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Operation system features and cloud services for lecturer work

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Abstract. The work proposes a conception of setup and use of teacher's or lecturer's workspace using common software and hardware products. The research object is a system built by using operating system capabilities in conjunction with office suite and public cloud service, as a foundation for teacher's digital workspace. Research is made on how to set up, scale, and operate such a system, by studying the experience of national and foreign scientists and teachers, and using our own experience in educational processes, and working with operating systems and cloud services. As a result, we got a system which is easy to set up, learn, and apply by teachers without significant experience working remote education systems, and could be used for initial learning of remote education principles. It could be used as an initial step before migrating to specialized remote education systems. In the future, the system itself could be improved by adding additional objects into the system and a higher integration level between objects and external subjects.

Keywords: cloud storage, operating system, teacher's site, distance education, office software, file manager

1. Introduction

Increased availability of modern computer hardware and high-speed communication systems made possible a more effective study process organization, to account for all interests of the modern generation of pupils and students, who are more accustomed to modern technologies if we compare with previous generations. It became especially urgent in modern conditions, associated with the objective impossibility of communication between teachers and students directly during quarantine activities. Researches, who support the blended education, consider, that in the process of the distance communication, as in the base of the distance education, arise new challenges related to the technical side of the process, which includes storage and providing access to education materials, providing feedback, knowledge assessment, etc. [6, 7, 20, 23, 28, 33, 37]

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Nowadays, many scientific researches are dedicated to the studying of using cloud technologies in the educational process. Aldakheel and Rajaei considers that the distance education is the main application of cloud services in education [3].

A lot of researches [4, 8, 15–19, 22, 25, 26, 30, 34, 35, 41, 46–48, 50, 51] substantiate the feasibility of using cloud environments in the educational process. Alamri and Qureshi confirm, that cloud services must be apply in higher education for educators and students. They substantiate the implementation of the on-line education using cloud services to share numerous education materials such as reference books, videos,online lecture and virtual class rooms [2].

Customers now have a big choice of software platforms, both commercial and free. For example, most Ukrainian universities use a learning platform (LCMS) Moodle for mixed mode education [1, 21, 29, 32, 38, 42, 44, 45, 49, 52, 55, 56]. But the biggest problem facing users now is learning new tools, which requires time and skills to use it effectively. This is especially the case for senior people and non-technical specialists. Mintii in the article [27] analyzes the results of the survey of lecturers on using the learning content management system (LCMS) Moodle in the educational process in Kryvyi Rih State Pedagogical University. The research shows that lecturers over 60 years old need methodic assistance in using Moodle. The results of the survey conducted by Institute of Information Technologies and Learning Tools of National Academy of Educational Sciences of Ukraine show the experienced lecturers, familiar with the latest technologies of distance education and communication, are not numerous [14, 31].

Prybylova notices that in the new approach to distance learning, the equipping of teacher and student workplaces also plays an important role, among other factors [36]. So there is a problem with lecturer personal workspace organization in case of absence of advanced personal computer skills.

2. Materials and methods

In the first phase, we did the theoretical analysis and abstraction of specialized literature. It was done to define the state research problem, determine it's actuality, and to formulate goals and objectives of the research. We also did pedagogical observations to determine common students and lecturer interaction patterns in a remote or mixed education environment.

In the process of building the model, we used the knowledge and experience of modern operating systems. The main attention was paid to Windows 10 OS, MS Office 2016 and 2019, cloud service OneDrive and their interoperations. Thus the model was built based on the actual teacher's needs and personal experience. After building the model and implementation we did a pedagogic experiment: we tested the implemented model on practice with students of the Faculty of Informations Technologies and Mathematics at Lesya Ukrainka Volyn National University.

3. Discussion and results

The main category of customers already is familiar with typical tools, which they already use in day to day life: operation system (working with filesystem objects), office suites, Internet browsers, cloud services (storage, access sharing, etc), electronic mail and messaging. It turns

out that a minimal level of computer experience is sufficient to quickly and relatively effectively organize their workspace for distance education.

Windows 10 OS already has the majority of components required for a teacher's digital workspace. We will use this operating system as the most popular among users [24, 54] (figure 1). So the operating system could serve as the main gateway to all tools required for the educational process.

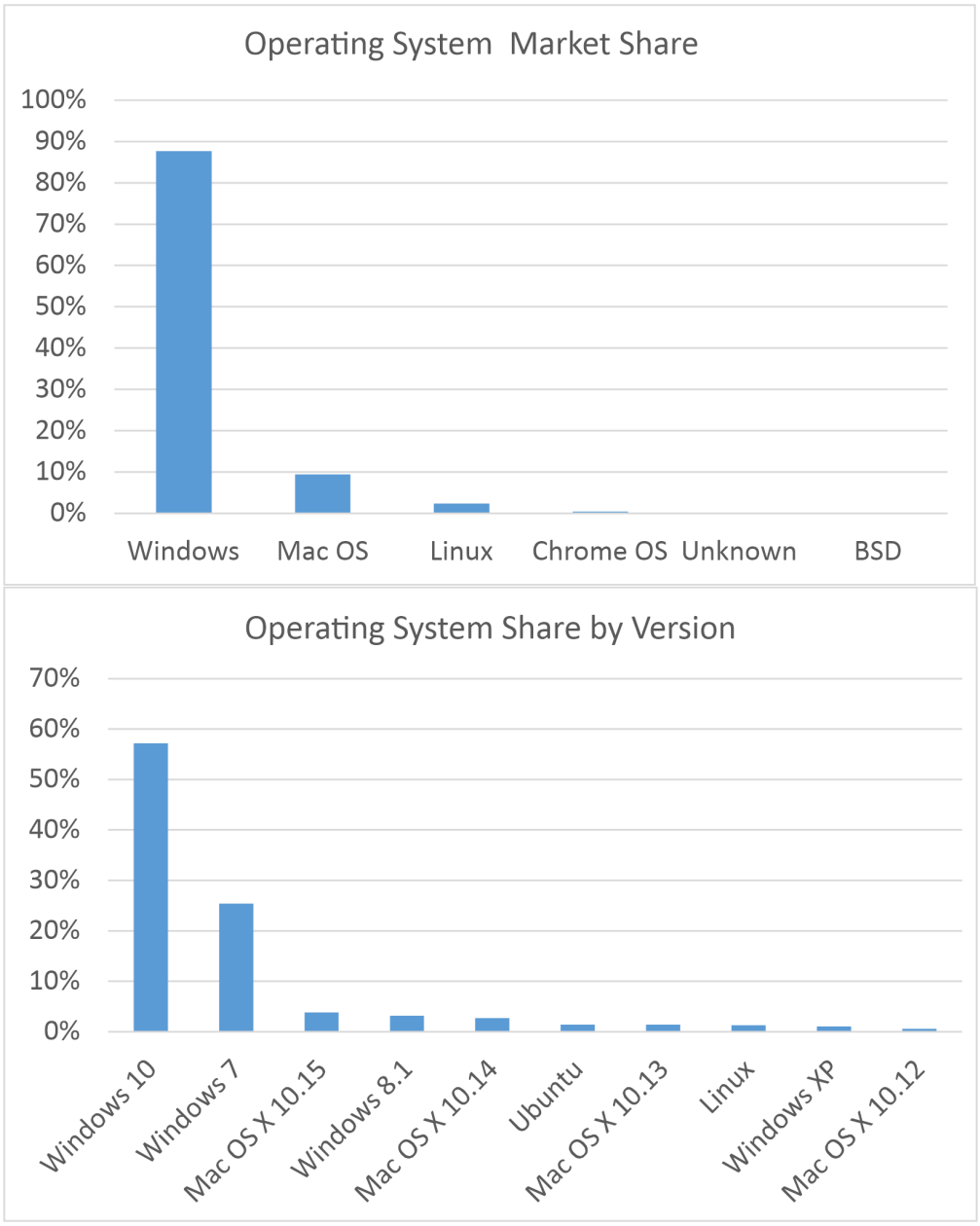


Figure 1: Operating system share (data is valid on 2020.10.14).

Let's consider this the whole system in detail.

It is possible to fill the cloud environment (OneDrive, for example) with files using the file manager of the operating system. As the OS contains the instruments for synchronization such data warehouse with the local folder, the teacher can operate. The OneDrive application allows you to create the account, if it is not created yet, use the backups of the important data, to restrict the bandwidth of the cloud communication channel and provide the interaction with office suites (MS Office, for example). Using this application, it's possible (if necessary) to get to the web-site, where you'll get a wider set of set-ups, for example, managing the access of other users to your information (figure 2).

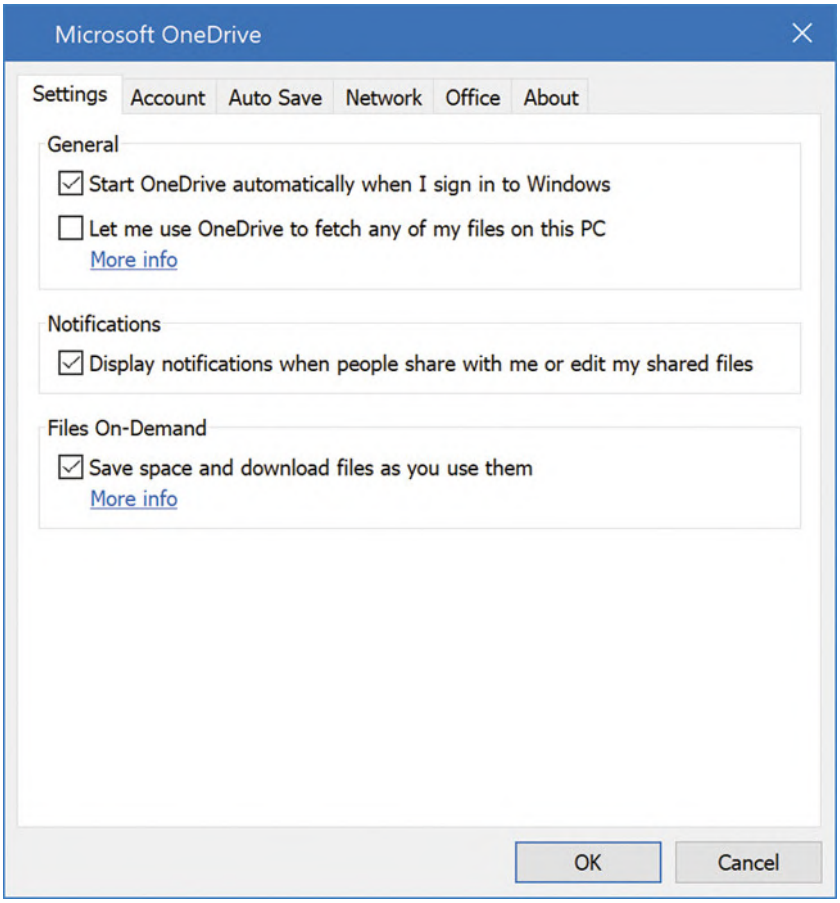


Figure 2: OneDrive addon setup, installed on Windows 10.

File organization in cloud storage deserves additional attention. One may separate files related to assessments from reporting or documentation files. It's worth creating a dedicated folder that will be used for read-only access for others and separate it from backup files (sorted by some periods). This will allow the customer to avoid unnecessary work of maintaining additional access controls (or shareable links for browsers). Backup files will be stored separately because the file name will be not changed but it's content instead with the latest actual content.

This is convenient for academic assessment reports which are changed every semester. The report itself is an Excel spreadsheet, which is easy to use for an average user and has large automation opportunities at the same time. These digital journals are easy to access both for the lecturer and a student. Gives opportunity for a central audit of student's scores and quickly spot lagging behind students. This system allows only to the lecturer to edit student's scores and provides better transparency of the education process. This spreadsheet can be rendered by every lecturer, based on his spreadsheet skills. Besides the usual students' list, assessments, dates, and topics one may implement the following:

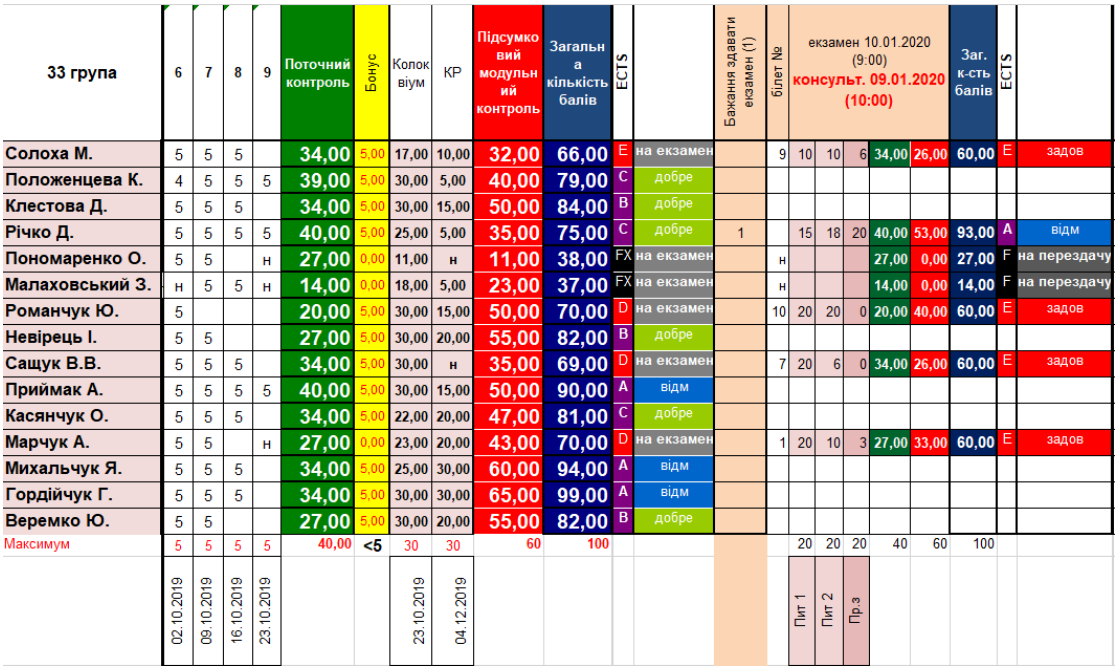
- auto-sum of all current and control grades,
- continuation of rows by leveraging columns, which include rating indexes (to avoid dealing with fractional rates in 100-based rate system, or any other system where rate are multiplied by constant index),
- implement conditional cells, for example: pass or didn't pass for a test, auto-sum of question's grades for exam,
- auto-hide rows with students which already passed all tests and highlight only remaining students,
- generate exams or tests report with auto-filled values,
- color-grading and custom rows format based on a conditional cell's formatting [5, 9, 11, 12, 39, 40].

An example of such a spreadsheet is shown in figure 3. Full spreadsheet is available at our web-site [53]. The most convenient way to work with it is by using a local MS Office application, instead of Microsoft 365 Web UI.

To store large files, which usage is not very frequent (distance course materials if the form of methodical recommendations, specialized software, multimedia files etc.) one may use the other cloud services and their storages: Google Drive (15 Gb of free space) – for large documents, Mega.nz (50 Gb free space) – for multimedia files and software, Flickr (up to 1 Tb free space) – for photo- and video materials [13].

It is expedient to create folders with the access to rewriting for students on such storages, as they may upload their files with completed tasks. The structure of such folders and subfolders can be determined by demands of the specific course. Such files and folders will be rarely edited by the owner, that's why it's not necessary to synchronize them automatically. It's faster and more convenient to manipulate such files by the file manager in OS, that's why the additional software is not needed.

The interface of cooperation with pupils and students is a very important part in the development of the distance course. The most effective, in our opinion, is web interface – the teacher web-site. Such website may include minimum information about a specific distance course, as all the information stored in cloud storages. The structure of such a web-site may be very simple. It is possible to add there ordered lists of hyperlinks, linked to the different materials of distance courses: digital journal, manuals, software, links for messengers for fast feedback, e-mails, resources for responding completed tasks and so on. Our web-site VV&VL is an example of a teacher site. It is used for organizing distance studying courses during several years [53]. This web-site is simple and it was developed using Internet-services only, without



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Річко Д.	5	5	5	5	40,00	5,00	25,00	5,00	35,00	75,00	C	добре	1		15	18	20	40,00	53,00	93,00	A	відм
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Малаховський З.	н	5	5	н	14,00	0,00	18,00	5,00	23,00	37,00	FX	на екзамен		н				14,00	0,00	14,00	F	на перездачу
Романчук Ю.	5				20,00	5,00	30,00	15,00	50,00	70,00	D	на екзамен		10	20	20	0	20,00	40,00	60,00	E	задов
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Михальчук Я.	5	5	5		34,00	5,00	25,00	30,00	60,00	94,00	A	відм										
Гордійчук Г.	5	5	5		34,00	5,00	30,00	30,00	65,00	99,00	A	відм										
Веремко Ю.	5	5			27,00	5,00	30,00	20,00	55,00	82,00	B	добре										
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Figure 3: The fragment of the digital journal, created with MS Excel spreadsheets.

any IDEs. Any lecturer (or teacher) may choose such a web-site or to develop it by himself and work with it, using browsers only.

In the first stages, we used Microsoft cloud services (Docs in particular) to create Web-site for our student users. However, Docs was discontinued in 2018 so we used Google Sites which has more design options and ease of use. One may consider using Microsoft SharePoint [10] or blog platforms, etc. Based on the technical experience and skills of a particular lecturer or teacher.

The structure can be organized in the following way:

1. Information about the teacher with contact data and other details, required for students and for colleagues, guests, others as well.
2. Sections by specialties, academic groups, subgroups. These sections contain links to electronic journals (stored in OneDrive), links to learning materials: lectures' contents, literature, subfolders with data for practical tasks (instructions, tasks, software, lists of questions for test or exam, links to useful resources) (stored in Google Drive or Mega.nz), links to available storage to submit completed tasks, completed tasks' contents, links to messaging platforms to discuss and get a consultation for a specific course, or specific academic group.
3. The section about research theses. It highlights subsections for abstracts, course works, diploma, and master research. After that, it contains a list of hyperlinks to examples and templates of documentation for research representation; requirements for research works; list of available research subjects; previous years research works archive; destination folder with write access where students can upload their research results in electronic

form (Google Drive, Mega.nz).

4. The section about different practicums: internship, pedagogical, graduate – and again with hyperlinks to tasks, documentation, examples, assignments upload forms, etc.
5. Section for lecturer's personal documentation, which is not accessible to students, but is visible to colleagues and management, and contains educational curricula, training reports and other document flow elements (Google Drive, Mega.nz).
6. News section. It may contain news subsections designed for specific branches, or academic groups.
7. Other sections, which may exist based on the requirements of a specific lecturer or course.

General system's scheme represented in figure 4.

According to the scheme above the system works in such a way. Lecturer loads the operating system and uses File Explorer (or any other convenient file management application) (1) to manipulate files and their contents, read and edit files in a local folder, synchronized with OneDrive storage (7). OneDrive application (5) must be installed in the OS. The office suite MS Office (2) is used for editing content of files in folders. But OneDrive app (6) is also needed for automatically synchronizing with cloud storage OneDrive (7).

Lecturer is able to set the synchronization type (interaction of this cloud storage with the office suite (8)) by changing the setting of OneDrive application (3). Also it is possible to manipulate by the storage using only web-browser (4, 9). It is able to give access to files and folders, to create hyperlinks, that may be used developing the teacher web-site (figure 5).

Also using web-browser the teacher fills other cloud storages (10), arranges these storages, creates hyperlinks and creates access permissions. Web-browser is the basic application in developing teacher web-site (based on hyperlinks created earlier), using Google Site (11, 12). Ant the student is able to use any web-browser to get the access to materials and resources placed in cloud storages and additional resources (e-mails, invitations to messengers, ets.) (13).

This scheme is extendable: add other resources, storages, services by adding corresponding hyperlinks on the web-site and depends on the lecturer's technical skills. For example, it could be Google Classroom courses, Moodle distance learning courses [43], but these do not belong to the typical user's tools spectrum.

Once in a while a need arises to perform backups, which could be done easily with the OneDrive folder synchronization feature. For other cloud platforms, dedicated synchronization software could be used, but it shouldn't be running permanently to save network traffic. It is possible to create a similar system based on the other operating systems. But the possibilities of such a system, its convenience and functionality depends on the components' integration degree into the system.

4. Conclusions

Our proposed conception to build workspace for teachers or lecturers is based on typical software and hardware components which is already used by typical user and doesn't require specialized components, designed for this purpose. However, if there is such a requirement, it's easy to include additional components into the system by adding corresponding hyperlinks,

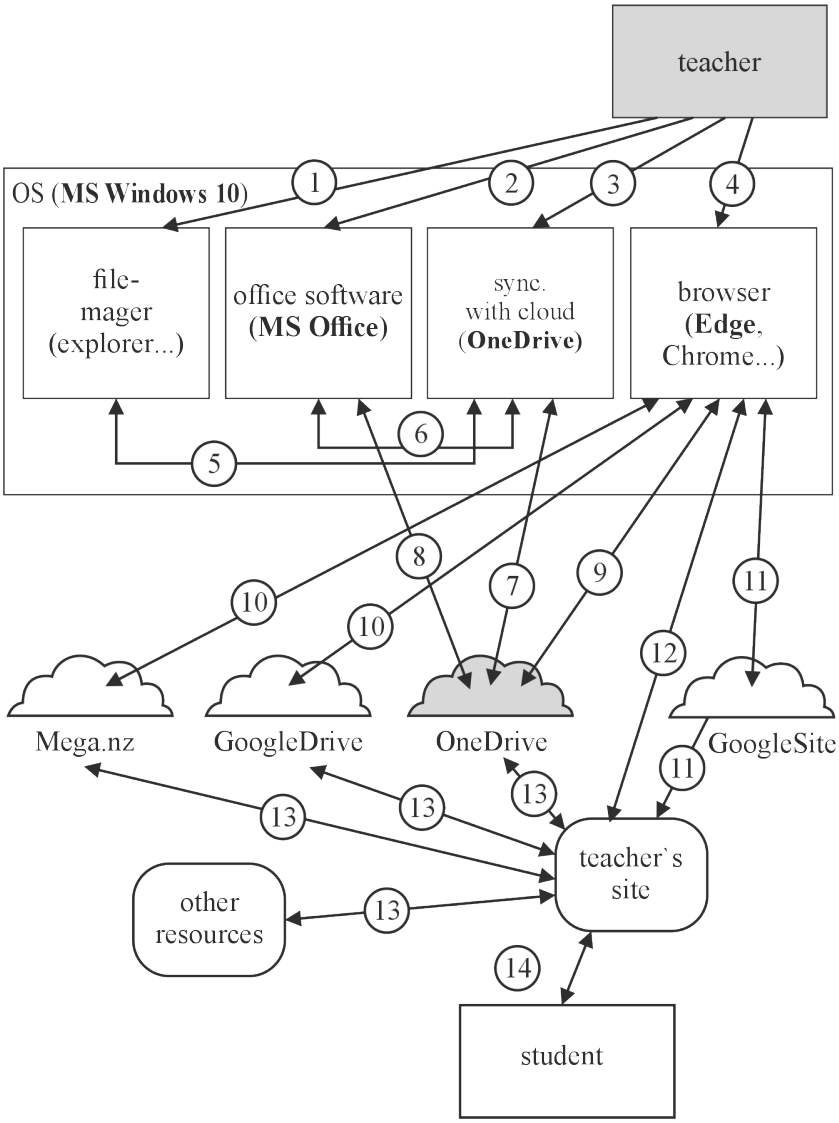

Figure 4: The fragment of the digital journal, created with MsExcel spreadsheets.

installation of corresponding software components and usage of special user interfaces. If a lecturer has all the necessary didactic materials for completing the distance course, he is able to create it, and doesn't spend the time studying to use specialized software, just using possibilities of the operating system. Such a system can be used by lectures and teachers to make their teaching activities during regular classes and for distance education. The system is scalable and easy to deploy and to implement. Of course, such a system doesn't have the online experience, but in exceptional cases, Microsoft 365 could be used, but with worse effectiveness and ease of use.

The system could be used in the initial phases of adaptation by non-experienced teachers,

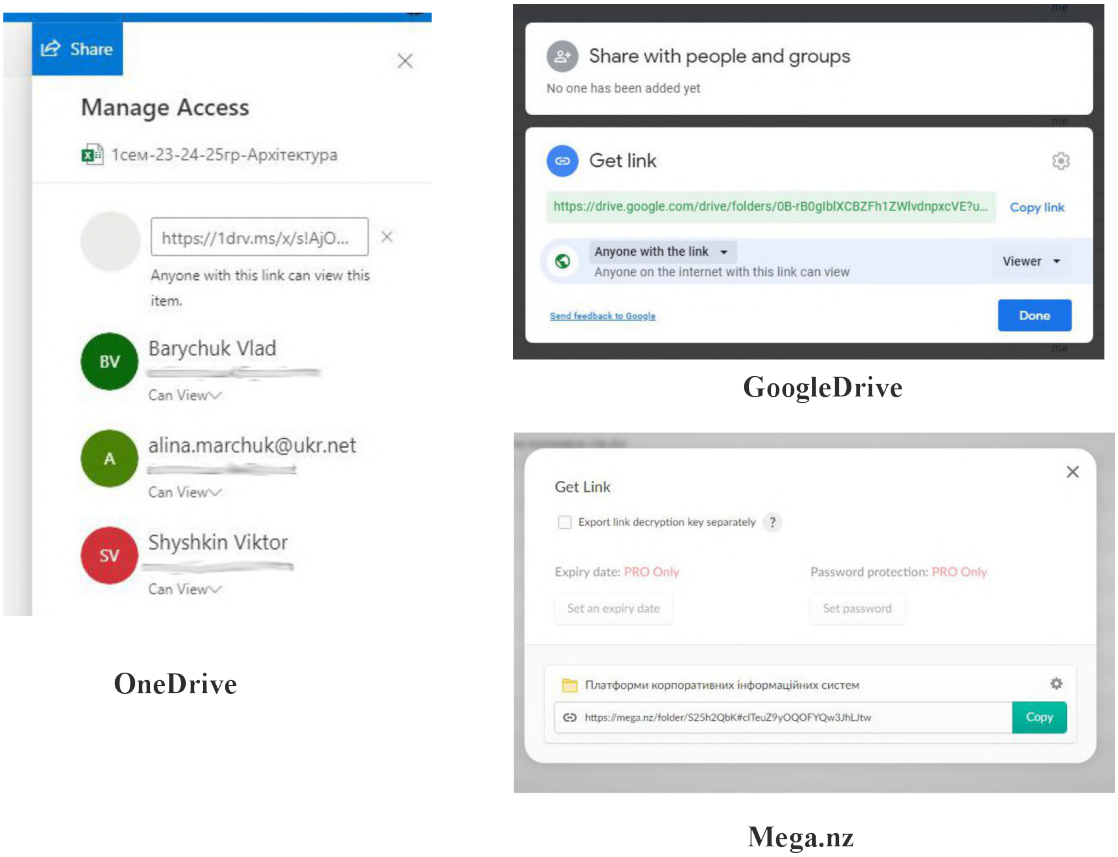

Figure 5: Examples of how to create hyperlinks into resources hosted in OneDrive, GoogleDrive, Mega.nz.

including phases of migration to the remote or mixed educational process. The system is easy to set up, learn, implement, but cannot be used as a single educational platform and should be considered the initial phase before switching to specialized educational platforms, which provide more features for students, teachers, managers.

In the future, one can make a more detailed research of teacher's digital workspace based on an operating system and public cloud services, implement more tight integration between the proposed system and specialized education platforms.

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