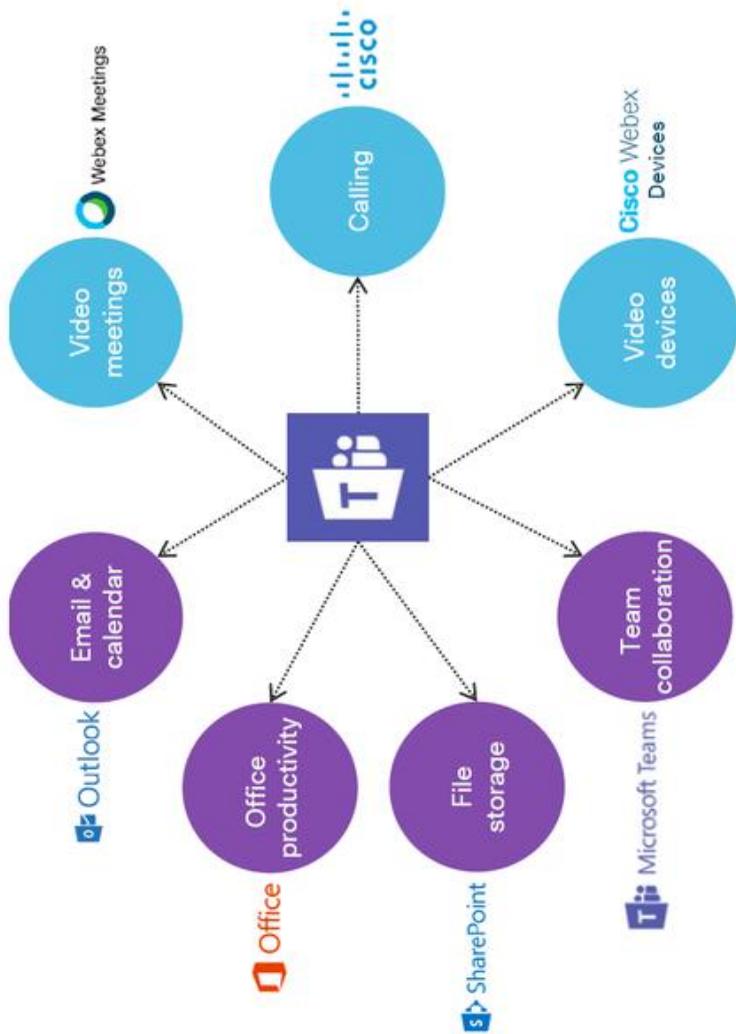


Figure 3.2.12. Integration of Microsoft Teams with Cisco tools [7280]

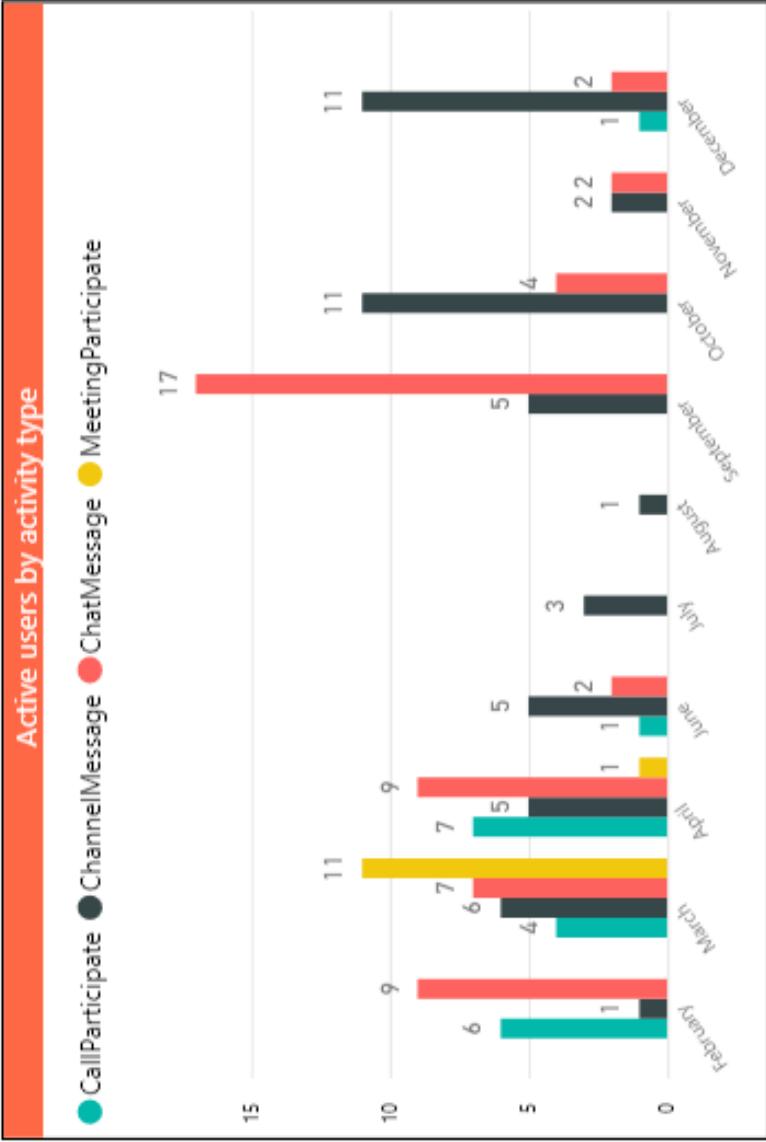
The teacher can expand the capabilities of Microsoft Teams with the help of Webex Call by installing this application and then conduct Webex voice and video calls in Microsoft Teams to organize various types of educational students' activities in accordance with the class schedule.

The Microsoft Teams Meetings application uses the LTI protocol to integrate Teams online meetings into LMS training courses. All participants in the educational process can thus view past and future events, schedule separate or recurring meetings, and also join online classes of a separate group related to the course in the LMS.

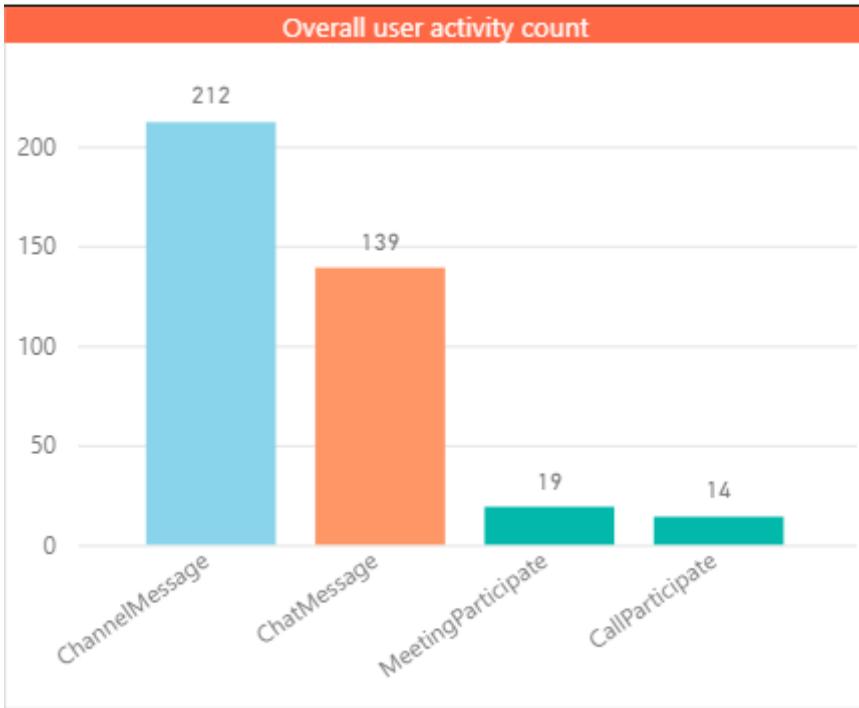
The use of tools for conducting video meetings during distance learning requires an analysis of the activity of participants in the educational process in these tools. The Microsoft 365 admin panel allows you to get information not only about the activity of all users of the platform, but also about their use of the functionality of a separate service. Analytics data in Figure 3.2.13. show the activity of users when using the Microsoft Teams service during the educational process at The National University of Life and Environmental Sciences of Ukraine for various types of activities.

Summary data on the use of the Microsoft Teams service during distance learning by participants in the educational process are available to the administrator, which allow analyzing the number of messages sent in channels (informational, meeting planning data, etc.), personal messages in chats, participation in online meetings or calls over a certain period of time (for example month, semester, academic or calendar year) (Fig. 3.2.14).

In addition to summary data, data on the use of the Microsoft Teams service during the year are available to the administrator, with details for each month, which allows to analyze the activity of users during distance learning, and to take into account to improve the effectiveness of the management of educational activities in the educational institution (Figure 3.2.15).

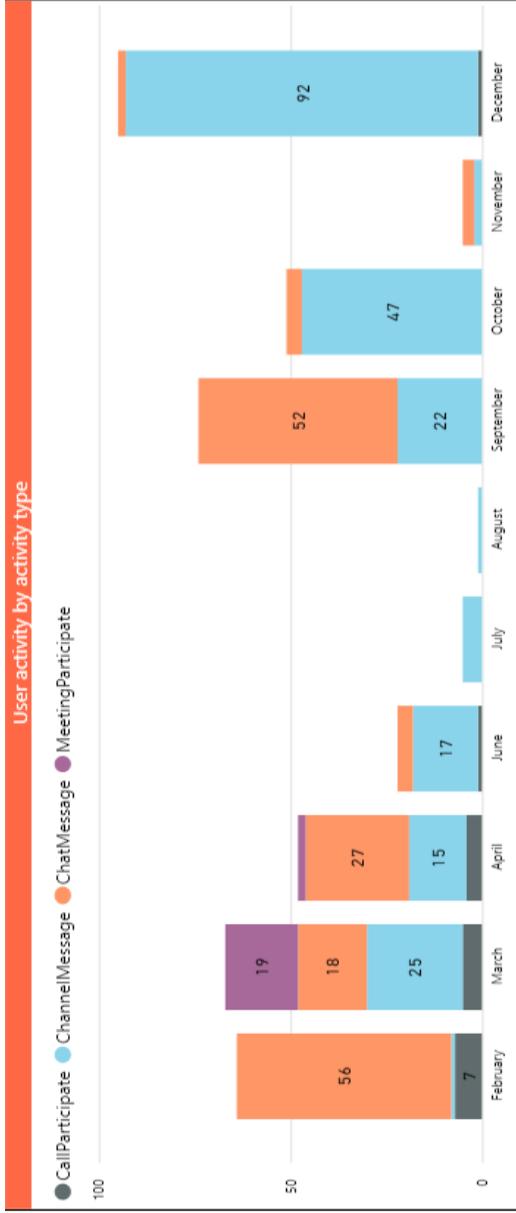


**Figure 3.2.13. User activity by activity type**



**Figure 3.2.14. Overall user activity in the educational process during a certain period of time**

Interaction with the participants of the educational process is important for the effective organization of distance learning. The use of Microsoft 365 online services for conducting classes in the format of online meetings, creating and delivering video content makes it easier to plan educational activities, ensure flexibility in learning, provide students with access to the content of the curriculum, organize the educational process remotely and expands the possibilities of virtual interaction.



**Figure 3.2.15. Activity of the participants in the educational process during each month**

### **3.3. Microsoft Teams tools for organizing asynchronous interaction between students and teachers**

In the mode of asynchronous interaction, students study a variety of educational content delivered to them according to a personally planned schedule, since teachers and students do not study online every day. Instructors provide designed instructional material, presentations, video lectures, screencasts, and assignments that students can review, work through, and complete relevant assignments within a specified period of time (a clear deadline is set for each assignment). During this time, students can participate in various discussion panels, work together on various formats of documents for completing tasks, view video instructions or relevant methodological recommendations. Instructors may host one or two online meetings per week where they address key issues around a specific topic and interact with the learning group as a whole. There can also be scheduled and configured virtual office hours by the teacher, where students can get additional advice or ask questions about completing tasks for a certain week.

Microsoft Teams is arguably an interactive tool because of its features, for instance audio, video, chat and content sharing, which allow students to do their homework assignments, quizzes, group projects, and record lectures with ease [99].

When creating different types of educational content, the teacher should focus on the skills that the future specialist should acquire in the process of learning in various types of educational activities. The main capabilities of Microsoft 365 tools for creating and delivering such content in Teams are:

- development and organization of training sessions, creation of instructions, methodological recommendations in Word, PowerPoint, Visio or Excel, delivery using OneDrive storage files or Teams tasks;
- online recording of live classes automatically stored in Stream with closed captions for students to review and pause as needed if they are unable to attend a live lecture or laboratory (hands-on) according to the class schedule;
- pre-recording of training classes with embedded survey forms for the purpose of organizing interactive cooperation with students;
- creation of interactive shared whiteboards for live interaction

and the ability to export them in PDF formats for distribution to students in a OneNote or Teams digital notebook.

A detailed description of the use of Microsoft 365 services for various types of educational activities by both teachers and students is described in Paragraph 1.3.

Using Teams for online learning, educators can deliver classes by bringing conversations, content, and apps together in one digital environment. It allows teachers to organize learning more creatively by setting spaces for collaborative work in digital notebooks, to join other colleagues in professional learning communities and to communicate with fellow teachers [72].

Embedded OneNote Class Notebooks and end-to-end task management allow teachers to organize interactive educational sessions, to provide effective and timely feedback between all participants of the educational process. Class Notebook includes a content library for sharing learning content and teacher resources with students, an interaction space where everyone can collaborate, and sections for students to complete their individual assignments and for teachers to share feedback on their work. Using Class Notebook, the teacher can organize individual spaces for each student to perform laboratory (practical) work and monitor them, while feedback is provided both with a specific student (chat) and with all Microsoft Teams tools that are learning, for example, during collective discussions. An example of joint processing of educational content placed in a space for collaboration is shown in Figure 3.3.1.

Microsoft Class Teams allows teachers to collaborate with students while integrating assignments, assessments, and various tools directly into the team they create. Such integration reduces the administrative burden on teachers and increases the efficiency and concentration of students on the management of students' educational activities.

In today's conditions, educational institutions need solutions to ensure effective joint work, taking into account mobility. Such a solution can be the use of the OneNote Online digital notebook as a tab in the "General" channel of the Microsoft Teams group together with the ability to communicate with all participants in the educational process, plan tests or module tasks for students who use the Teams environment based on OneNote Online in distance learning conditions.

**GlobalService Бюджет**

System analysis

Task

Library

Space for collaboration

Vojnovsky Vladislav

Gavriilenko Anna

Kolyadenko Ilya

Cherednichenko Geor...

Shynay Dmytro

The investor plans to invest in the creation of the GlobalService service center. The main areas of work of which are: diagnostics and repair of equipment, software installation, smartphone setup, cartridge refilling. To create such a center, it is planned to buy a space of 80 square meters, in which it is planned to place:

- management and accounting;
- department of diagnostics;
- repair department;
- testing and configuration department;
- customer service department;
- server.

The activities of the center will be provided by:

Position	Number of people
Head	1
Accountant	1
Customer Service Managers	4

**Figure 3.3.1. Collaborative development of educational content hosted in a collaborative space**

Staff Notebook is a digital educational environment for the organization of teacher professional development remotely. This service provides a personal workspace for each teacher, a content library for storing public data, a space for collaboration with other users, and a space for managers. In a digital notebook, you can place samples of visual materials with elements of video and audio content, methodological recommendations (instructions) for using the tools of the Microsoft 365 cloud platform, examples of working with these services, etc., which apply to a certain educational institution, taking into account the latest innovations with the possibility of adding new ones educational materials.

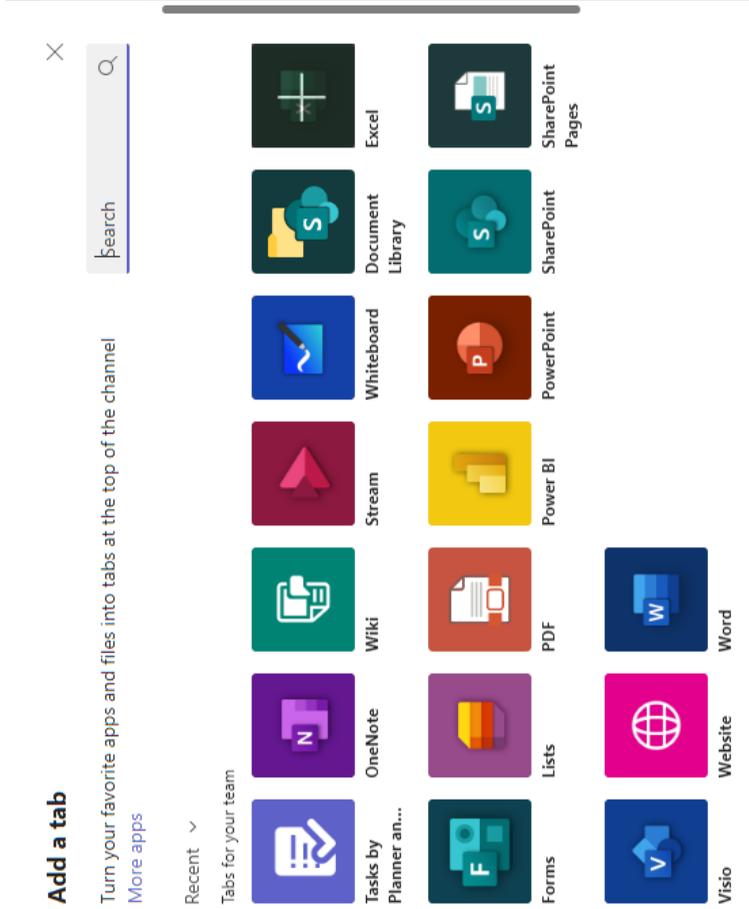
Each team and Teams channel has a separate repository that can be used to host learning content, as well as to create and process it together. In such a repository, all participants of the educational process can place the results of their work, useful materials and resources, and also work together on their creation. In this way, it is possible to create Word, Excel workbook, PowerPoint presentations, OneNote notebook, Visio drawings and Forms for Excel. The class repository additionally contains the Educational Materials directory, in which only teachers can place educational content. Students have access only to view and process posted content. An example of a repository of educational materials filled with various types of content is presented in Figure 3.3.2.

For quick access to the content that is most often used in the educational process, it can be placed in the Tabs of the team or channel. Thus, on the tab it is possible to place various types of educational content (OneNote, PowerPoint, Stream, content library, Wiki, SharePoint), areas for student collaboration (Word, Excel, PowerPoint, Whiteboard), tools for planning various types of educational activities (Lists, Tasks with Planner and To-Do), etc. Possible types of services to add to Teams tabs are presented in Figure 3.3.3.

It is possible to add a tab to the Teams channel both for collective processing and personal tabs on which all team members can work independently. One of the tabs that makes it possible to place educational materials for students to read is the Wiki tab (Figure 3.3.4), which acts as a smart text editor, using which not only teachers can place the necessary materials, but also students can work together



**Figure 3.3.2. Placement of various types of educational content in the repository of the team or channel**



**Figure 3.3.3. Possibilities to add tabs to a Teams channel or team**

The screenshot shows a Wiki page for 'System analysis'. At the top, there is a navigation bar with 'General', 'Posts', 'Files', 'Wiki', and a '+' icon. A 'Meet' button is visible in the top right corner. The page content includes a table of contents with two entries: '1. CASE toolkit of systems...' and '2. Preliminary examining...'. Below the table of contents, the main text begins with the heading 'CASE toolkit of system-object modeling and analysis'. The text defines CASE (Computer-Aided Software Engineering) as a set of tools and methods for software engineering, aimed at ensuring high quality and ease of maintenance. It lists various tools and methods used in CASE, such as modeling, analysis, and design tools, and mentions that these tools often include application software interfaces and even solution development environments. A section titled 'CASE tools are divided into:' lists three categories: analysis and modeling tools, design tools for requirements and documentation, and application modeling tools. The page concludes with a note that the most popular CASE tool is IBM Rational Rose (RBM).

**System analysis**  
Last edited: just now

**CASE toolkit of system-object modeling and analysis**

**CASE (Computer-Aided Software Engineering)** is a set of tools and methods of software engineering for software design, which helps to ensure high quality of programs, absence of errors and ease of maintenance of software products.

From information technologies, CASE tools include tools that allow you to automate certain processes of the life cycle of an IT product.

CASE is an IS design methodology, as well as a set of tools that allow you to visually model and present the subject area, analyze this model at all stages of IS development and maintenance, and develop applications in accordance with the information needs of users. Most existing CASE tools are based on structural or object-oriented analysis and design methodologies, which use specifications in the form of diagrams or texts to describe external requirements, relationships between system models, system behavior dynamics, and software architecture.

Features of modern CASE tools are graphic tools for creating models. Often, CASE tools contain tools for generating reports based on models, reengineering tools - generating models based on existing data (for example, contained in a relational database). CASE-tools often include application software interfaces and even solution development environments on their own basis.

**CASE tools are divided into:**

- analysis and modeling tools designed to create descriptions of processes and other subject areas as such;
- analysis and design tools used to manage requirements and document IT projects;
- application modeling tools (today, the most common category of such tools is the family of UML modeling tools);
- data design tools that provide data modeling and generation of database schemas for the most common DBMS.

The most popular CASE tool are: IBM Rational Rose (RBM) - a UML modeling tool. CA ERwin Process Modeler

**Figure 3.3.4. Example of delivery of educational content (Wiki tab)**

on different sections of the same document. In this way, the teacher can manage the work of students in the Wiki in asynchronous mode and monitor their activity and, accordingly, the results of the activity.

To discuss posted materials or work results, the teacher and students can start a conversation on each Wiki page in which to send a comment, emoji, sticker, request for material approval, attach a file, and also link to the video content posted in Stream. To maintain communication between all participants of the educational process in Teams, the chat on the Team Posts tab is key. The teacher can send short notes to students, attach files with educational content, add links to external resources for additional processing of the material, @address mention, start a communication chain or even react using emotions to quickly and effectively establish communication. In addition, the changes made in the command, such as an added tab or a posted task, will be automatically placed in the chat (Figure 3.3.5). The chat function allows direct messages, group chats and conversations in channels to be used by all participants in the educational process. The chat also has a search function that will help you track previous conversations by keyword and message types, such as unread messages, likes, messages with address mentions, or replies. Students can save chat messages to return to later to revisit the content presented. If there are students in the study group who need individual counseling, the teacher can start a private chat with this student at any time.

To organize distance learning, on the one hand, it is necessary to have modern learning tools, access to cloud services within corporate accounts, and on the other hand, the need to create effective digital learning spaces for teachers, technical specialists and administration of various educational institutions. One of these solutions is Microsoft Viva, which takes into account three main aspects of work in modern conditions: collaboration, learning and well-being of all participants in the educational process. For Microsoft Teams, the Viva Learning application is a learning center where participants in the educational process can search, share, assign and learn using the best content libraries in the institution, which are configured by the administrator of the respective educational institution (Figure 3.3.6). If necessary, the administrator of the educational institution can connect additional content repositories of the Viva Learning application, that is, connect

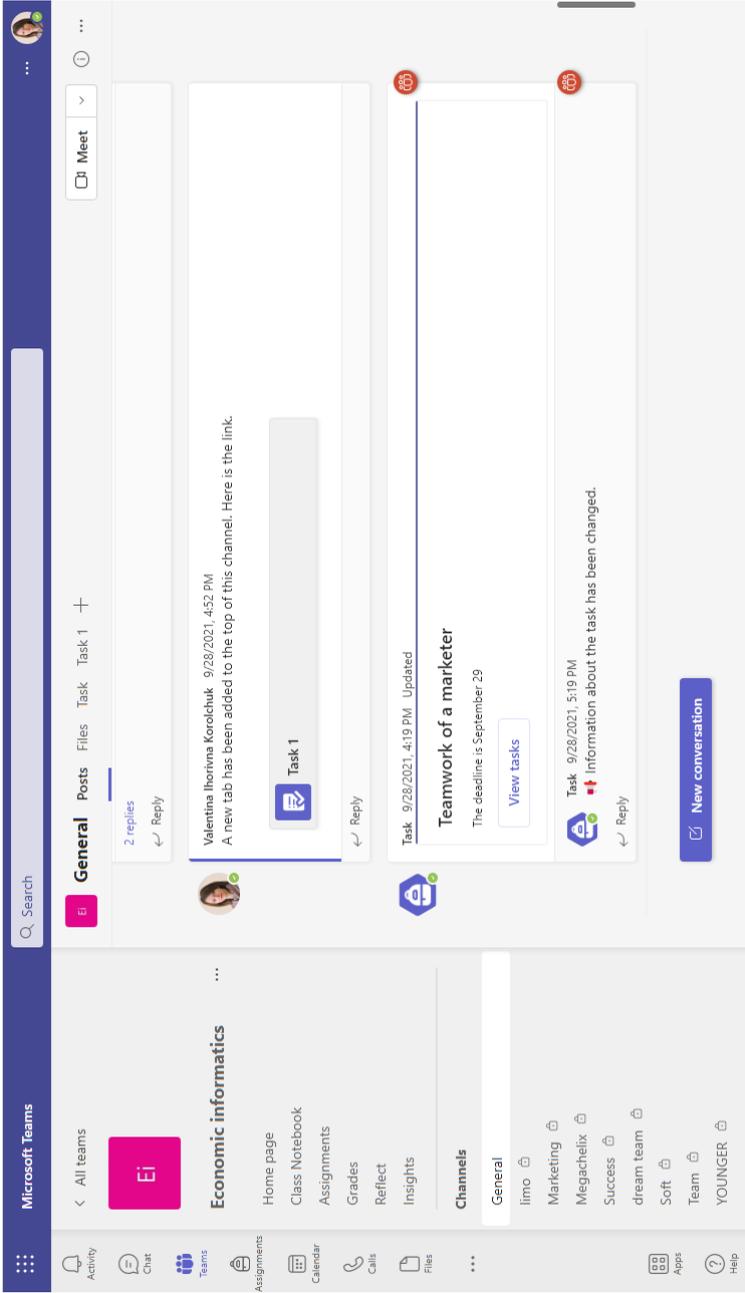
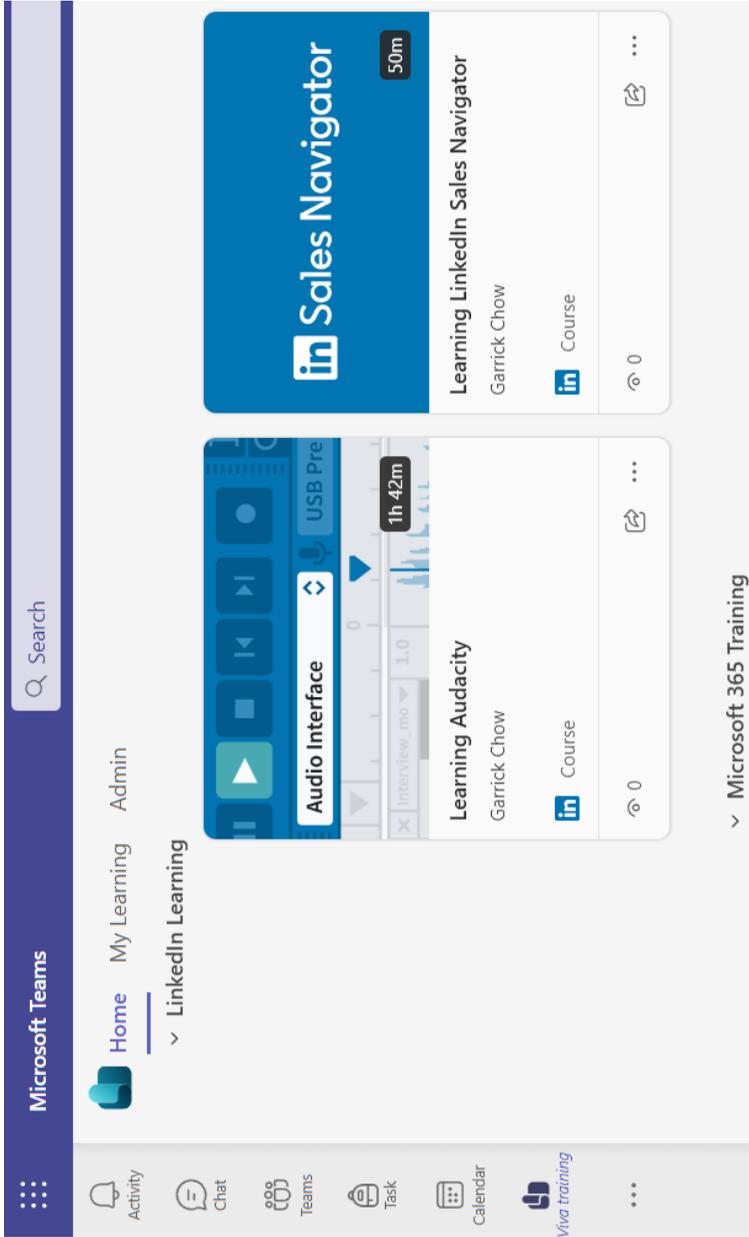


Figure 3.3.5. Display of created tasks in Teams posts



**Figure 3.3.6. Example of a Viva Learning home page**

various educational materials of the educational institution, which are contained in the folders of the SharePoint document library.

Microsoft Viva, based on the functionality of Teams and Microsoft 365, generally promotes the continuous self-development of both teachers and students. Microsoft Viva consists of four modules: Viva Connections, Viva Learning, Viva Insights and Viva Topics.

For the classic Teams program, the Viva Connections solution (connections) enables all participants in the educational process to find the necessary information, sites and news in the intranet of the educational institution directly from the Microsoft Teams program panel. That is, Teams users can go to intranets, such as SharePoint sites, pages and news, and share content.

Viva Learning in Microsoft Teams provides access to all participants of the educational process to a personal presentation of the educational content of the educational institution and other providers of educational content, for example, LinkedIn Learning. In this way, teachers can recommend and assign e-content to the groups they work with within the educational disciplines, which is constantly updated.

Viva Insights provides all participants in the educational process with recommendations to improve their productivity:

- constantly stay in touch with participants during joint work;
- plan time for productive work and interaction with other participants in the educational process;
- send appraisals to students in Microsoft Teams chats to increase their motivation;
- conduct reflection among students of study groups to improve the quality of presentation of educational content;
- take a break from various types of educational activities by watching special video content;
- plan the distribution of tasks among students and set clear deadlines for their completion.

Viva Topics uses Microsoft AI (artificial intelligence), Microsoft 365, Microsoft Graph, Search, other components and services. Artificial intelligence is used for automatic search and identification of topics used in a certain educational institution.

After defining the course goals and creating the necessary content

according to the curriculum, teachers need to focus on the channels of delivery of such content to students, as well as develop interactive elements of interaction with it. In the created digital environment of Microsoft Teams, the teacher can plan and organize various tasks for students, while receiving data showing how the participants of the educational process interact in the group, including completed tasks, indicators of their activity and evaluations.

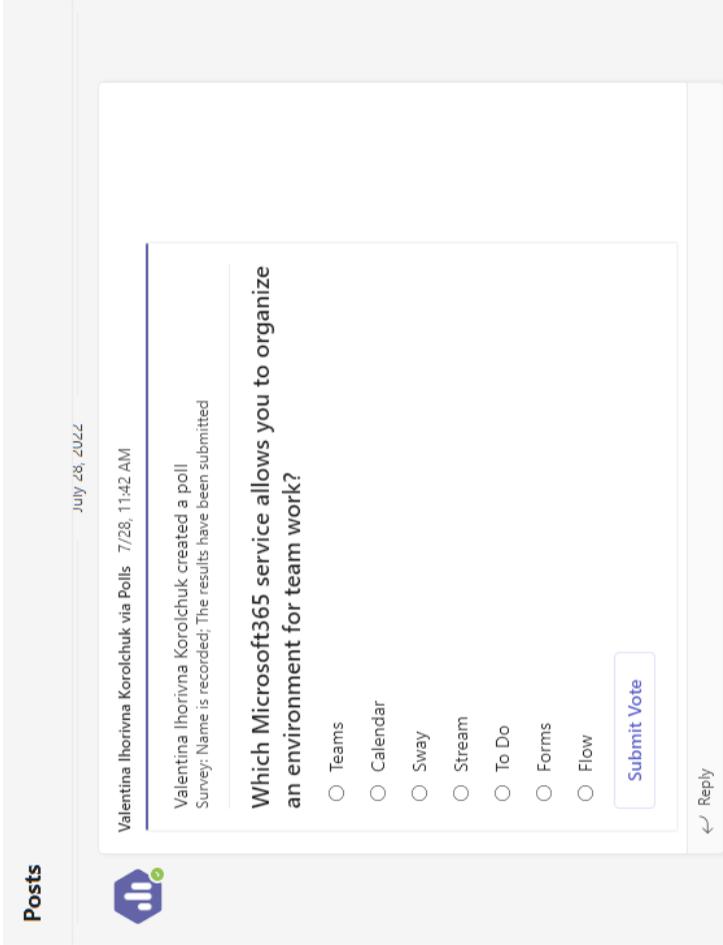
To study the material during asynchronous classes, teachers can record video instructions and screencasts. To increase student engagement, educators can add interactive content such as form-based quizzes or quizzes to a video by uploading it to Microsoft Stream.

For better assimilation of the material by students, during remote classes in synchronous mode in Teams, teachers can involve students in:

- expressing their own thoughts, asking questions and discussing problematic situations;
- taking a short Teams survey or testing your knowledge with a Forms quiz;
- discussion or working out the concept of solving a problem situation;
- discussion in groups of various educational material presented by the teacher;
- using simple emojis in the chat window to demonstrate the level of understanding of the material presented.

One of the options for involving students in class activity, as well as checking the level of mastery of the presented topic, are surveys, which can be created immediately in Teams using Pools or using the Forms service.

The Pools tool allows the instructor to create polls, quizzes, and word cloud polls both before and during the meeting, and to view student responses in real time. The teacher can create such a survey, send it in chat or to students during an online class, and also show the results to students. An example of a survey created using the Pools tool is presented in Figure 3.3.7.



**Figure 3.3.7. An example of conducting student surveys using the Pools tool in the Teams environment**

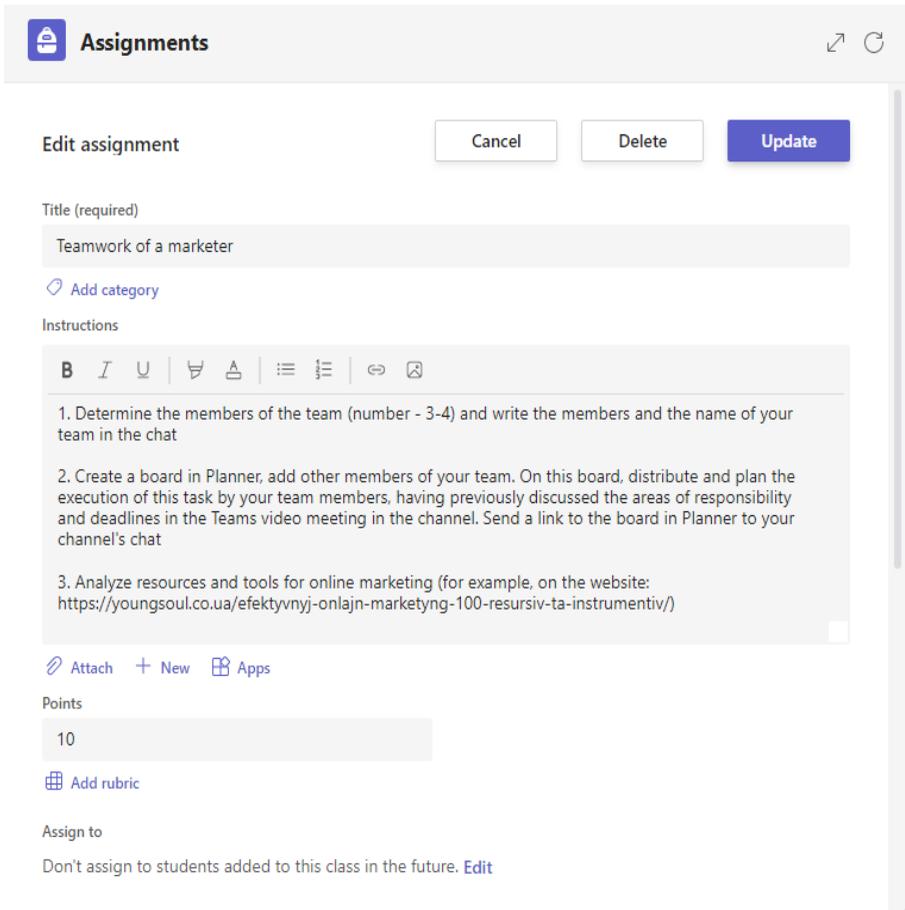
Another option for conducting such student surveys is the teacher's use of the Forms tool, which can also be attached to the team's posts. More details about conducting surveys (reflections) of students using this tool are described in the Paragraph 1.3.

Organization of laboratory, practical, independent work, as well as conducting formative and control assessments is possible using Tasks in Teams. The teacher can create both assignments and Q&A sessions, as well as manage the assignment schedule, instructions, add resources for submission, assign grades according to criteria, and more. When a task is created, it is possible for the teacher to post instructions for its implementation, attach files with educational materials for processing, create files for collective filling, set the number of points and assessment criteria, set deadlines, as well as select teams and students within them for which the task will be assigned this task (Figure 3.3.8).

An important element of task placement is the setting of their display parameters, which include the selection of a channel and calendars for task publication, as well as submission notifications upon completion of the due date. Tasks in the form of a test are created on the basis of the Forms service, using which the teacher can both create a new survey and attach an already created one. More details about creating surveys in Microsoft Forms are described in Paragraph 1.3.

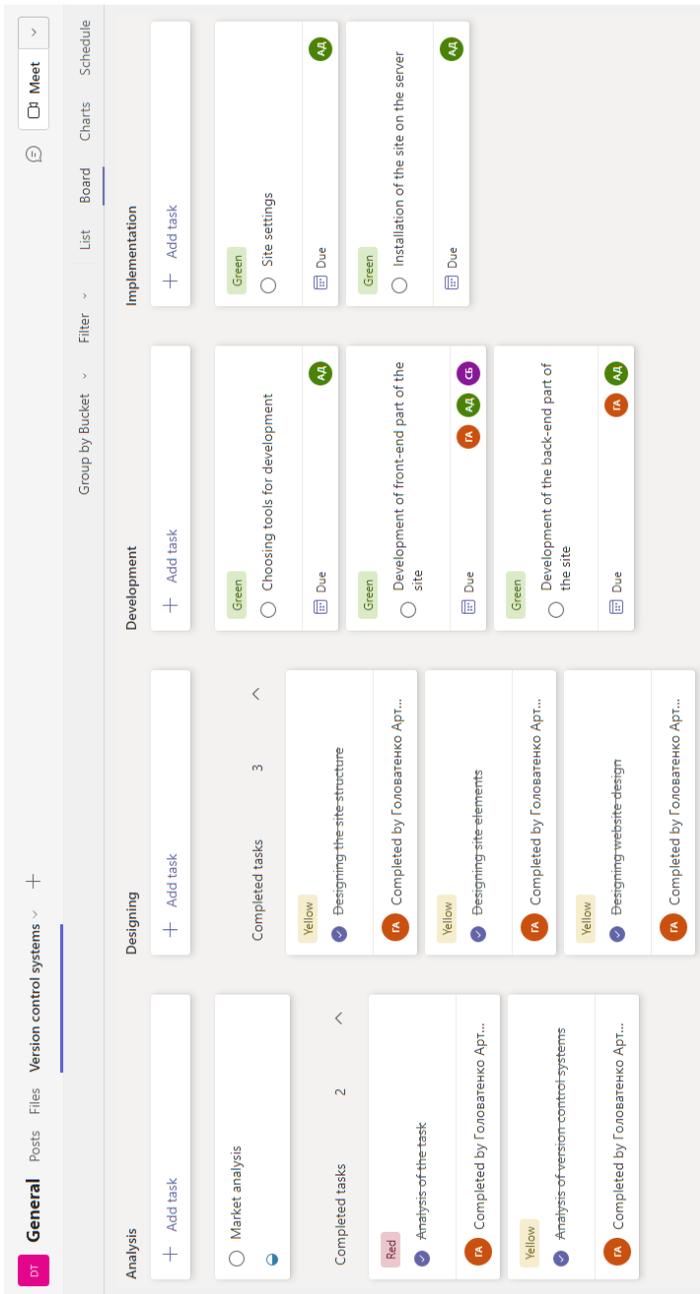
Information about the created and posted tasks is published in the posts of the channel in the form of announcements, and is also placed in the calendar of each student. In this way, all students can see changes in tasks, as well as plan their implementation, taking into account the deadlines set by the teacher.

When working with complex professionally-oriented or collective tasks, students need to independently plan and divide the execution of such a task into separate tasks, which can be done using Tasks with Planner and To Do. Tasks makes it easy to organize all the tasks in Planner and To Do, because it allows you not only to create tasks, but also to assign and track the completion of tasks individually or together with your team and view everything in a single location (Figure 3.3.9).



**Figure 3.3.8. Creating Tasks in Teams**

Using the Insights application in Microsoft Teams by an educator, filling it with data, it is possible to receive analytical information about student activities, that allows analyzing joint work in groups, which are the main indicators of the interaction of participants in the educational process. The report on digital activities in Insights shows the activity of students in Teams during a certain period of time, the educator can see the level of activity of each of the students in the digital environment.



**Figure 3.3.9. Planning the execution of a collective task in Tasks with Planner and To Do**

*Assignments and grades* in Insights allow a teacher to identify support needs and track student learning by reporting average and grade distribution, assignment status, and more. All the data received by the teacher can be organized at the level of the learning group, by individual students or based on tasks, which helps to adapt the strategy of teaching, creating and delivering different types of content according to the learning styles of students.

Getting started with *Data Mapping in Insights* helps students identify and navigate emotions, share them, and be heard among participants in the educational process. Reflexivity can help expand each student's emotional vocabulary and deepen empathy for their colleagues, as well as provide valuable feedback to teachers. Research shows that teaching students taking into account their social and emotional skills improves the academic and behavioral performance of each participant in the educational process, which in the future has a positive impact on the conduct of professional activities.

With the *Communication Data report in Insights*, an educator can see how students communicated with each other, engaged in conversations with posts, replies, and reactions. The progress status allows the educator to see how many students are at each stage of completing tasks and check where they need some advice or reminders about deadlines. If the educator chooses a yellow or red segment of the diagram, only those students who still need to complete this stage of the task will be displayed. The educator can also choose the name of any student and send him a reminder message accordingly. The interaction of students in the Teams digital environment, the educator can monitor their communication activity, in which information is available on the total number of posts, replies to them, sent reactions, and also view such activity by day for a certain period of study: week, module, semester, etc.

An educator, checking the completed tasks of the students, has the opportunity to add files to the feedback to achieve constructive feedback and add a personal video with a comment. In such videos, the teacher can note the positive results of the task and offer students to use the educational materials from the attached files to clarify the answers to the task. Such videos will be available for students to view and download on their own devices and will be stored in the Microsoft Teams SharePoint site library. On the "Assessment" tab, the teacher

evaluates students' work and can further monitor the success of study groups in general or of each student individually (Figure 3.3.10).

With the help of the Thanks function, the teacher can add badges to congratulate each of the students of the study group on certain successes, to express gratitude for active participation in completing tasks. Such achievements and corresponding thanks can be seen by all students of the study group.

Another option for interaction in the educational process can be in the form of quick questions and answers using a bot. In the Microsoft Teams ecosystem, all bots are built using the Microsoft Bot Framework. The Teams App Studio tool allows you to create a bot, deploy it, upload it, or send it to the Microsoft Teams team for review and addition to the store. It is also possible to organize the forwarding of messages between Telegram and Microsoft Teams using Power Automate, namely to set up a two-way exchange of text messages between these services. Thus, a message sent to the Telegram chat or to several different chats will be sent to the Teams chat, in turn, messages from the Teams chat will be forwarded to Telegram. This is also relevant in modern conditions, as teachers and students actively use Telegram channels for communication (Figure 3.3.11).

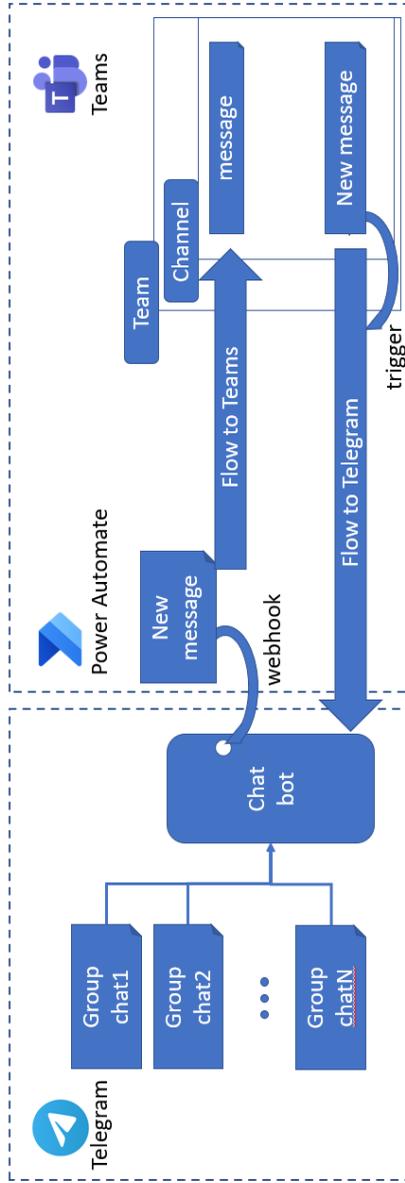
A new tool for collaboration in Microsoft 365 is Microsoft Loop, which consists of three separate elements: Loop components, Loop pages, and Loop workspaces (Figure 3.3.12).

Loop components, which are focused on the joint work of participants in the educational process, are available in Microsoft Teams. In the Teams chat, the teacher can add Loop components for instant changes by students for collaborative interaction (bullet and checklist, table, task list and division). Such components are automatically saved in the OneDrive storage as a file with the extension ".fluid." Loop components can be applied in various Microsoft Teams chats and by linking to a file from the Microsoft 365 home page. The Microsoft Loop component can be used both synchronously and asynchronously. In this case, teachers are focused on the information of the tasks of a particular day, and not on the issues of using Microsoft Office files and choosing tools for joint work, that is, the main work of the participants of the educational process is carried out in the single educational space of Microsoft Teams. Loop pages are a single, flexible canvas on which teachers can host different

The screenshot displays a Microsoft Teams interface for a 'Grades' channel. The top navigation bar includes a search bar, a 'Grades' icon, and filters for 'Due before May 15, 2018' and 'Since class creation'. Below the header is a table with columns for 'Search students', 'Presentation of project results', and 'Investment attractiveness of'. The table lists students and their scores: Анатолий, Ба... (95), Андрей, Гриб... (82), Володимир, ... (Viewed), Денис, Скри... (74), and Олександр, ... (82).

Search students	Presentation of project results	Investment attractiveness of
Class average		
Анатолий, Ба...	95	80
Андрій, Гриб...	82	Viewed
Володимир, ...	Viewed	Returned
Денис, Скри...	74	Returned
Олександр, ...	82	84

Figure 3.3.10. An example of a journal of student assessments within the study group



**Figure 3.3.11. Text messages exchange between Telegram and Teams**



## Elements Microsoft Loop

### components Loop

building blocks that help you interact and get work done in a chat, email, document, or loop page:

- lists;
- notes;
- tables;
- task

### pages Loop

flexible canvases on which to organize components and use other useful elements to help the team communicate, interact and collaborate:

- files;
- link;
- data

### workspaces Loop

shared spaces that allow the team to see and group everything important to the project:

- what everyone is working on;
- respond to the ideas of others;
- track progress in achieving common goals

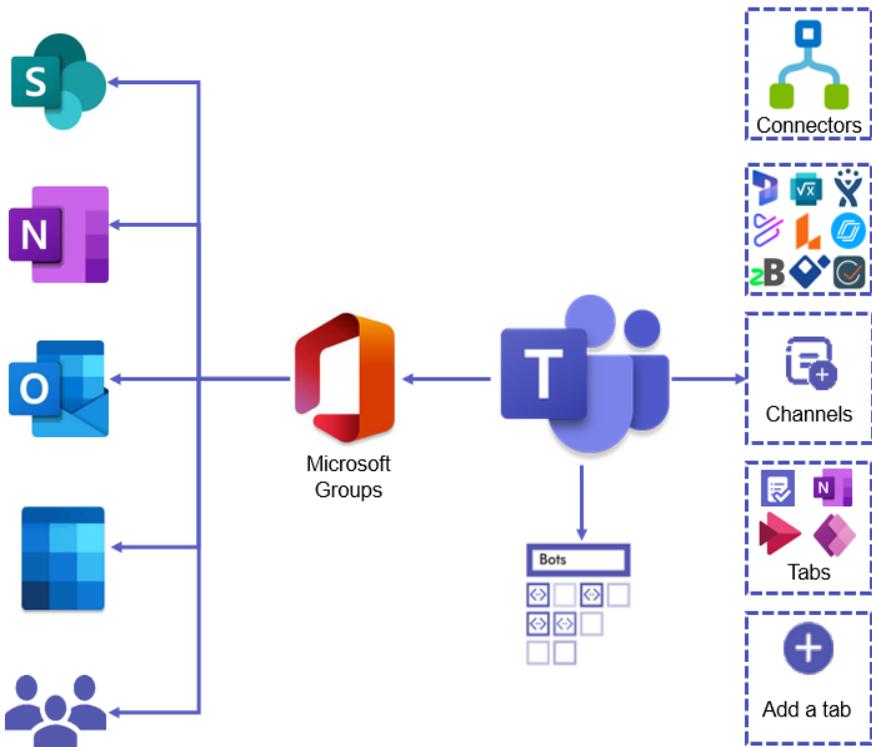
cooperation: synchronous and asynchronous

Figure 3.3.12. Microsoft Loop Components

learning content (files, links, and data), and workspaces can be used to collect all materials related to a specific learning discipline or project.

Thus, the organization of distance and mixed learning is aimed at ensuring that the participants of the educational process can quickly complete common tasks from any device, and receive various educational content due to the Microsoft Loop components.

The created digital environment based on Microsoft Teams is also called a learning hub, which includes components of the Microsoft 365 group and created channels for managing learning activities. The structure of such an educational hub based on Microsoft Teams is presented in Figure 3.3.13.



**Figure 3.3.13. The structure of the educational hub based on Microsoft Teams**

Microsoft 365 groups allow you to integrate into MS Teams Hub such components for the communication of participants in the educational process as:

- email – for sending and receiving mail with members of the environment;
- joint calendar – for planning events related to participants of the educational process who cooperate in the same environment;
- the SharePoint document library – a central place for storing educational content and sharing files;
- OneNote shared notebook – for collecting ideas, research data and information;
- the SharePoint group site – a central repository of information, links, and content related to educational activities;
- contacts – for managing the contacts of participants in the educational process.

The structuring of educational content takes place by distributing it to separate sections of the team (channels). The functionality of the channels can be expanded with the help of connectors and applications. Connectors act as an interface to integrate into the Teams learning hub of other services in or outside of the Microsoft Cloud and place them in channel tabs. In Teams, the teacher can integrate such support programs as Dynamics 365, Math, Jira, Powtoon, Nearpod, Lucidchart, zipBoard, Skillsoft Percipio, LMS365, Kahoot, Pear Deck, Polly or Flipgrid and others. Creating a distance learning environment, which is based on a dynamic and flexible tool, will help reduce cognitive load, and due to the integration of tools, ensure work with educational content in this environment throughout its life cycle. The teacher can also connect various add-ons for Microsoft 365 cloud services in the Teams environment, one of which is the Pear Deck add-on for PowerPoint, which allows you to make interaction with students more active, in particular, turn static presentations into interactive ones.

Educational institutions usually have learning management systems, the most popular of which is the Moodle open source system. This system can also be integrated with Microsoft Teams, which is confirmed by the experience of many universities. M. Krasna and I. Pesek describe the experience of using Moodle and Microsoft Teams in two universities in Poland and Slovenia. In the study, the authors provide examples of online courses and analyze how the studied

systems are combined to improve the results of the presentation of educational material. The integration of Moodle and Microsoft Teams allows you to get a well-structured and administered course based on the Moodle platform, as well as enhanced opportunities for collaboration and communication between participants in the educational process using the Microsoft Teams digital environment.

The use of standard Moodle and Microsoft 365 tools complement each other's learning system in distance education, as such integration helps teachers and students work together on educational content on the Moodle platform, as well as communicate and interact immediately in the Teams digital learning environment. For this integration, the educational institution administrator needs: a Moodle administrator account and an Azure Active Directory, as well as an appropriate Azure subscription in which resources can be created. The integration of Moodle in Microsoft Teams is based on the open source code of the Moodle module. The data flow diagram of the Moodle tab for Microsoft Teams is shown in Figure 3.3.14. Details are described in the Moodle documentation [26].

There is also the option of using the free Moodle bot assistant for Microsoft Teams, which allows teachers and students to answer questions about e-learning courses, assignments, assessments and other Moodle resources. This bot also sends Moodle messages for all participants of the educational process directly to the Teams environment (Figure 3.3.15). This bot is an open source project available on GitHub.

Using the Microsoft Teams platform in the educational process, the administrator of the educational institution, having access to the administration panel, can analyze the activity of users over a certain period of time, their use of channels or devices, providing teachers with exported data of analytics of the use of the Microsoft Teams service, in order to adjust the educational activities of students in system of hybrid (distance) education. Analytical data allow to analyze not only the activity of users during the educational process, but also the devices with which they have the opportunity to connect to educational classes and process educational content placed in the designed environment of Microsoft Teams.

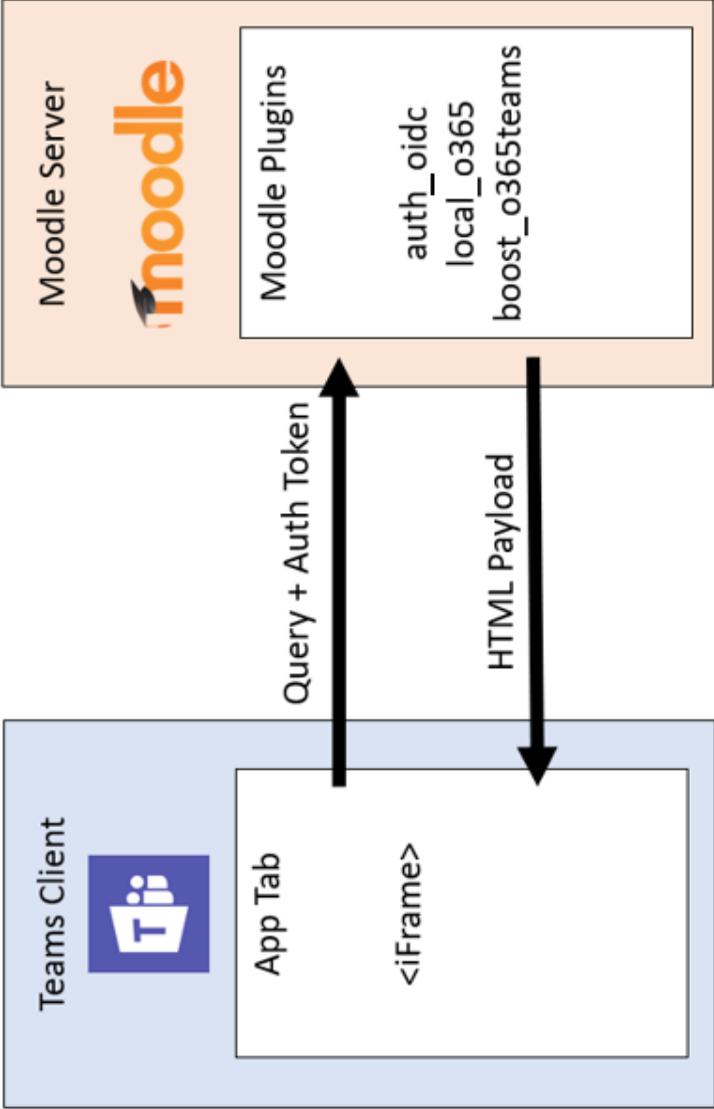


Figure 3.3.14. Moodle tab data flow for Microsoft Teams [93]

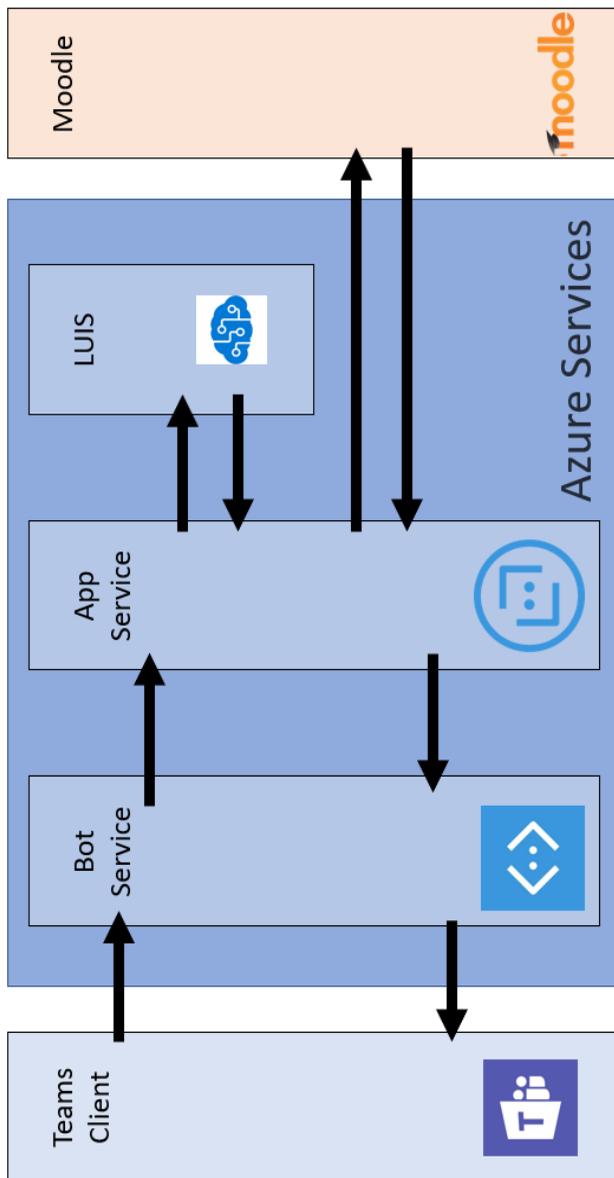


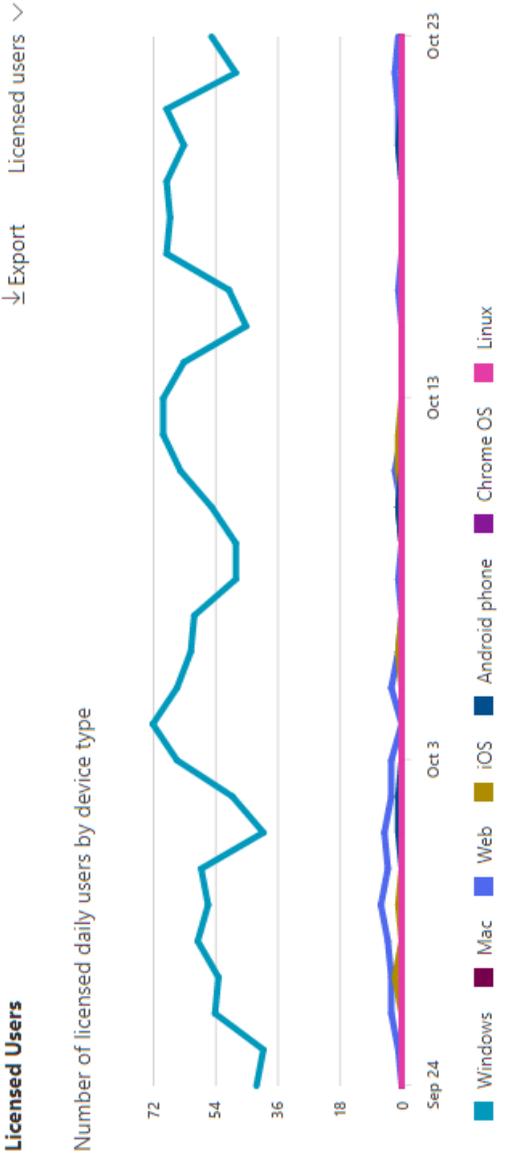
Figure 3.3.15. Moodle bot data stream [93Ошибка! Источник ссылки не найден.]

Analytical data in Figure 3.3.16 show the use of the Microsoft Teams service during the educational process at the National University of Life and Environmental Sciences of Ukraine from various devices and operating systems.

In the process of using such educational environments with the help of the administrator panel, it is possible to analyze the actions of the participants of the educational process in the channels of the educational environment designed in Microsoft Teams. In this way, the administrator can view the number of active channels, active users in each channel, as well as the messages they exchanged while interacting in the process of distance learning during various types of educational activities. The report of channel usage activity by action type during a certain period is presented in Figure 3.3.17.

In addition to the administrator, every teacher who designs a learning environment in Microsoft Teams for hybrid distance learning can monitor the activity of users in such environments. The teacher can analyze the activity of students during educational activities in the analyst section for each team, or by connecting Power BI in general for all educational environments. Using Power BI, the teacher can monitor both his own and student activity in all educational environments in general (Figure 3.3.18).

In this way, an opportunity to analyze the activity of participants in the educational process is available for the administrator and teachers.



**Figure 3.3.16. Using the Microsoft Teams service during distance learning by device type**

# Microsoft Teams

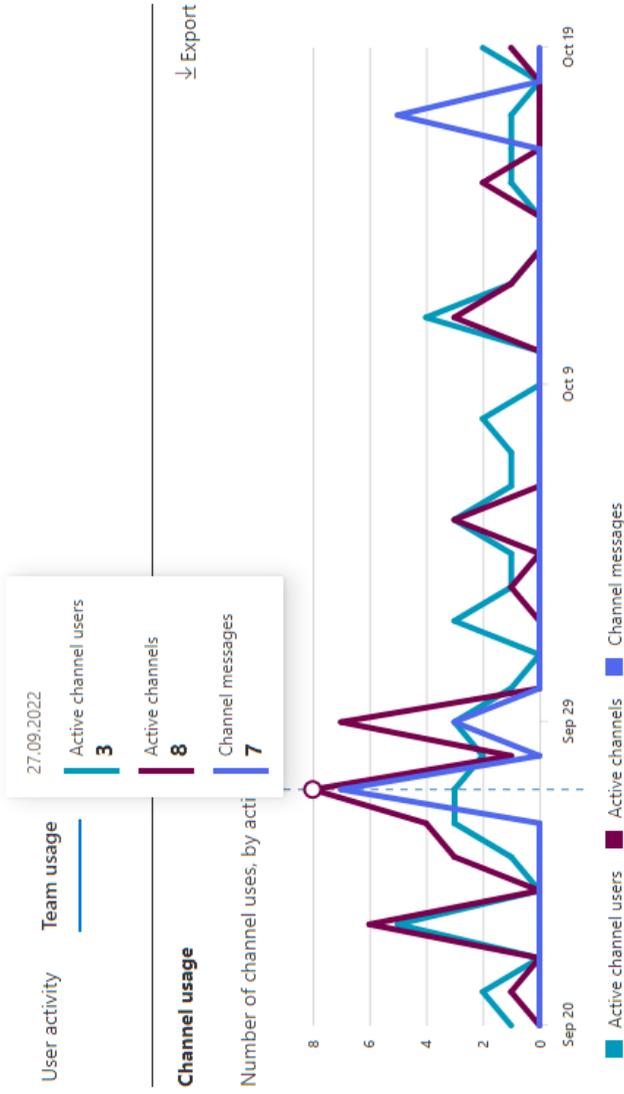


Figure 3.3.17. Channel usage activity report by action type during a certain period

Team name	Posts and replies last 7 days	Active users	Guests	Active channels	Total Posts	Total Replies	Meetings organized	Days without active users	Days without posts or replies
AmbiSelf	0	6	0	1	7	2	0	78	87
Ben Team	0	13	0	2	3	5	0	83	89
BIODIGITAL	0	4	0	1	0	0	0	87	90
BRIGHT HOUSE	0	11	0	1	1	0	0	53	89
Dream Team	0	1	0	1	0	0	0	59	90
Finacom (НП)	0	9	0	1	0	2	1	84	88
RainbowTeam	0	1	0	1	0	0	0	89	90
Retable	0	9	2	1	0	0	0	85	90
Sabotage	0	12	0	1	1	0	0	80	89
AT&B	0	2	0	1	0	0	0	88	90
Група №1 Навчальна Практика	0	12	1	1	3	0	0	81	88
Економічна інформатика	0	2	0	4	0	0	0	27	90
Колективна робота	0	9	0	1	18	1	0	51	87
Коллективный проект з НП	0	3	0	1	4	12	0	87	89
Команди для практичного заведення	0	8	0	1	1	0	0	85	89
Команда робота Екк+ЦЕ	0	8	0	4	0	0	0	74	90
Міждисциплінарний проект	0	1	0	1	0	0	0	88	90
Мікрочеліки	0	4	0	1	0	0	0	68	90
НП ІТ команда	0	14	0	1	0	0	0	77	90
Практика	0	1	0	1	0	0	0	89	90

Figure 3.3.18. Student activity in Microsoft Teams learning environments

## **CHAPTER 4. THE EXPERIMENTAL STUDY OUTCOMES OF THE EFFECTIVENESS OF USING MICROSOFT 365 SERVICES IN THE EDUCATIONAL PROCESS**

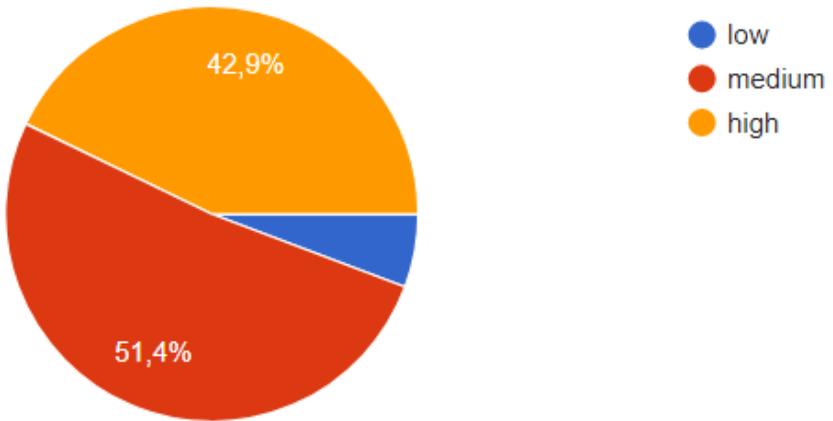
### **4.1. Organization of the experiment and outcomes of using Microsoft Teams for e-learning**

Within the framework of the study, a survey was conducted for the pool of 193 students of the NUBiP of Ukraine majoring in “Software Engineering”, “Computer Science”, “Computer Engineering” and “Cyber Security”, who used Microsoft Teams to organize various types of educational activities during distance learning. The survey (<https://forms.gle/jzytroGSQLFiEDwm8> application) was developed to assess the possibilities of working with various types of educational content during distance learning in the Microsoft Teams environment. During the survey, students rated the possibility of working with each type of educational content in this service by three levels: low, medium and high. A low level corresponds to the minimum ability to create, post and work with a certain type of educational content. The average level indicates the presence, but not sufficient functionality for creating, posting and working with a certain type of educational content. The high level provides full functionality for creating, posting and working with a certain type of educational content using this tool for distance learning.

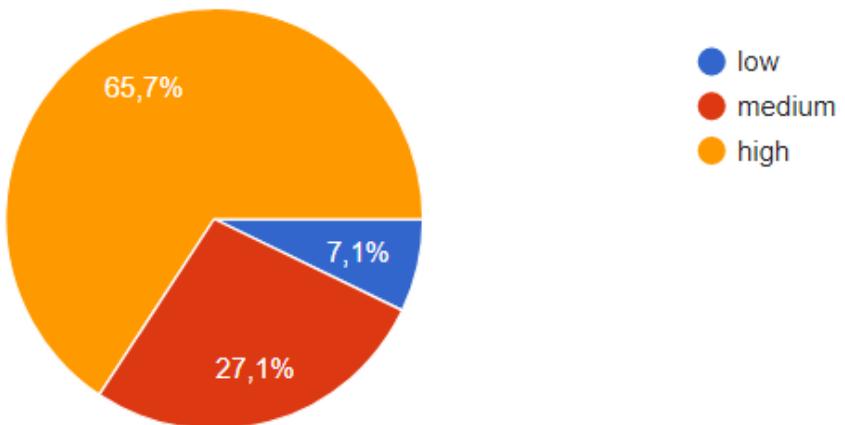
Evaluating the possibility of creating, filling, placing and working with e-books, 94.3% of students noted a high and average level of Microsoft Teams for working with this type of educational content (Figure 4.1.1).

65.7% of students assessed the possibility of creating, hosting and working with presentations, including interactive ones, at a high level, 27.1% – at a medium level, and only 7.1% – at a low level, which indicates that students are adequately provided with this type of educational content during various types of educational activities (Figure 4.1.2).

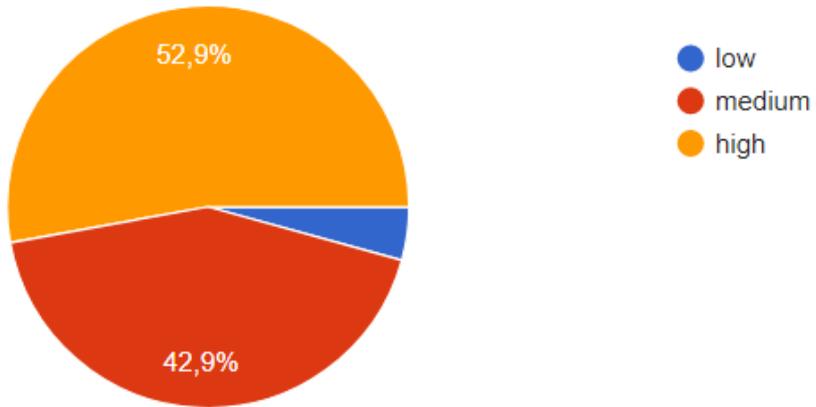
In addition, 52.9% of respondents highly appreciate the possibility of integrating additional resources and creating various types of interactive content via them (Figure 4.1.3). 42.9% estimate the possibilities of integrated additional resources at an average level, the other 4.2% – assessed at a low level.



**Figure 4.1.1. Survey results: the ability to create, fill, host and work with e-books in Microsoft Teams**

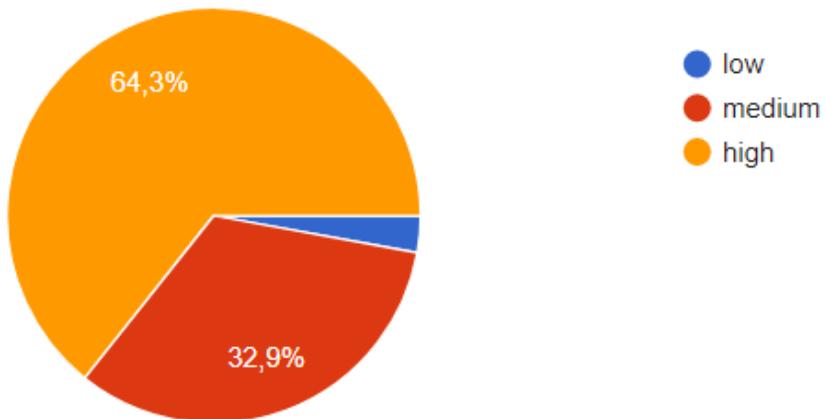


**Figure 4.1.2. Survey results: the ability to create, host and work with presentations in Microsoft Teams**



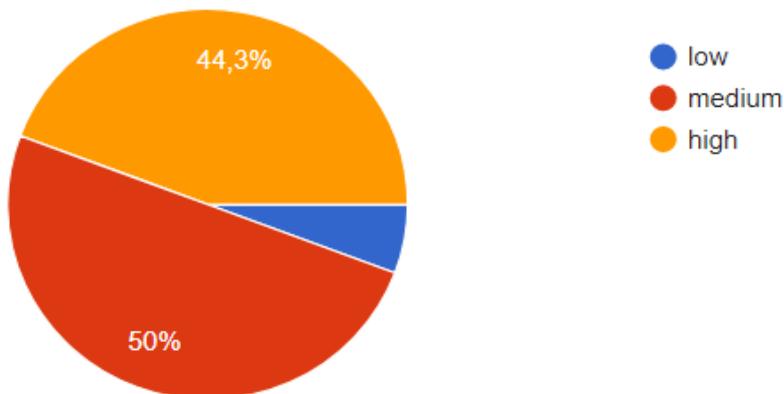
**Figure 4.1.3. Survey results: the possibility of integrating additional resources and creating various types of interactive content in Microsoft Teams**

An important element of the educational process, including during distance learning, is the organization of surveys and assessment of students' level of mastery of the material by conducting tests. Evaluating the possibilities of creating surveys and tests in Microsoft Teams, 64.3% of students noted a high level of such functionality (Figure 4.1.4).



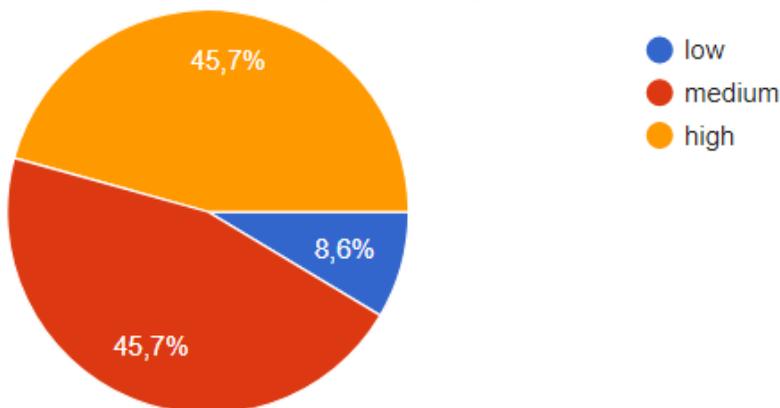
**Figure 4.1.4. Survey results: the ability to create surveys/tests in Microsoft Teams**

44.3% of surveyed students noted a high and 50% - an average level of capabilities of Microsoft Teams for creating additional web pages for joint work, sending results or feedback (Figure 4.1.5).



**Figure 4.1.5. Survey results: the ability to create additional web pages for collaboration, sending results or feedback in Microsoft Teams**

In distance learning, it is important for students to use educational content that will allow them to revise the received educational material in the form of video recordings. According to the data of Figure 4.1.6, 45.7% of respondents highly appreciate the capabilities of Microsoft Teams for recording, hosting and working with video content.



**Figure 4.1.6. Survey results: the ability to record, host and work with videos in Microsoft Teams**

Thus, with the use of Microsoft Teams, educational activities can be varied with the help of the provided capabilities of the offered cloud services, such as conducting video conferences, online quizzes, creating and delivering various types of e-content, assigning tasks to students, in particular using this tool, so such a type of learning is not much different from face-to-face training in the classroom, since it is implemented in a separate room and virtually.

#### **4.2. The results of assessing the effectiveness of Microsoft 365 services use for managing the educational activities of students**

To evaluate Microsoft 365 services for distance learning, a survey was developed (<https://forms.gle/MQ1SFivkABufx9WF8>) and 221 experts were involved, 28 of them are faculty who have practical experience in organizing various types of educational activities using appropriate tools and 193 students studying Computer Science, Software Engineering, Computer Engineering and Cyber Security. These teachers, respectively, underwent advanced training during 2020-2022, namely, on the use of various tools for distance education, one of the topics was “Microsoft 365 services for managing students’ educational activities.” Students studied the possibilities and practical application of Microsoft 365 services as part of studying the Information Technologies academic discipline during the 2nd academic semester, which is provided by the syllabus of the academic discipline. Microsoft 365 services were evaluated according to four developed criteria:

- (1) **management:** the effectiveness of using planning tools in Microsoft 365 for planning educational activities (timetable, distribution of tasks, etc.); the possibility of managing educational activities (planning classes, conducting classes, providing resources, organizing independent work, monitoring) using Microsoft 365 services; the ability to monitor user activity in real time using Microsoft 365 services; the ability to monitor progress on various types of educational activities using Microsoft 365 services;
- (2) **functional-technological:** availability and mobility of Microsoft 365 services; privacy of Microsoft 365 user data; the possibility of integrating additional services to expand the functionality of Microsoft 365; the ability to control access to

Microsoft 365 services and resources; the possibility to organize collaboration environments using Microsoft 365 services;

– (3) **communicative:** the possibility of establishing various types of online communication (audio/video or visual), using Microsoft 365 services; the possibility of planning and organizing joint work in real time using Microsoft 365 services; the possibility of sharing various types of educational content using Microsoft 365 services;

– (4) **content:** the possibility of creating various types of educational content using Microsoft 365 services; the possibility of combining (integrating) different types of content for better achievement of educational goals using Microsoft 365 services; the possibility of placing educational content in digital educational environments using Microsoft 365 services.

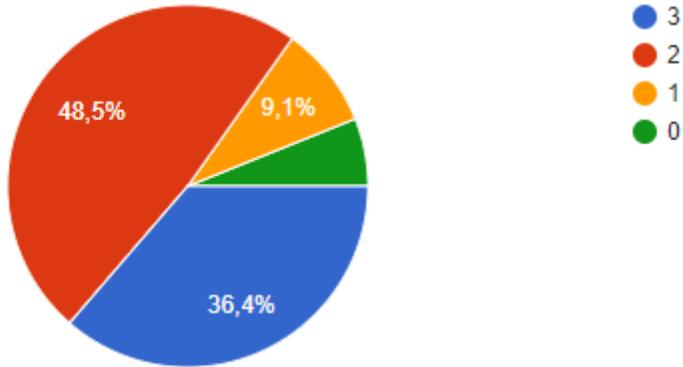
The rating scale ranged was from 0 to 3, namely:

- 0 points – the indicator is not manifested;
- 1 point – the indicator is more non-manifested, than manifested;
- 2 points – the indicator is more manifested, than non-manifested;
- 3 points – the indicator is fully manifested.

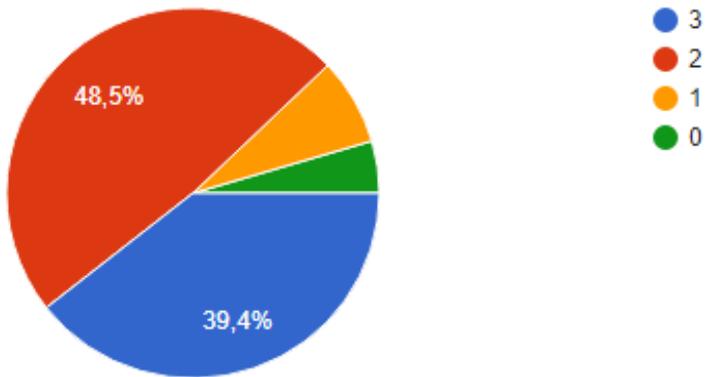
Analyzing the answers of the respondents according to the management criterion, namely the effectiveness of the use of planning tools in Microsoft 365 for planning educational activities (timetable, distribution of tasks, etc.), we see that 84.9% of the respondents assigned 2 and 3 points, which shows that this indicator is fully manifested. The other 15.1% scored 0 and 1 points, respectively, as shown in Figure 4.2.1.

87.9% of students and teachers positively assessed the possibilities of Microsoft 365 services for managing educational activities, which includes: planning classes, conducting classes, providing resources, organizing independent work, control, which indicates a high degree of manifestation of this criterion (Figure 4.2.2).

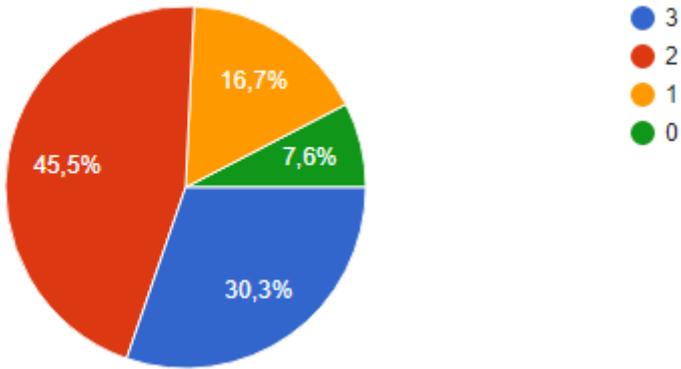
The results of the assessment of the ability to monitor user activity in real time demonstrate a high degree of manifestation of this criterion, since 30.3% of respondents noted this indicator as fully manifested in Microsoft 365 services, and 45.5% estimated that the indicator is more manifested, than non-manifested (Figure 4.2.3).



**Figure 4.2.1. Management criterion: the effectiveness of using planning tools in Microsoft 365 for planning educational activities**

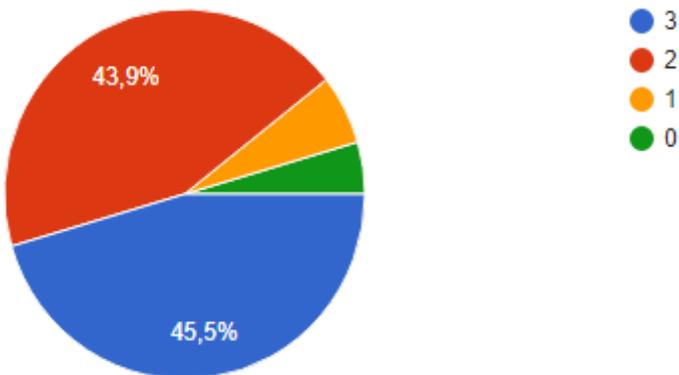


**Figure 4.2.2. Management criterion: the ability to manage educational activities (planning classes, conducting classes, provision of resources, organization of independent work, control) using Microsoft 365 services**



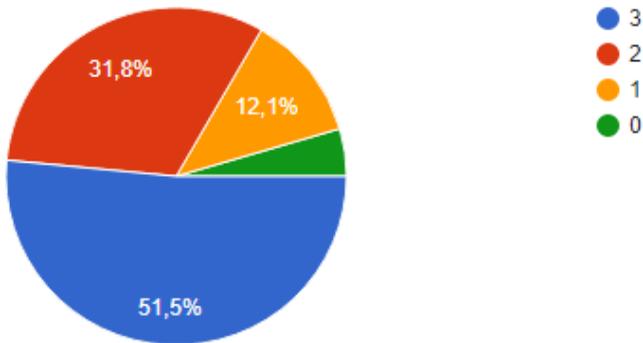
**Figure 4.2.3. Management criterion: the ability to monitor user activity in real time using Microsoft 365 services**

In addition, 45.5% of teachers and students rated the possibility of monitoring their own progress in various types of educational activities at a high level according to this criterion, and 43.9% indicated that this indicator is more manifested, than non-manifested. The remaining 10.6% of respondents consider that this indicator of the management criterion is not manifested (Figure 4.2.4).



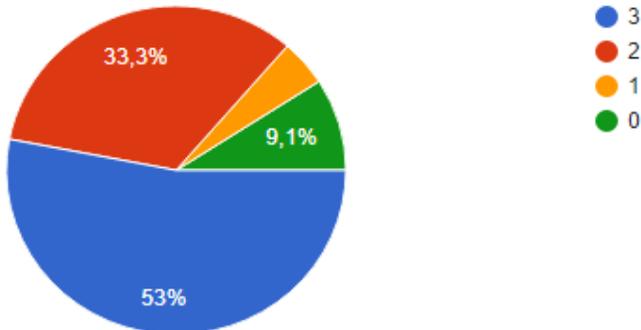
**Figure 4.2.4. Management criterion: the ability to monitor progress by various types of educational activities using Microsoft 365 services**

Functional-technological criterion is important in assessing Microsoft 365 services as it allows you to evaluate the availability, safety and technical capabilities of the offered tools. The respondents' assessment of this survey shows that more than 80% consider these tools to be accessible and mobile. 16.6% of respondents consider this criterion to be non-manifested (Figure 4.2.5).



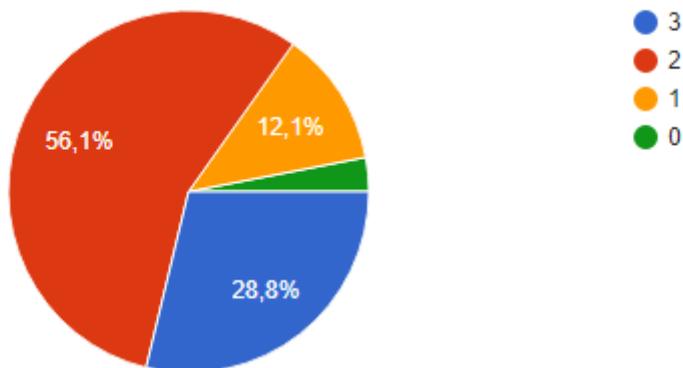
**Figure 4.2.5. Functional-technological criterion: accessibility and mobility of Microsoft 365 services**

When working with cloud services, an important indicator is ensuring the confidentiality of all users' data. Evaluating this indicator, 86.3% assess a high level of ensuring data confidentiality when working with these services. 13.7% estimate the insufficient level of manifestation of the indicator (Figure 4.2.6).



**Figure 4.2.6. Functional-technological criterion: data privacy of Microsoft 365 users**

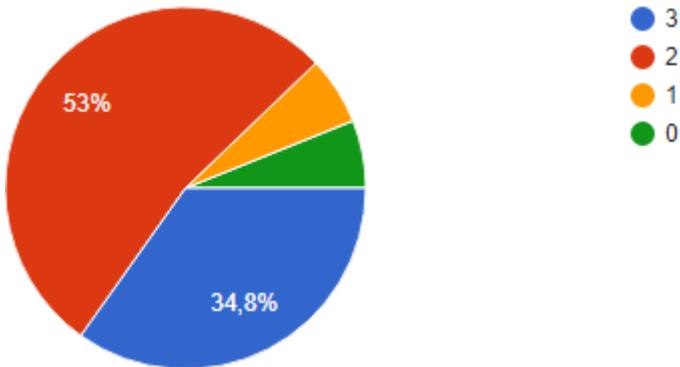
In distance learning, it is important to expand the capabilities of tools by integrating additional services to Microsoft 365 for effective management of educational activities. That is why 84.9% of the surveyed participants of the educational process evaluate the manifestation of this criterion above average, and only 15.1% consider the possibility of integrating external tools to be insufficient (Figure 4.2.7).



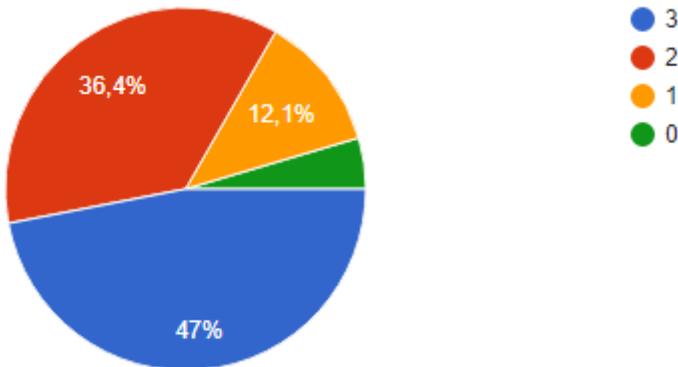
**Figure 4.2.7. Functional-technological criterion: the possibility of integrating additional services to expand the functionality of Microsoft 365**

53% of students and teachers assess the ability to control access to Microsoft 365 services and resources as fully manifested. At the same time, 34.8% consider this indicator to be more manifested than non-manifested, and only 12.2% assess a low level of control of access to resources and services in the process of distance learning (Figure 4.2.8).

In order to successfully manage educational activities during distance learning, it is necessary to organize an educational environment that will enable cooperation and interaction of all participants in the educational process. As shown in Figure 4.2.9, 83.4% of respondents highly appreciate the possibility of organizing such an environment using Microsoft 365 services. According to the other 16.6% of respondents, this possibility is not sufficiently provided.

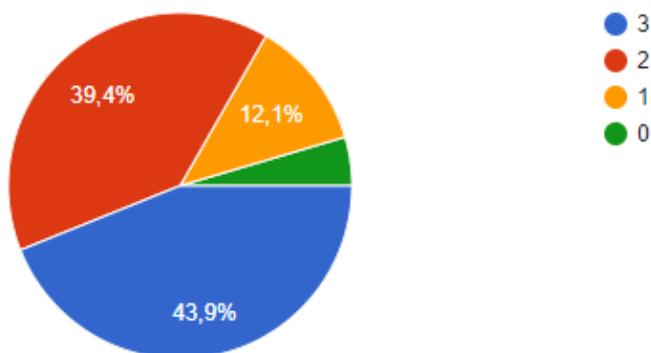


**Figure 4.2.8. Functional-technological criteria: the ability to control access to Microsoft 365 services and resources**



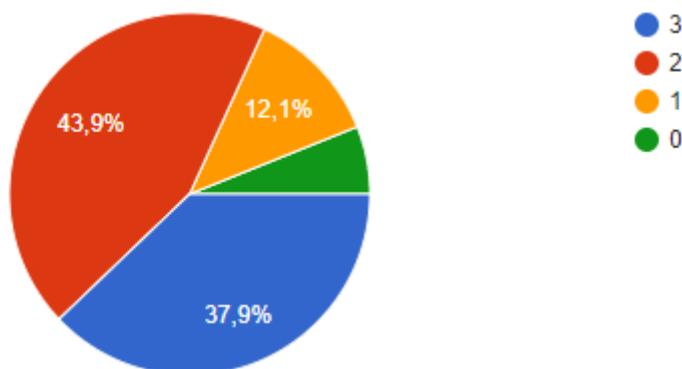
**Figure 4.2.9. Functional-technological criterion: the possibility of organizing collaboration environments using Microsoft 365 services**

The possibility of setting up various types of online communication, in particular audio/video or visual, using Microsoft 365 services is an important indicator of the manifestation of the communicative criterion, which is evaluated by 83.3% of the surveyed students, teachers and students. The other 16.7% of respondents determine the insufficient possibility of setting up audio and visual communication during distance learning, which is shown in Figure 4.2.10.



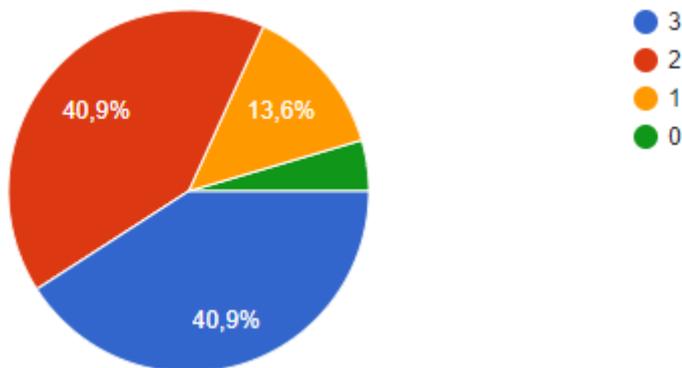
**Figure 4.2.10. Communicative criterion: the ability to establish various types of online communication using Microsoft 365 services**

In the process of distance learning, it is important for the teacher to plan and organize collaborative work together with students in real time. 81.8% of the respondents who took part in the survey highly evaluated this opportunity using Microsoft 365 services. Only 18.2% of the participants in the educational process assessed the insufficient manifestation of this criterion according to the corresponding indicator. The results of such a survey are shown in Figure 4.2.11.



**Figure 4.2.11. Communicative criterion: the ability to plan and organize collaborative work in real time using Microsoft 365 services**

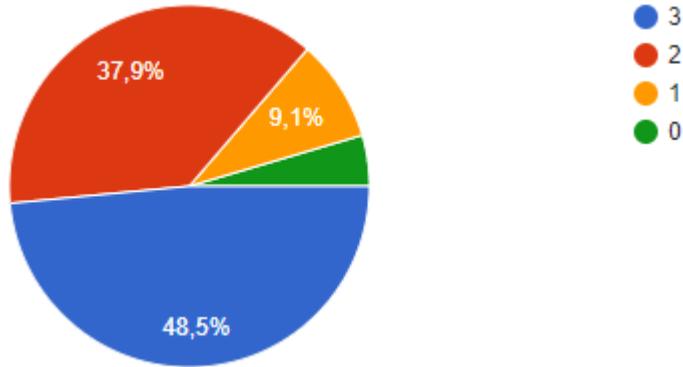
In addition, 81.8% assess the importance of sharing various types of educational content using Microsoft 365 services, which is necessary when organizing various types of educational activities. Figure 4.2.12 shows that 18.2% of teachers and students, using available Microsoft 365 services during distance learning, evaluated the indicator of the manifestation of this criterion at 0 and 1 points.



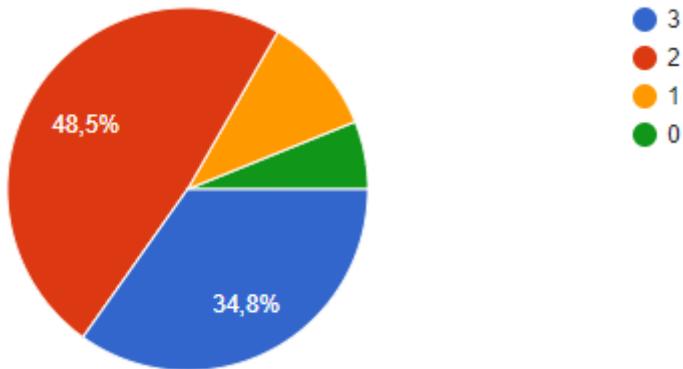
**Figure 4.2.12. Communicative criterion: the possibility of sharing various types of educational content using Microsoft 365 services**

The creation and delivery of educational content during distance learning is an important criterion for evaluating the use of Microsoft 365 services in organizing various types of educational activities. 48.5% of respondents determined that the indicator is fully manifested, and 37.9% consider that this indicator is more manifested, than non-manifested. Another 13.6% of teachers and students assess the insufficient possibility of creating various types of educational content using Microsoft 365 services (Figure 4.2.13).

The ability to combine (integrate) different types of content to better achieve educational goals using Microsoft 365 services is a sufficiently and fully (83.3% of respondents) manifested criterion, as evidenced by the data presented in Figure 4.2.14 for 16.7% of teachers and students, the manifestation of this indicator is insufficient for the full achievement of educational goals during distance learning.

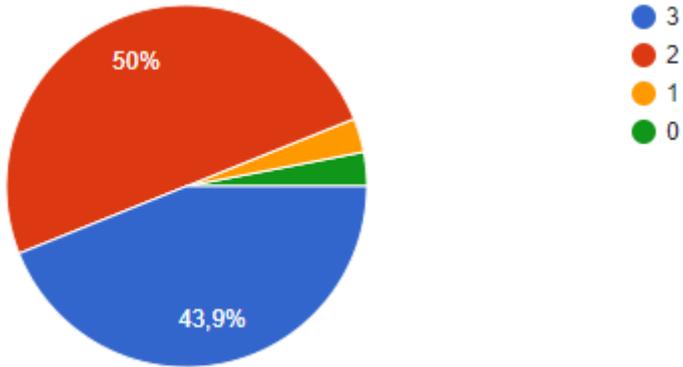


**Figure 4.2.13. Content criterion: the ability to create a variety of educational content using Microsoft 365 services**



**Figure 4.2.14. Content criterion: the ability to integrate various types of content using Microsoft 365 services**

Almost 94% of the surveyed respondents assessed the more than sufficient manifestation of the existing indicator, namely the possibility of placing educational content in digital educational environments using Microsoft 365 services, and only 6% consider it insufficient or completely non-manifested (Figure 4.2.15).



**Figure 4.2.15. Content criterion: the possibility of placing educational content in digital educational environments using Microsoft 365 service**

Thus, in modern conditions, the services of the Microsoft 365 cloud platform allow you to create and deliver various types of educational content, organize distance learning, and manage the educational activities of both students and teachers.

## CONCLUSIONS

The results of the experimental study lead to the conclusion that the functionality of Microsoft Teams makes it possible for teachers to effectively organize educational activities using this service in the distance learning process, such as: conducting video conferences, online quizzes, creating and delivering various types of e-content, assigning tasks to students, conducting tests and surveys, etc. Learning, which is carried out in this way, undoubtedly, differs from learning in the classroom. The difference, though, lies only in the fact that it is implemented in a virtual room and exclusively with digital content. 90-98% of students note the average and high level of Microsoft Teams tools for working with different types of educational content and underline the possibility of integrating additional resources and creating different types of interactive content with their help. As for the teaching staff, they note the possibility of effective use of Microsoft Teams for recording, placing and working with video content.

In the course of the study, the authors also performed an assessment of Microsoft 365 services for distance learning to the following criteria: management, functional-technological, communicative and content ones. According to the indicators of the effectiveness of training management, namely: the use of tools for planning training activities, management of training activities, monitoring of user activity in real time and progress in various types of training activities using Microsoft 365 services, assessment results were obtained at the level of 84.5% of positive evaluations from respondents.

By functionality, which included indicators of service availability and mobility, user data confidentiality; integration of additional services to expand functionality, control access to services and resources, organizational environment of cooperation, the positive assessment was at the level of 85.1% of the total number of evaluations..

The following basic indicators for evaluating the communication capabilities of Microsoft 365 services for the organization of e-learning were chosen: the ability to establish various types of online communication (audio/video or visual), planning and organizing joint work in real time, exchanging various types of educational content.

According to the results of the survey, 82.3% of respondents highly rated M365 services for ensuring communication during the organization of e-learning.

An important criterion for evaluating Microsoft 365 services is work with digital content. The results of the survey show a high rating given by 84.5% of respondents according to the following indicators: the possibility of creating different types of educational content using, combining (integrating) different types of content for better achievement of educational goals, placing/posting educational content in digital learning environments.

Effective use of a hybrid digital educational environment for e-learning based on the use of Microsoft 365 services is facilitated by a sufficient level of digital competence, namely the following components: mastery of information and communication technologies at a functional level; digital literacy; creation of digital content, problem solving and innovation; digital communication, collaboration and interaction; digital learning and development; digital identity and well-being.

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