BRNO UNIVERSITY OF TECHNOLOGY

FACULTY OF ELECTRICAL ENGINEERING AND COMMUNICATION

DEPARTMENT OF FOREIGN LANGUAGES

G SUITE AT UNIVERSITIES: POSSIBLE BENEFITS AND RISKS

G SUITE NA UNIVERZITÁCH: MOŽNÉ PŘÍNOSY A RIZIKA

BACHELOR'S THESIS

BAKALÁŘSKÁ PRÁCE

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Describe and compare information systems at different universities and G Suite. Analyse risks and benefits of G Suite and consider a possible conversion of university information systems to G Suite.

RECOMMENDED LITERATURE:

1) Matthew, G. (2017). The ultimate guide to G Suite: Everything you need to set up and administer Google's apps for your business. Sunnyvale: Zapier.

2) Sato, Y. et al. (2017). Transforming your organization with G Suite. Tips and best practices. Tokyo: Impress R&D.

3) Furht, B., & Escalante, A. (Eds.). (2010). Handbook of cloud computing. Berlin: Springer.

4) Morel, M. et al. (2011). Google Apps: Mastering Integration and Customization. Birmingham: Packt Publishing.

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Abstract

The purpose of this bachelor's thesis is to describe and compare information systems of four Czech universities, specifically Brno University of Technology, Masaryk University, Tomas Bata University in Zlín, and the Mendel University of Brno. The thesis focuses on the overall appearance and design of the described information systems, with a focus on organisation, clarity, and navigation between modules and system applications. Besides, the bachelor's thesis concentrates on particular modules of information systems, especially on schedules, emails and messages, file storages, and learning management systems - these modules are analysed and evaluated by students at the universities in the practical part of the thesis. Moreover, the thesis analyses and describes Google Apps, its security and privacy, and the practical part questions usage of Google Apps in personal and university life. The thesis also discusses and focuses on synchronisation and conversion of information systems to G Suite based on the quantitative research findings.

Key words

information systems, Czech universities, schedules, emails, messages, cloud services, file storages, learning management systems, Moodle, G Suite, Google Apps, security, privacy

Abstrakt

Cílem této bakalářské práce je popsat a porovnat informační systémy čtyř českých univerzit, konkrétně Vysokého učení technického v Brně, Masarykovy univerzity, Univerzity Tomáš Bati ve Zlíně a Mendelovy univerzity v Brně. Práce se zaměřuje na celkový vzhled a design popsaných informačních systémů, se zaměřením na organizaci, přehlednost a navigaci mezi moduly a aplikacemi systémů. Navíc se bakalářská práce zaměřuje na konkrétní moduly informačních systémů, zejména na rozvrhy, emaily a zprávy, úložiště souborů a systémy řízení výuky – tyto moduly jsou analyzovány a hodnoceny studenty daných univerzit v praktické části práce. Dále práce analyzuje a popisuje Google Aplikace, jejich bezpečnost a soukromí a praktická část také zjišťuje užívání Google Aplikací v osobní a univerzitním životě. Práce rovněž diskutuje a soustředí se na synchronizaci a konverzi informačních systému s G Suite vyplývající z výsledků kvantitativního výzkumného šetření.

Klíčová slova

informační systémy, české univerzity, rozvrhy, emaily, zprávy, cloudové služby, úložiště souborů, systémy řízení výuky, Moodle, G Suite, Google Aplikace, bezpečnost, soukromí

Rozšířený abstrakt

Bakalářská práce na téma *G Suite na univerzitách: možné přínosy a rizika* se zabývá informačními systémy vysokých škol a aplikacemi cloudového řešení, konkrétně G Suite. Cílem práce je popsat a srovnat informační systémy různých univerzit a G Suite, dále analyzovat přínosy a rizika G Suite a zvážit možnost konverze univerzitních informačních systémů na systém G Suite. Jako popsané a rozebrané informační systémy českých univerzit včetně jejich modulů byly vybrány čtyři české univerzity. Vzhledem k jednodušší možnosti přístupu do informačních systémů (za pomoci studentů jiných univerzit) byly vybrány univerzity: Vysoké učení technické v Brně (vzhledem k univerzitě, na které studuje autor této bakalářské práce), Masarykova univerzita, Univerzita Tomáše Bati ve Zlíně a Mendelova univerzita v Brně. Bakalářská práce je rozdělena na dvě hlavní části – teoretickou a praktickou. Cílem teoretické části je popsat a rozebrat informační systémy zvolených univerzit, jejich moduly a možnosti, dále popsat jednotlivé aplikace G Suite, soukromí a bezpečnost dat při užívání tohoto cloudového řešení. S ohledem na konverzi na G Suite byly rozebrány studenty nejčastěji používané moduly, tzn. kalendáře a rozvrhy vyučování a zkoušek, emailová komunikace a zprávy v rámci univerzity, možnosti úložiště souborů využitelné při studiu. Praktická část navazuje na část teoretickou – jejím cílem je analyzovat hodnocení uživatelů konkrétních informačních systémů při používání v rámci studia, zjistit v jaké formě studenti používají jednotlivé moduly, jestli využívají Google aplikace i v osobním životě a jestli by zvážili synchronizaci jednotlivých modulů právě s těmito aplikacemi.

Práce začíná krátkým úvodem popisujícím rozebíranou problematiku informačních systémů a nastiňujícím možnou alternativu – G Suite. Teoretická část je rozdělena na šest podkapitol. První podkapitola se týká všeobecného popisu informačních systémů jednotlivých univerzit a jejich možností. Další čtyři podkapitoly se týkají informačních systémů jednotlivých univerzit – každá podkapitola popisuje určitou univerzitu, její moduly řízení výuky, jejich možnosti a nastavení. V kapitole 2.1.1.4 jsou také rozebrány a porovnány možnosti cloudových úložišť, které do určité míry nabízejí některé z univerzit – studenti Mendelovy univerzity v Brně nemají přístup k Disku Google, zatímco studenti Univerzity Tomáše Bati mají přístup pouze k úložišti OneDrive od Microsoftu. Poslední podkapitola teoretické části se zabývá G Suite, jeho jednotlivými aplikacemi, které jsou detailně popsány, a to především aplikace pro emailovou komunikaci – Gmail, aplikace pro správu kalendářů – Google Kalendář, aplikace pro správu souborového úložiště – Disk

Google a v neposlední řadě kancelářské nástroje pro práci s různými typy dokumentů – Google Dokumenty, Tabulky a Prezentace. Dvě zbývající podkapitoly sekce G Suite popisují další Google aplikace, jejich vlastnosti, bezpečnost a soukromí.

Po seznámení a popsání všech rozebíraných modulů informačních systémů univerzit a aplikací G Suite jsou tyto znalosti aplikovány v praktické části bakalářské práce, která spočívá v cíleném dotazování se studentů na jednotlivé moduly a prvky informačních systémů jejich univerzit. Uživatelé (studenti) byli v první části dotazníku kategorizováni dle univerzity a dále v jednotlivých sekcích průzkumu dotazováni, zdali si myslí, že jsou informační systémy jejich univerzity přehledné a poskytují dostatek informací, v jaké formě aktivně používají rozvrhy vyučování, jaké možnosti využívají pro čtení a posílání školních zpráv a emailů a jaké vlastnosti emailového klienta vyhledávají. Dále byli dotazováni, které možnosti úložiště souborů v rámci univerzity využívají a pro jaké účely, a také jaké vyhledávají vlastnosti úložiště souborů. V rámci každé sekce týkající se určitého modulu IS byli také dotázáni, jestli by při jednoduchém nastavení zvážili možnost propojení (synchronizace) daného modulu s jejich chytrým zařízením (telefonem, tabletem). V poslední části dotazníku byli respondenti dotázáni na používání jednotlivých aplikací v jejich osobním životě s celkovou sumarizační otázkou: Pokud by vaše univerzita nabízela snadnou synchronizaci rozvrhu předmětů a zkoušek, emailů a souborů s aplikacemi Google, využil(a) byste tuto možnost?

Z výsledků vyplývajících z dotazníkového šetření je možné dospět k několika závěrům. Převážná většina studentů používá webové stránky univerzity k prohlížení rozvrhů vyučování, zatímco přes 50 % studentů z každé univerzity by zvážilo synchronizaci individuálního rozvrhu s jejich chytrým zařízením, přičemž tuto možnost již využívá menší procento studentů. Synchronizací školní emailové komunikace se svým zařízením by zvážilo či již využívá alespoň 75 % studentů z každé univerzity, zatímco přístupnost z mobilního telefonu prostřednictvím aplikace nejvíce vyhledávají studenti ze tří univerzit. Možnost přístupu ke školním souborům z chytrého zařízení odkudkoli by zvážilo či již využívá alespoň 60 % dotazovaných studentů z rozebíraných univerzit a studenti univerzit, kteří mají přístup k Disku Google prostřednictvím G Suite využívají této možnosti úložiště nejvíce.

Poslední část praktické části diskutuje výsledky dotazníkového šetření, možnosti synchronizace či přechodu na Google aplikace a také výhody a nevýhody používání G Suite na univerzitách či v podnikové struktuře.

Macek, M. (2020). *G Suite na univerzitách: možné přínosy a rizika*. Brno: Vysoké učení technické v Brně, Fakulta elektrotechniky a komunikačních technologií, Ústav jazyků. 116 s.
Vedoucí práce: Mgr. Ing. Eva Ellederová.

Prohlášení

Prohlašuji, že bakalářskou práci na téma *G Suite na univerzitách: možné přínosy a rizika* jsem vypracoval samostatně pod vedením vedoucí bakalářské práce a s použitím odborné literatury a dalších informačních zdrojů, které jsou všechny citovány v práci a uvedeny v seznamu literatury na konci práce.

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V Brně dne ....

                                                              Martin Macek

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1 INTRODUCTION

An information system is defined as software or a set of programs that enables to collect, process, and store data for a subject (university) and to distribute it to users. For better accessibility, information systems are commonly situated on websites of educational facilities. According to Sedláček (2017), "information systems are generally modular (individual modules processing specific logical data areas and containing different levels of authorisation)" (p. 9). Information systems are designed to give possibly the best user experience (usability) to a target group of users – adapt to their needs, activities and expectations. Krug (2014) mentions that usability may be defined by attributes that make systems useful, learnable, memorable, effective, efficient, desirable, and delightful, moreover; he adds that "a person of average (or even below average) ability and experience can figure out how to use a thing to accomplish something without it being more trouble than it's worth" (p. 23).

With the constant development of mobile devices (smartphones, tablets, etc.), the base of users accessing websites on these portable devices is continually growing, especially younger population aged 15–24 (mostly students) and people aged 25–34 (NetMonitor, 2017). For the reason that only some of the Czech universities have downloadable applications for smartphones and other devices, most students have to access information systems of the universities through a web browser, which implies that data from information systems are not accessible without Internet access. This problem could; however, solve an application that synchronises data with the information system of a university, and provides information about studies (index, schedule, exams date, etc.), for instance as UPlikace at Palacký University Olomouc (Novinky, 2016).

For university students who do not have access to such applications, there are other options of how to synchronise data and how to access them when their devices are without Internet access. Today's worldwide market share of mobile operating systems is made up of 70 % of Android devices, which have Google applications pre-installed (StatCounter Global Stats, 2018). Since Google applications offer a solution for schedules (Calendar), emails (Gmail), and file storage (Drive), it may be an optimal solution to convert these modules to G Suite. Morel (2011) describes an online synchronisation service, named Google Sync that enables synchronisation of Gmail messages, Google calendar events, and contact information without user's interference (p. 68).

The whole thesis is divided into two parts: theoretical and practical. The aim of the theoretical part is to compare modules, websites, and functions of information systems of several Czech universities. In the following subchapters of the theoretical part, information systems of the Brno University of Technology, Masaryk University, Tomas Bata University in Zlín, and the Mendel University of Brno are described, with a focus on schedules, emails and messages, e-learning modules, and file storages solutions for students. Each subchapter of Chapter 2.1 is focused on a different university, its information system, and its modules. Moreover, the thesis focuses on G Suite, its security and privacy, Google Apps and other Google products in the following chapters.

The practical part describes quantitative research based on an online questionnaire survey that was conducted in order to identify how students evaluate described modules of the universities' information systems; how they use it and whether they would consider synchronisation of these modules with Google Apps. In the discussion chapter, the research questions that are outlined at the beginning are answered.

2 THEORETICAL PART

2.1 Information systems of Czech universities

Czech universities described in the following subchapters do have available applications for students, although none of them can be used for accessing schedules, emails, or other necessary modules for studies administration. Bezděková (2017) notes that an application named IS MUNI was available for download at Google Play[1] during her research, designed by Marek Krupka, offering students only to read information (study materials, schedule, exam dates, noticeboard, study news, and notes) from information system of Masaryk University (p. 23). However, the application was not available for download, or could not be searched during research for this thesis. Lack of applications implies that students at these universities have to access information systems through a web browser or to import data to a cloud service that is accessible from a smart device.

Students at Tomas Bata University in Zlín and Mendel University of Brno have access only to Office 365, moreover for students at Tomas Bata University in Zlín Office 365 is the only available email solution. On the contrary, students at Brno University of Technology and Masaryk University have the opportunity to choose between G Suite and Office 365. G Suite has the same functionality as G Suite for Business, but it is free for universities. Both universities have information about using G Suite on their websites, as displayed in Figure 1. Users can access it on as many devices as they desire. As a part of the G Suite for Schools, every student has access to the main G Suite applications: Gmail, Drive and its applications, such as Docs, Sheets, Slides, and Forms, Calendar, Hangouts, Contacts, Groups, Sites, and others (Vysoké učení technické v Brně, 2016).

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[1] Google Play is a distribution service primarily concerned with distributing of applications, music, movies, and electronic books on Android devices. It was created on March 6, 2012 by connecting of services Google Music and Android Market. The service is an appropriate tool for distributing applications, updating, and gaining feedback from users. (Kováč, 2013, p. 23)

Figure 1. BUT Google Apps. Reprinted from http://apps.vutbr.cz/

The second option, Office 365, offers students to use Microsoft software online using a web browser and offline on a total of five devices (a smartphone, a tablet, a laptop, ¨ a desktop, etc.). However, Office must be installed for offline use. The primary online services include Outlook (Email, Contacts, Calendar, and Tasks), OneDrive (File Management and Sharing), SharePoint (Teamwork Services), Office (Word, Excel, PowerPoint, OneNote). Offline applications offer more software to be installed. OneDrive and Skype can be installed separately. Office package includes Outlook, Word, Excel, PowerPoint, OneNote, Access, Publisher, and InfoPath. If students want to use Office 365 locally, they must install Office package altogether with all applications, whether they want to or not (Vysoké učení technické v Brně, n.d.).

2.1.1 Brno University of Technology

As a student at this university, I can describe the information system of this university from my personal point of view and experience. Composition and layout of the Brno University of Technology (hereinafter referred to as BUT) Information System are well arranged, uncluttered, and the modules of the information system are accessible. It is divided into the five main parts, located in the header – at the top of the page: Portal, Studis, Teacher, E-learning, and Wiki. In recent years, the overall appearance of Portal and Studis parts have been redesigned to provide users with a modern appearance.

The Studis part is a set of sections related to information about studies – Introductory Information, Studies, Personal Information, News Study Issues, Electronical Record Book, News from the Courses, Management of Scholarships and Charges, Schedules, Registration of Terms, Registration of Specification, Control of Completed Courses, Registration of the Final Project, My Final project, Student's Degree Certificate, Questionnaires, Results of Courses Evaluation, Sports, Counselling and Courses, Foreign Stays[2], and subsequently the part I will focus on in one of the following chapters – Individual Schedule.

The BUT Intraportal consist of sections related to the administration of studies – BUT Messages Overview, Card List and Ordering, Micro-charges, BUT Software, BUT Password Change, BUT pin, My Contacts, Accommodation IS, Accounting Documents Overview, BUT Enquiries, Elections and Votes, Apollo on Web. Furthermore, we can find here BUT Email Setup, BUT Drive, Cloud Apps – the parts that will be described in more detail in the next subchapters. As illustrated in Figure 2, the main page offers us a view of five received reports – BUT messages, email interfaces, individual schedule, and two suites of cloud productivity apps available for BUT students – G Suite and Office 365. Cesnet ownCloud, additional option for cloud services, can be found in Cloud Apps section.

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[2] Counselling and Courses and Foreign Stays are presented in Studis only in Czech as Poradenství a kurzy a Zahraniční pobyty
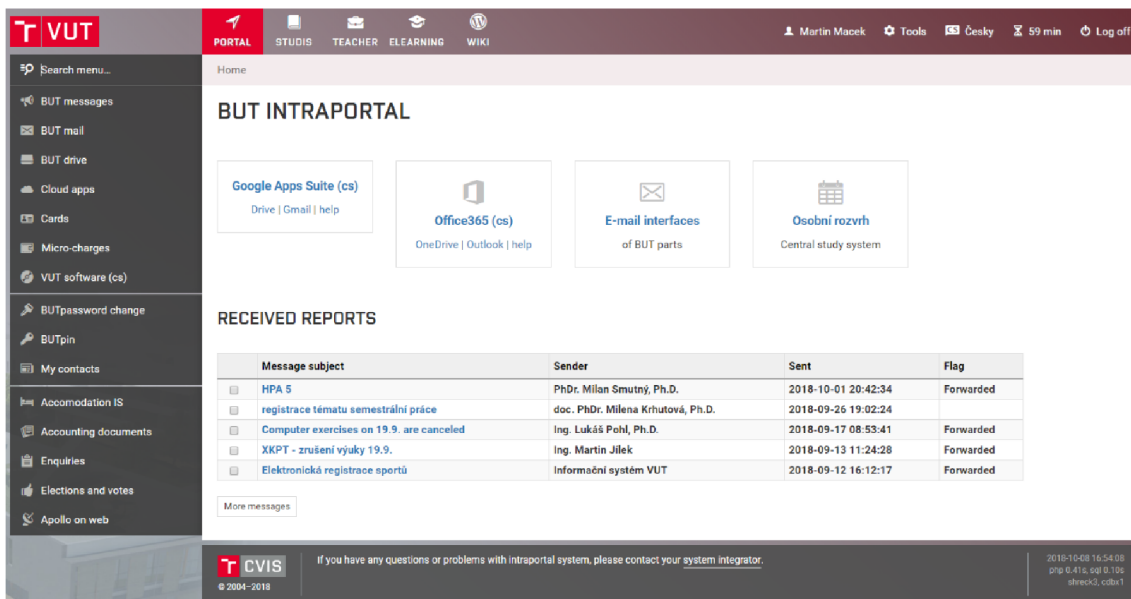
Figure 2. BUT Intraportal. Reprinted from https://www.vutbr.cz/en/intra

Students at BUT use the E-learning module based on the Moodle platform where the particular course is opened for online learning, accessing documents and lectures and assignment submitting; however, presentations and study materials are often uploaded to the course detail in the information system. The E-learning module is located on the separated subdomain, and it has a lightweight, modern-looking design. After redirecting, or logging into the module, a student sees currently opened courses in the current academic year and a search box for searching courses in the centre of the webpage. A sidebar containing two boxes is located on the left side. The upper box called Navigation provides a page parts overview (Home, Dashboard, Site Pages, My Courses) and the lower box called My Courses provides a list of academic years and relevant subjects. Students can only access the courses that they participated in. A sidebar containing three boxes is located on the right side of the page. The upper box called Main Menu includes site news, FAQ, and the information about the user support. The middle box comprises the calendar and the lower box displays upcoming events (created in the courses).

For more information and manuals, written by BUT employees and students, Wiki of BUT is available. On the one hand, there are enough manuals for employees. On the other hand, this site lacks up-to-date information and manuals for students, i.e., manuals are not updated and information, for example about the information system, is not detailed. The Teacher module is not accessible to students.

2.1.1.1 Individual schedule

Individual schedule, located in the Studis part, is a single page section divided into three subparts: Standard Schedule, Weekly Schedule, Semester Schedule. In every subpart, there are options to display the week title and to show free days. In the standard and semester schedule, it is possible to choose between different semesters and to select a period according to from-date and to-date options. The standard schedule displays the current week of the semester, and in the weekly schedule, users can pick any week from a slider. Both options display one week only. The semester shows all the weeks of the semester.

Figure 3 demonstrates that the schedule is displayed in the form of the table of one week divided into days and hours. Every course is displayed as a rectangle (the size of the rectangle is given by course duration) with course details – an abbreviation, teaching method, room, and a teacher. More details are shown after moving the mouse cursor over the course.
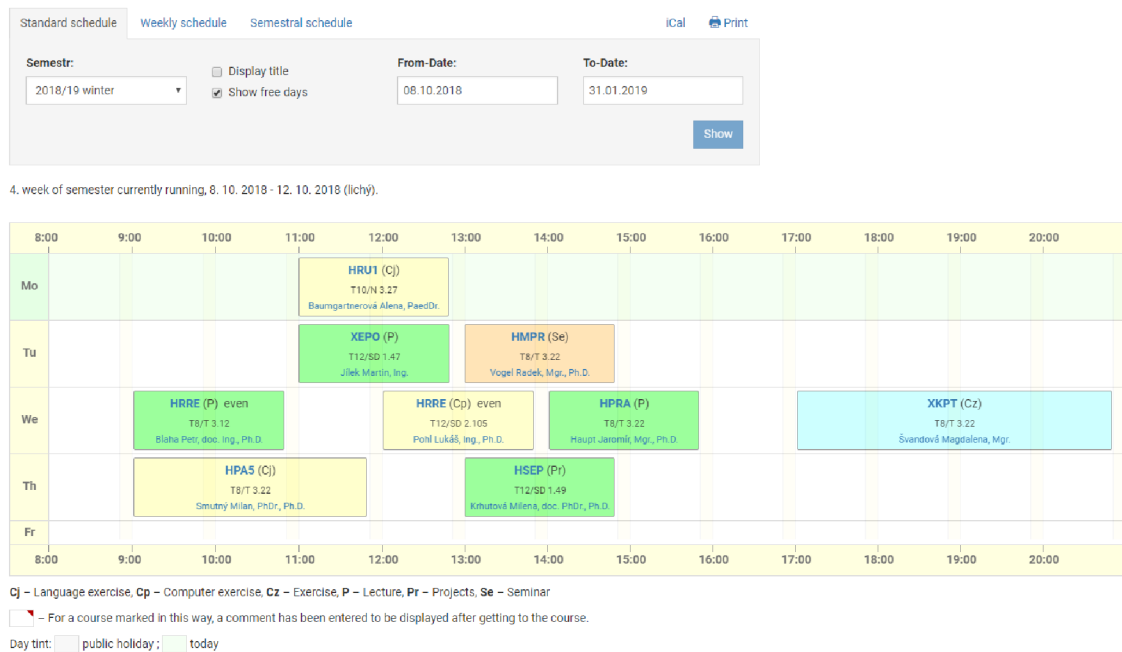

Figure 3. BUT Individual schedule. Reprinted from
https://www.vutbr.cz/studis/student.phtml?sn=osobni_rozvrh

The Print function offers users to print the schedule with optional details of the schedule. Possible conversion to G Suite will be discussed in Chapter 3.5 – Discussion.

2.1.1.2 Messages and mail modules

For BUT students, there are two options on how to communicate with other students or teachers. Firstly, BUT messages are accessible via the BUT Intraportal section where students can write a new message or see delivered and sent messages. When creating a new message, three text boxes are available to be filled in – Recipient, Course and Message. The Recipient text box is in the form of the drop-down menu offering to send a message to the person on the list – only the people to whom a message has been sent in the past are accessible. If the person is not on the list, a user must find the person on the BUT website and click on the button "Send BUT Message". On the one hand, BUT messages serve as a quick and basic communication tool for students and teachers. On the other hand, there is no file attachment option, and it is not possible to send messages to people outside the BUT and messages are only accessible via a web browser. For better access, messages can also be forwarded to BUT mail and managed there. If messages are forwarded and deleted in the email client, the original messages are still accessible in the BUT Intraportal.

Secondly, BUT email (VUTmail) is a more configurable option, and its settings are located in the BUT Intraportal in the BUT Mail section. After visiting the page, a user can see twelve hyperlinked boxes with a redirection to faculty emails (Faculty of Electrical Engineering and Communication, Faculty of Chemistry, Faculty of Information Technology, KolejNet, etc.). Below the faculty emails section, BUT email settings are located where a preferred email address (alias) can be selected. The users have four options:

- Vutlogin@vut.cz
- Name.Surname@vutbr.cz
- Vutlogin@vutbr.cz
- Name.Surname@vut.cz

Another setting is the choice of the incoming VUTmail email destination. Students can select between Microsoft Office 365, G Suite and forwarding to a primary contact "vutlogin@stud.feec.vutbr.cz". It is possible to send the email from any of these options, even if it is not the default option, but emails are received only at the preferred cloud application (Vysoké učení technické v Brně, 2016). The default option is set to forwarding

to the primary contact and emails are accessible at the web-based application used by a faculty (e.g. Horde, Roundcube, Microsoft Outlook Web App).

2.1.1.3 File storages

BUT students have access to several file storages platforms. As the Intraportal side menu suggest, two basic categories can be distinguished: a BUT Drive and Cloud services. The BUT Drive is file storage with the capacity of 2 gigabytes, accessible from the BUT Intraportal, directly in a file browser. If the user has an IP address of BUT, they must be in the BUT building; moreover, there is a possibility of connecting from outside without the BUT IP address – through a VPN[3]. Basically said, files are accessible from any device with the Internet connection. The BUT Drive can be mapped (mounted) as windows sharing network drive, and users can upload and manage files in their drive if they have the VPN configured. On the Intraportal webpage, it is possible to create a new directory, upload files, delete or rename folders and files, navigate through the drive and in every user's directory the "public" folder is created by default. This folder cannot be deleted, and as the name suggests, this folder is used to share files with other students. A file must be firstly uploaded, and then a share link can be created. There are two options for sharing files via the BUT Drive: Authorised link to a file (a file can be downloaded by people, who have a link and can log into the BUT portal) and link to a file protected by a password (a file can be downloaded by anyone who has a password). There is also an option to the time limitation of the link sharing, as shown in Figure 4.

Figure 4. Shared link creation. Reprinted from https://www.vutbr.cz/en/intra/butdisc

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[3] VPN refers to a virtual private network that extends a private network across a public network and enables users to send and receive data across shared or public networks as if their computing devices were directly connected to the private network. Applications running across a VPN may therefore benefit from the functionality, security, and management of the private network (Mason, 2002, p. 7).

From my personal experience, a practical way of using the BUT Drive can be as follows: a student sets up a connection via a VPN from home, map the BUT Drive, uploads files or materials necessary for a laboratory exercise, go to the laboratory exercise, login into a computer and then they can access and edit files without a USB drive or logging into the cloud. After the laboratory exercise, they can easily access the files at home and use them for further work, for example, writing a protocol, and share them with a collaborator using the public folder.

2.1.1.4 Google Drive, OneDrive, ownCloud

The second option of file storage is cloud services where more information and manuals are accessible via Intraportal. From the point of view of the file storage, four cloud services providers are available: G Suite (Google Drive), Office 365 (OneDrive), Cesnet (ownCloud), and the BUT Drive described in the previous chapter. Users do not have to create additional accounts or register to use described commercial cloud services. Accounts for these services are created automatically; an email address is used as a login, a password is the same as the BUT password. Comparison of regular, basic, everyday usage of these services includes several factors needed to be considered: storage capacity, accessibility from more devices and platforms, synchronisation, security, file versioning, applications integration and file sharing. For the basic comparison, see Table 1.

Table 1. *Basic comparison of file cloud storages*

	Google Drive	**OneDrive**	**ownCloud**
Storage Capacity	Unlimited	1 TB (1024 GB)	100 GB
Officially supported platforms	Windows, OS X, iOS, Android	Windows, OS X, iOS, Android, Xbox OS	Windows, Linux, OS X, iOS, Android
File versioning	Yes – limited	Yes – limited	Yes
Applications integration	Google applications	Microsoft Office	No
Security	Two-factor authentication	Two-factor authentication	Password only

Every service offers file versioning, however with different attributes. According to Gildrerd (2018), Google Drive preserves the past versions of Google Docs files indefinitely, but non-native files are retained up to 100 versions, although only for 30 days (after that, they get permanently deleted). When using OneDrive, versioning is only

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possible for Microsoft Office file types. Non-native files are not backed up with previous versions. When using ownCloud, as written in the manual, there is another (dynamic) approach to the file versioning. Versions of a file are created based on a file's age – one version is kept for the first second; for the first minute one version is kept every 10 seconds; for the first 24 hours ownCloud keeps one version every hour, etc. The versions are adjusted along with this pattern every time a new version gets created. The oldest versions are deleted after exceeding more than 50 % of the user's currently available free space.

When using a cloud file storage, users can manage their files through a web browser, however, a client (application) for a background synchronisation is the more desired solution. The only ownCloud offers an officially supported application for synchronisation on Linux-based systems. File sharing is possible with all three services via link sharing, or by sharing in user groups within the organisation (the university).

2.1.2 Masaryk University

Of all the systems described in this thesis, the information system of Masaryk University has the most modern, user-friendly lightweight design. The success of the Masaryk University information system is evidenced by a number of awards and the fact that this system has been used by other schools as well (Informační systém Masarykovy univerzity, 2018). Background of the information system is configurable, offering 21 motives. A central body of the information system web page is composed of a grid of applications rectangles, specifically My Mail, Calendar, Student, Courses, Studies, Noticeboard, Discussion Group, Files, Document Office, Shopping Center, Scholarships, E-learning, Publications, People, Timetable, Admission Procedures, Cards, E-vote, Surveys, Managerial Data, Meet People, Tools, External Services, and System. At both sides of the grid, two sidebars are located – a navigation menu on the left and a configurable Life at MU sidebar. The navigation menu is configurable to display desired applications with the Home button at the top. The sidebar on the right side, Life at MU, displays posts from a noticeboard, blogs, invitations, and other types of contributions. Users can select various types of posts to be displayed. A search bar is located above the grid; contacts and settings of the IS are located in the footer. The information system is, with minor exceptions, translated into the English language and every application of the information system is supported by help and manuals.

E-learning is a subpart of the information system, i.e., it is located on the same web page, not separately. Functions and design are similar to the e-learning module of Mendel University (described in Chapter 2.4). Students can access a catalogue of all courses at all faculties and browse or download documents freely. Besides that, a module Study Materials is available in the Student application. In this module, students can access e-learning courses related to the courses they attend.

2.1.2.1 Timetable and Calendar

The Calendar application has two possibilities of displaying the schedule. Firstly, My Timetable represents the classic view of the courses schedule (days in a column, teaching hours in a row). Lectures are illustrated as light grey and seminars as light blue rectangles. It is possible to display a full timetable (semestral) or a timetable of the current week, and standard display options are present. Secondly, My Calendar displays a Google-styled calendar of courses, examinations, homework vaults, term events, holidays, and other events, happening at the university. It is possible to display a month, week, and day calendar and, furthermore, to display a list of events. The design of Google calendars will be described in Chapter 2.2.1.2. The other modules of the Calendar application are an overview (of holidays, of weeks) and statistics.

2.1.2.2 My Mail

The My Mail application is displayed by default as a list of received messages by a stylish plugin. In addition to classic operations with emails (composing, sending, sorting, reading, folder managing, etc.), it is possible to block certain addresses and to create a list of blocked addresses. Information on limits is situated in the folder administration where the limit for messages (one gigabyte), space occupied by messages and information about the maximum message size of 20 megabytes can be seen. Forwarding of messages can be set in settings, altogether with IMAP[4] and POP3[5] protocols.

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[4] IMAP refers to the Internet Message Access Protocol which is an Internet standard protocol used by email clients to retrieve email messages from a mail server over a TCP/IP connection. (Dean, 2010, p. 519)

[5] POP3 refers to Post Office Protocol 3 which is the most recent version of a client/server protocol in which e-mail is received and held for you by your Internet server. Periodically, you (or your client e-mail receiver) check your mail-box on the server and download any mail, probably using POP3. This standard protocol is built into most popular e-mail products, such as Eudora and Outlook Express. It is also built into the Netscape and Microsoft Internet Explorer browsers. (Rouse, 2007)

2.1.2.3 Files

A file manager located in the Files application is an overview of all possibilities related to the file management – official documents of the university departments, files concerning a student's studies (study materials, such as presentations and lecture recordings; file vaults – materials shared by students, for example, lecture notes), and storage of student's personal files in the IS. Students have two types of file storages. Firstly, file depository with a 10-gigabyte quota that is space for temporary storage and transfer of large files. Secondly, the storage My Web with a quota of one gigabyte is used for personal files that are supposed to be public to the world. Both storages are managed in the same plugin in the information system, as illustrated in Figure 5. The plugin supports uploading of files by using the toolbar or with click and drag function, searching for files, a creation of new files (in plain text, HTML, or XML) with a built-in editor, managing the folders, link creation and sharing, managing accessibility rights, a ZIP file extraction, synchronisation with ownCloud and importing files from this cloud service, and it is possible to upload files into someone else's Depository. Document server of MUNI, where there are official documents of all faculties and departments uploaded, is accessible by the plugin, altogether with the official notice board.
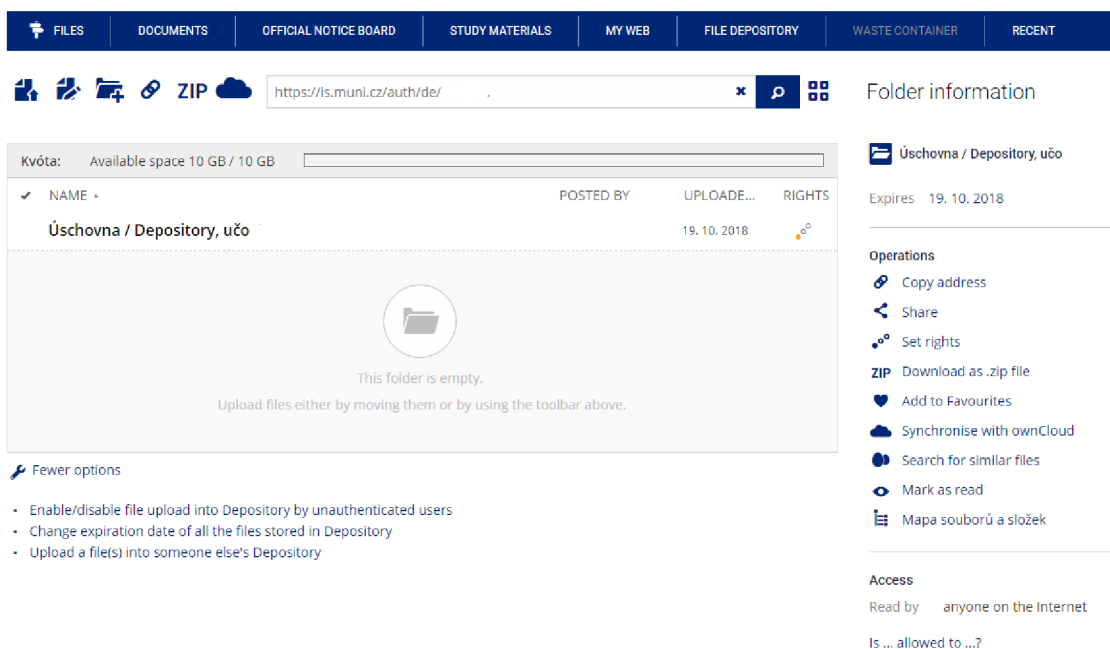

Figure 5. The file depository in the IS of MUNI. Reprinted from
https://is.muni.cz/auth/de/482529/?lang=en;ag=el_mv

In addition to the services described in the previous paragraph, students at Masaryk University have access to ownCloud, G Suite, and Office 365 and all modules of mentioned services. The comparison of cloud services is described in Chapter 2.1.1.4. Settings of these services are available in an application called External Services of the IS, which is available only in Czech.

2.1.3 Tomas Bata University in Zlín

The default webpage of Portal IS (hereinafter referred to as STAG) of Tomas Bata University in Zlín is divided into three parts. The web page is designed in orange and grey colours. Firstly, a header with a logo of the university, a redirect button to user login, change of a language, and a web page menu, is located at the top of the web page. The rest of a web page's body is divided into two adjacent frames. Secondly, the left frame is composed of several parts containing information and updates for students (a portal signpost without information, offers for graduates and students, etc.). Text boxes for login are located at the top of the frame. Thirdly, the frame on the right side of the web page displays information of how to log into STAG, how to change and reset a password in the upper frame and information about STAG access in the lower frame. It is possible to browse STAG anonymously (without logging in) to display information about study programmes, courses, departments, etc. After logging into the information system, a portal signpost displays the identity of a student (ID) and links to a timetable, registration for examinations, and links to all courses in a semester. Besides the portal signpost expanding, the portal header menu discloses options of navigation in STAG: My Study, Quality of Teaching, User Info, and Password Change. All modules of the information system are available under the menu item My Study, and the layout consists of a left side menu and full-width frames with modules of the IS. The overall appearance of STAG gives an out-of-date impression as a result of an increased amount of modules on a single web page with a simple sharp-edged grey design.

The learning management system of Tomas Bata University is powered by Moodle with a design similar to Moodle at BUT. Moodle applications of faculties are situated in separate sub-domains. Course details and materials are available only for students who–participate in the course.

2.1.3.1 Timetable

A timetable is located in the Course of Study menu item, accessible from STAG side menu. The Course of study web page consists of modules Information about the User and his STAG roles, Study Results, Course Completion, and the lowest situated Student module under which the timetable is located. In addition to the timetable, basic data about a student and a list of courses are included in the module. The timetable has a standard layout of days in a column and a day layout according to hours. Boxes related to teaching hours and days are displayed dynamically, i.e., the width of the box is related to the amount of information displayed in the courses, and overlapping more than one course (see Figure 6 for demonstration). Under the timetable, a key and a legend related to the schedule are located.
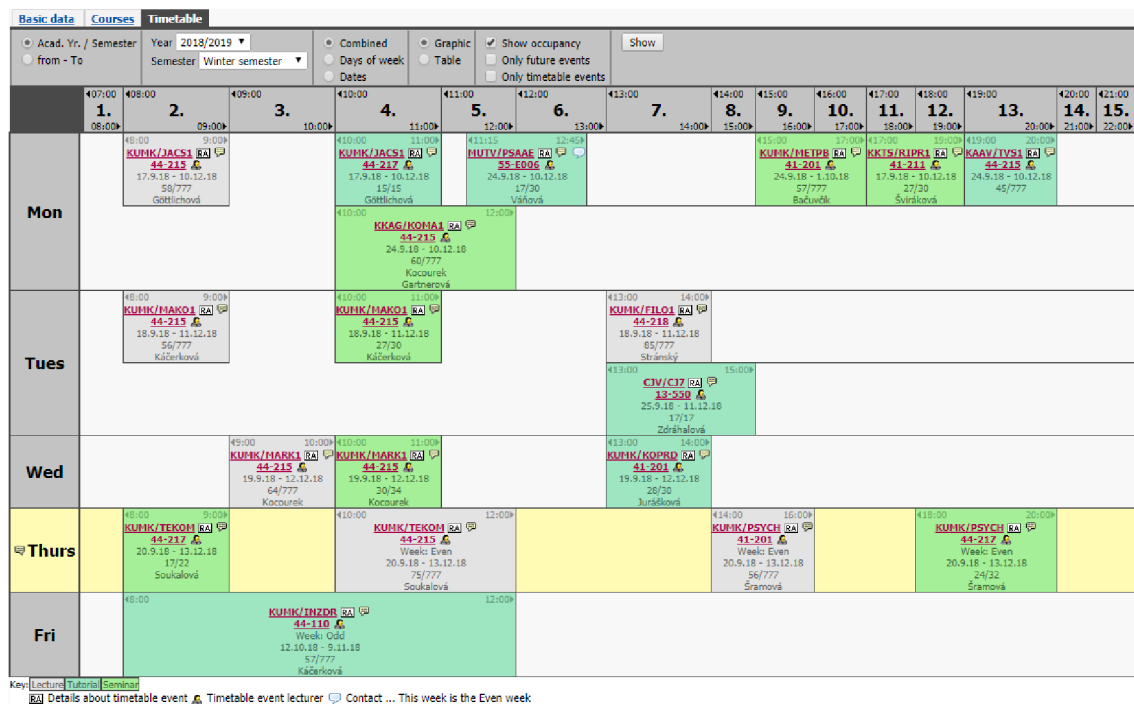
Figure 6. The STAG timetable at Tomas Bata University. Reprinted from
https://stag.utb.cz/portal/studium/moje-studium/index.html

Standard options linked with the timetable view are present, for instance, a choice of an academic year and a semester, a range of displayed days, and a type of the timetable (displaying days of a week or a whole semester). It is also possible to show occupancy of a lecture room, but only future and timetable events. After selecting one of the options, changes are displayed immediately, and the web page is refreshed afterwards. The timetable export options include a PDF file export (with or without a colour background),

XLS format for Excel, CSV format, and iCal exportation.

2.1.3.2 Emails and file services

Students at Tomas Bata University do not have a messages module, for instance, as students at BUT. Microsoft Outlook is the only option of email communication since the students have access to Office 365. Concerning the file services, it is understandable that students have access to OneDrive simultaneously with Outlook and other Office 365 services. Besides, students have their file storages located at the university, accessible from university computers and the possibility of mapping the drive from home as other universities. Despite that STAG help centrum websites are wide-ranging with information, I have not found expanding instructions related to the emails and file storages during the research.

2.1.4 Mendel University of Brno

According to Hrabcová (2010), the system was at the beginning developed by university developers, and after more than ten years the subject of litigation between the management of Mendel University and system developers, who founded the company IS4U. The University Information System (hereinafter this referred to as UIS) of Mendel University in Brno, with its history dated back to the 2000s, with 1301 active users at the beginning of its launch, has developed to its present form with 15820 active users in 2018 (Mendelova univerzita v Brně, 2018). The UIS is divided into several parts; every part is then divided into more specific subparts. After logging in, the default webpage Personal Administration is displayed. At the top of the webpage, a header with the logo and the photography of the university, the list of all faculties, date, time, and change of a language of the UIS are located. Below the header, there are functional elements to log out, redirection to Office 365 webpage, a number of documents uploaded in a Document server, tasks for a student, and the Home button, which redirects users back to the Personal Administration. Student Guide to MENDELU Information Systems and Noticeboard are located between the header and the main body. During the research, I discovered that several hyperlinks were not working, e.g., video guides located in the Student Guide, the link for contacting a development team located in the footer, and several links located in the UIS applications. The Noticeboard displays five latest notices about events, advertising, internships, etc. The main body of the webpage is composed of thirteen rounded boxes focused on a particular

part of the UIS, specifically: Public Information Portal, My Studies, eLearning, Science and Research, Personal Management, eAgenda, Technology and its Administration, Information System Administration, UIS Documentation, Game Room (where students can play three games and see statistics of the best players), Adjustment of the Information System, Information System Set-up, and Protection of Personal Data. Boxes can be reordered and moved by clicking and dragging the box to the desired place – i.e., users can customise the Personal Administration webpage and move the most used modules to the top of the webpage. It may be confusing to new students to orient themselves in the UIS as there is no side menu to a quick redirect to another part of the UIS. It is possible to return to parent web pages, or to the Personal Administration by clicking the links generated at the bottom of the webpage. Almost all parts and applications are translated into English; nevertheless, the UIS documentation is not translated into English at all. Students can find useful information about cloud services, mail settings and information about the UIS in Czech on a website of the Department of Information Technology, but there is only basic information in English.

The eLearning application is used for filling in tests and examinations (if they are available) and to provide electronic study materials. The application is located in the UIS, therefore it has the same design. Students have access to all materials that are uploaded in the eLearning application where all materials and documents are sorted by the courses. Materials can be viewed online or downloaded. The online view of materials is displayed in a basic form, with a side menu with chapters and the content on the right side (see Figure 7).
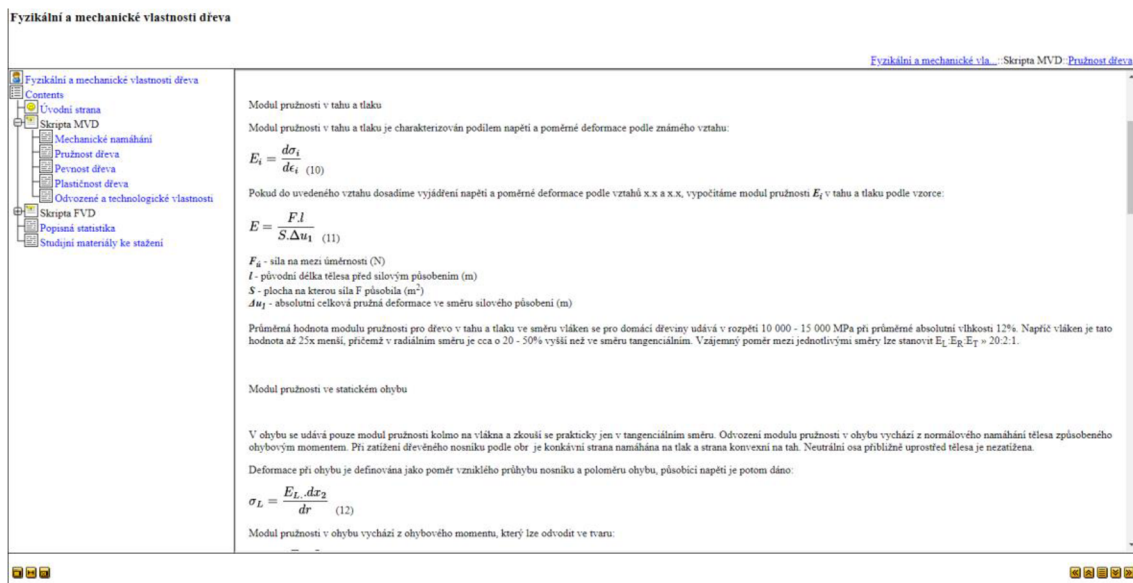
Figure 7. Sample document view in the eLearning application. Reprinted from https://is.mendelu.cz/auth/eknihovna/opory/index.pl?opora=554;lang=en

2.1.4.1 Personal timetable

The personal timetable is located in My Studies, in a section Support of the selected study, together with the Academic Calendar, Academic Year Schedule, and other applications. Academic Calendar displays a week overview for the given study period. Academic year schedule is used to display the time schedule for a particular period, in the form of the timeline, displaying all events related to studies (matriculation, enrolment, course registration, etc.).

The timetable is displayed in the form of the table of one week divided into days and hours. The timetable is designed in green colour, as the UIS and courses are displayed as green (lectures) and blue (seminars). Courses are displayed as a rectangle; the size of the rectangle is proportionate to course duration. At the top, there is a lecture room, under which a course title is displayed, and a teacher's name is at the bottom. Every identifier is hyperlinked to a separate webpage with more information about it.

Timetable options, called Timetable Display Mode, are below the timetable. The first option defines a type of the list – Total Weekly displays the semester schedule; Particular in Days displays the schedule for the particular days chosen by the date, which is selected below; Exemption in Days displays days with exceptions in the schedule. A Format of the Schedule is the next option. The classic format of the schedule described in the previous paragraph is a HTML format; another format is a list of timetable items which displays the

schedule in an organised table with courses separated in rows. When the third option is selected, a PDF file with the schedule is downloaded. Remaining options are to display notes (notes for events, other teachers, and full descriptions of timetable restrictions) and all possible versions of item types for courses where a timetable item of a given type has been (or has not been) selected.

In Personal Administration, in the section Adjustment of the Information System, an option called Configure Transfer of Events to Office 365 is the only form of how to export the timetable to another system. Two types of events can be selected: student's classes and student's exam dates. Each type of event configures separately. Names of the events are generated in a default UIS language. After setting, the types of events are exported to the Office 365 Calendar in Outlook Web App.

2.1.4.2 Mail box

Delivered messages and mail box configuration can be edited in the Mail Box application, located in the Personal Management part of the UIS, accessible from Personal Administration. After visiting the application, an inbox of the mail box is displayed. This application can be used to display the content of the mail folder, and messages can be read, replied to, deleted, forwarded, bounced and moved to other folders. Figure 8 shows that the inbox is designed in a minimalist and uncluttered form. A navigation side panel with inbox folders and information is present on the left side of the webpage. A quick-action button to update folders is at the top of the side panel. Under the button, there is a structure of inbox folders: Inbox, Sent, Trash, Unfinished Mail Box, and Spam. Under the structure of the inbox, a Folder Administration button is present, which will redirect a user to a separate webpage that is used to make, rename and remove the folders for saving messages. It is possible to reorder the folders and to create subfolders. An overview of emails in total, unread emails, full inbox notification in percentage, and a total quota of 300 MiB is below the Folder Administration button. Under this overview, there is a key to icons used in the inbox. Next to the side panel, there is a list (a table) of received messages with parameters of the message (Tags, Sender, Subject, Received, Size) and possible message actions: Reply, Forward, and Delete. There are also other options, for instance, to select individual or all messages, move them to a folder, or to rearrange the messages by date, a sender, or a subject. If a user redirects the inbox to Office 365, a message shown in red saying that messages are forwarded is displayed above the table.
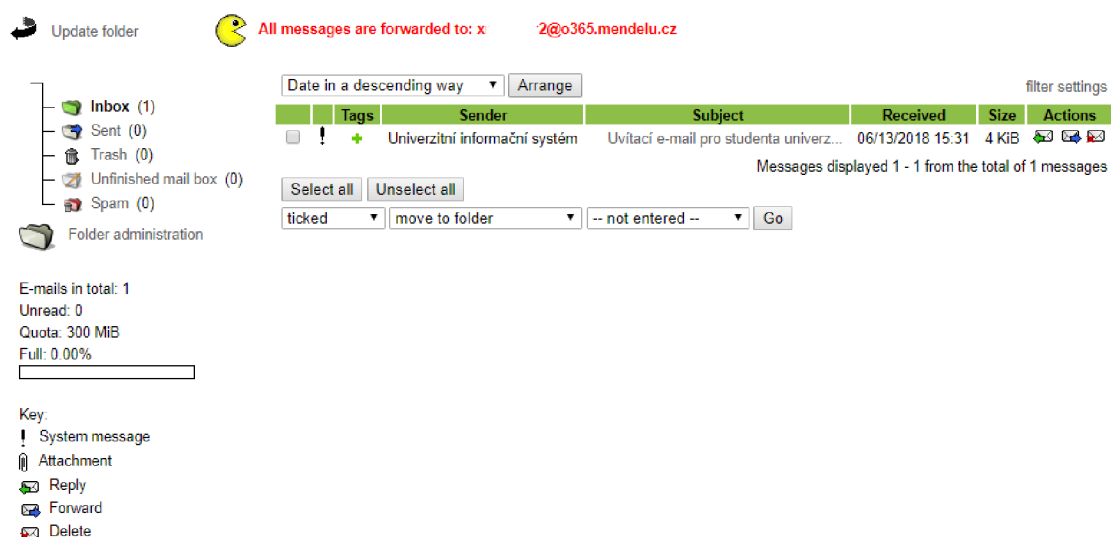
Figure 8. Inbox in the UIS Mendelu. Reprinted from
https://is.mendelu.cz/auth/posta/slozka.pl?lang=en

In addition, Mail box settings allow a user to send short notes informing about a new message in the inbox – the note can be sent to a mobile phone or any email address. Downloading and sending emails by an email client (Mozzila Thunderbird, MS Outlook) can be set in Distance Reading settings. Many options of the inbox can be set in Basic setup, e.g. a number of messages per page, a format of the sender address (similar to BUT settings in Chapter 2.1.1.2), automatic emptying the trash folder, sending a list of spam emails intended for deletion. University email delivery application is not in the settings of the mail box, but it is located in Technology and Its Administration part. It offers four options of a distribution server where emails will be received: Akela (akela.mendelu.cz), Mail (mail.mendelu.cz), Office 365 (o365.mendelu.cz) and the UIS (is.mendelu.cz).

2.1.4.3   File storages

There are no options concerning the file services in Personal Administration or its applications, except for the redirection to Office 365, where OneDrive is located. All information about file storage services is available in Czech on the website of the Department of Information Technology. With the exception of OneDrive, students have access to ownCloud by Cesnet and a Disk server provided by Mendel University. The comparison of OneDrive and ownCloud is described in Chapter 2.1.1.4. Similar to BUT Drive, the Disk server is mapped every time a student logs into a computer at university, or they can access it remotely by connecting via a VPN or SSH. Apart from that, the Disk

server can be used as hosting for personal websites (based on PHP) of students (Ústav informačních technologií, Mendelova univerzita v Brně, 2018). There is no information on the webpage about file sharing (at the Disk server) with other students; however, an alternative solution provided by Cesnet is present. FileSender by Cesnet is an application where files up to 500 gigabytes in size can be shared. Files are stored for a month, after that, they are automatically deleted. The recipient who does not have to have an ownCloud account will receive an invitation to the service and will be authorised to download the file. The FileSender service is available to students at other universities with access to Cesnet services.

2.2 G Suite

2.2.1 Google Apps and other products

2.2.1.1 Gmail

Gmail is a free (for non-commercial use), coherent email service accessible via web browsers, official Gmail applications on several platforms, and other third-party software, which support email synchronisation through POP or IMAP protocols. In 2014, Google launched an alternative to their native Gmail app on Android and iOS devices, and as an alternative to default Gmail webpage – Inbox. The Inbox application was preferred over the Gmail application by many users. However, Google shut down Inbox in March 2019, but some features that were in favour of application users were added to the Gmail application (Bohn, 2018).

Gmail, designed in the early 2000s, has come a long way from its introduction. Firstly publicly available as a limited beta release[6] on April 1st, 2004 only in a limited number of countries including Austria, Germany and the United Kingdom, it was initially considered as a hoax, or an April Fools' joke (McCracken, 2013). According to Hailey (2004), Google used an invitation mechanism to the service that allowed beta testers to send two invitations to other people of their choice throughout this preliminary phase. This mechanism allowed Google to control the growth of the new system. Since Google offered a powerful search function and mainly 1 gigabyte of "free" email storage, gaining entry to this service was hugely in demand, as other providers of email services offered only a fraction of the storage capacity, for example, Yahoo's popular Yahoo Mail service provided only 4 megabytes of free storage – 250 times less space than Gmail (Sullivan, 2004). The main advantage for users was the disappearance of the necessity to delete the old and unimportant emails for the price of displaying contextual advertisements. Baker (2004) acknowledges that the demand for the service was so high that people were auctioning Gmail accounts above $150 on eBay[7]. The number of invitations per user was raised after some time, causing a significant decrease of the price (Wired, 2004) and

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[6] Beta release is a process of distributing a beta version of software to the users and it is typically the first time that the software is available to people outside of the organization. It is the second phase of the software development, with alpha phase foregoing, name after the second letter of the Greek alphabet. Beta release can be either public or private, software is feature complete, but it probably contains a number of known or unknown bugs. (Software Testing Help, 2019)

[7] eBay is a worldwide online auction service used to buy and sell various items and services. Users can look up for desired items in several auctions or offers and make bids over a specific time period determined by seller. Payment is usually made electronically through PayPal, and the goods is shipped (delivered) to the buyer. (BussinessDictionary.com, n.d.)

Google soon decided to change its policy, resulting in the ban of the sale of Gmail accounts since then (Google, n. d.). Gmail was made publicly available without invitation on February 7th, 2007, yet it remained altogether with other Google Apps officially in beta until July 7th, 2009 (Glotzbach, 2009). Almost one decade later, Gmail posted on its Twitter account that it has 1.5 billion users and the number is increasing. Kerns (2018) points out that this number does not equal the actual number of people using the service, but email addresses – one person can manage more addresses.

Considering using Gmail provided by G Suite for Education, Google offers its domain for universities – students have email addresses in the following form: name@university.cz/com. It is possible to create conferences (a group of people) under one email address and to make voice and video calls in the Gmail client due to the integration with the Hangouts application. Besides that, Google guarantees 99.9 % the availability of the service, no advertisements in the client, spam protection, automatic backups, and constant support (Cloudforce, 2016). When converting to G Suite, universities and companies can import emails from other services like Microsoft Outlook, Exchange or Lotus, that means no emails and messages will be lost. Google additionally guarantees compatibility with other clients like Apple Mail, Mozzila Thunderbird, Microsoft Outlook, and others through IMAP protocol (Google, n.d.). Outlook users can synchronise emails, contacts, and calendar events with G Suite (Microsoft, n.d.).

The Gmail web application is composed of several parts. The search bar is located in the header of the web page. On the right side of the search bar, an interactive button that enables filtering of the searched messages is located. Gmail enables creating a filter, or search by following parameters: from (sender of a message), to (receiver of a message), subject, includes the words, does not have (excluded words), size (it is possible to search messages that are greater or smaller than specified the size defined by the user), date within (date can be specified), if it should be searched in specific folders or all mail, if the email has an attachment and if it does not include chats.

Support button, Shortcut for redirecting between Google Applications and Google Account button (containing a user's photo and the name of the university) are located on the right side of the header. On the left side of the search bar, a Gmail logo and a "quick action" button are located. The Gmail logo redirects the user to the main page of the inbox and the "quick action" button rearranges the left side menu to a more compact view – only icons

are visible. The side menu on the left side serves to display all folders and labels. The body of the webpage contains emails in the desired folder, altogether with the quick navigation bar on the top. The side panel is located on the right side of the webpage, containing add-ons for a quick view – Calendar, Tasks, and Calendar by default but more add-ons from G Suite Marketplace can enrich it.
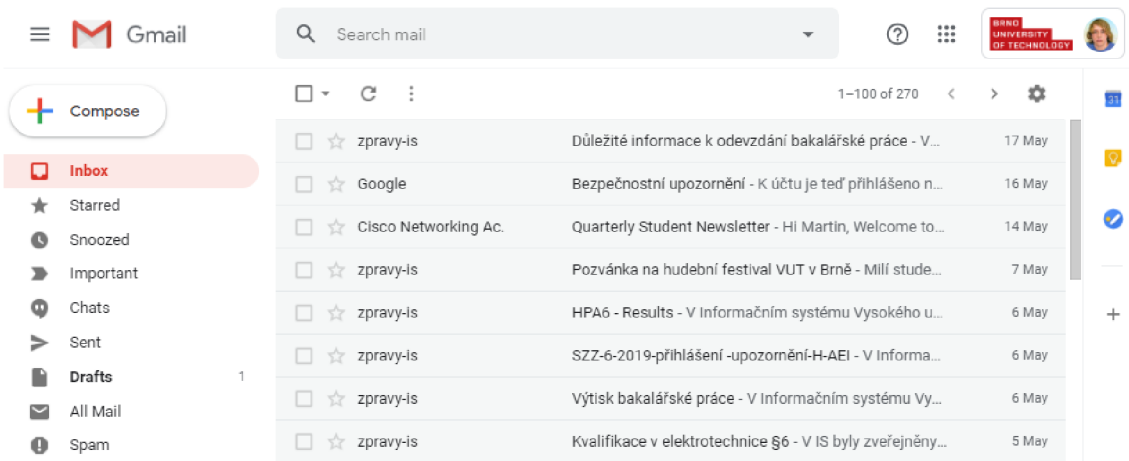

Figure 9. The inbox of Gmail. Reprinted from https://mail.google.com/mail

The Gmail application offers many functions and settings, such as various themes of the inbox (predefined, or customisable with uploaded photos), display density settings, out of office autoreply (in set time period), settings of the signature that is automatically added to all outgoing messages, desktop notifications, smart replies, send cancellation within up to 30 seconds, etc. Gmail interaction can be enriched by keyboard shortcuts for various functions – users can use predefined shortcuts, or customise them (Google, n.d.). Considering the sorting of incoming emails, there are several options available. According to Macich ml. (2013), Gmail introduced the sorting of incoming messages to categories tabs in 2013, namely Primary (default inbox), Social (messages from social networks and websites), Promotions (deals, offers and other marketing emails), Updates (receipts, bills and statements), and Forums (online groups and discussion boards). It is up to users if they want to use this feature (the bar can be hidden). The primary advantageous function of Gmail is filtering and labels. Received emails can be filtered by parameters described in the previous paragraph, and when a message matches set parameters, one or more of the following actions can be executed:

- skip the Inbox (archive the message),

- mark as read,
- star it (marking the message with a star),
- apply the label (multiple labels can be selected),
- forward it,
- delete it,
- never send it to spam,
- always mark it as important,
- never mark it as important,
- categorise as,
- apply the filter to already matching conversations.

Mainly the labelling function is useful since it is very user-friendly to set up filter rules to label specific messages, making the inbox interface organised and structured. When composing an email, various text formatting options are available (fonts, size, alignment, numbered or bulleted lists, quotation), files up to 25 megabytes can be attached (files exceeding this size can be uploaded to Drive and additionally attached to an email) or insert files directly from Drive, it is possible to insert links, emojis and photos, or turn on spell-checking. Another advantage of the connection between Gmail and Drive is that the received email attachments can be directly saved to Drive folders from Gmail.

2.2.1.2 Calendar

Google Calendar is a scheduling and time-management calendar service initially only available on the web, or by using optimised applications by Google or third-party developers on Android operating system and additionally on iOS since March 10, 2015 (Bonnington, 2015). The calendar can be easily connected and shared with Gmail, Drive, Contacts, Hangouts, and Sites. For instance, the calendar can be set to add events (concerts, restaurant reservations, flights and others) from Gmail automatically with detailed information in the description. .iCal or .CSV format files are importable to one of the user's calendars, and calendars are exported in .ics format files. Besides creating a new calendar, users can subscribe to someone else's calendar in the settings; the only requirement is knowledge of other persons email address and his permission. Google further offers predefined calendars of interest that include Jewish, Christian, Muslim, Orthodox, Regional Holidays and Sports calendars (American football, baseball, basketball, cricket, hockey, and rugby) of various leagues and associations. Google can

furthermore display phases of the moon and forecasted weather. The last offered option of adding a calendar is from URL in the iCal format address. By this method, users can display Facebook events and friends' birthdays in their Google calendar, which can be an effective way of how to keep track of events from another platform (Price, 2017).

The overall design of the web interface is similar to Gmail and other Google Apps. The header serves as an orientation element – a search icon to search through events, a button to change the view of the calendar, and two arrows to switch between individual days, weeks, months, or years based on the actual view of the calendar. On the left side panel, there is a minimalist monthly calendar, enabling users to navigate between days, weeks, and months quickly. Below that, users can search for other people to display their schedule and plan an appointment and two lists of calendars: Firstly, My Calendars displaying users' calendars and four calendars in default, such as a personal calendar, birthdays of contacts, reminders, and tasks. Secondly, Other Calendars displaying subscribed calendars and holidays by default. The colour settings of every calendar are done by clicking on three dots next to the calendar name. On the right side, there is a side panel with add-ons as in other Google Applications.

Users can display the calendar as one day in the form of agenda divided by hours, and displaying the week calendar divides the calendar into days (it is possible to hide weekends) and its hours. Figure 10 provides an illustrative example of a weekly calendar displaying a weekly school schedule. As can be seen, all-day events are displayed at the top of every day. A monthly calendar is in the form of a table – every table cell displays a single day and its events. Other options are to display a yearly calendar, four days calendar and a schedule that displays all events from desired calendars in the form of the agenda, enabling the user to quickly view the consecutive events without searching for them in other agendas.
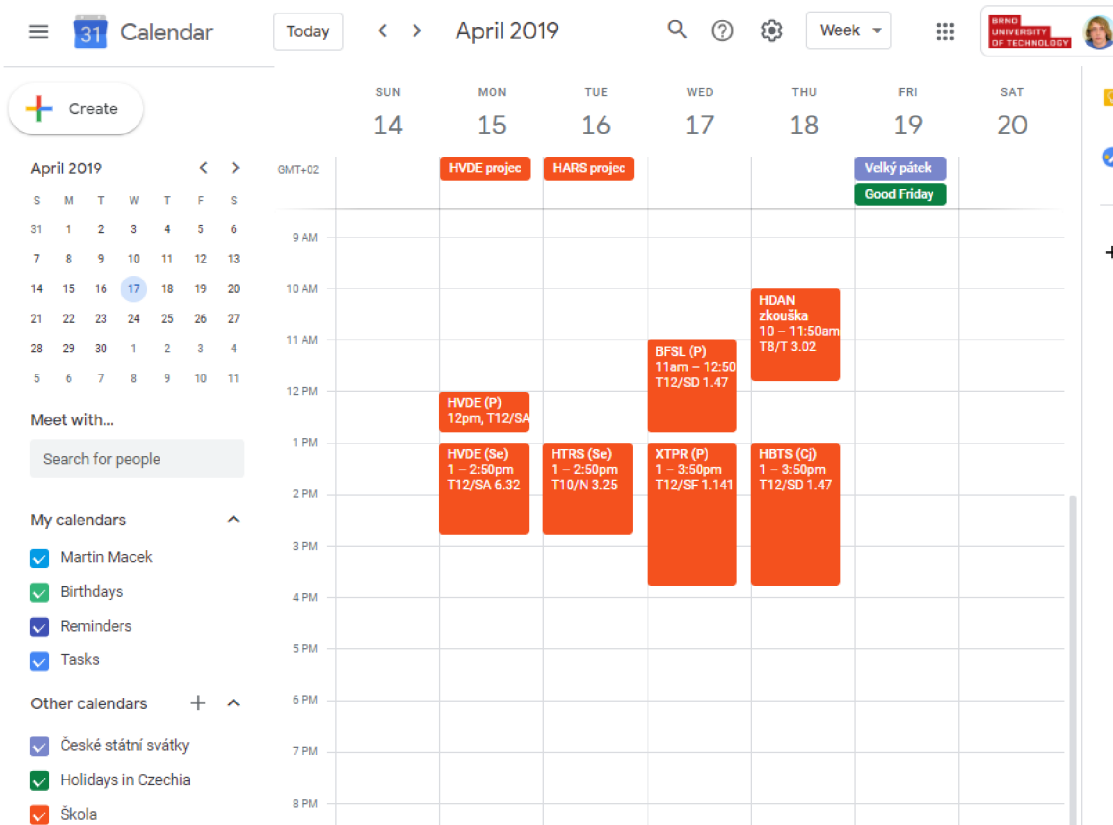
Figure 10. The weekly calendar web interface. Reprinted from
https://calendar.google.com/calendar/

For an event creation, two possible approaches can be chosen. Firstly, the Create button at the top of the left side panel opens an event creation window with an event starting at the next half-hour after creation time and, secondly, by clicking on the desired hour or day in the calendar agenda. Both approaches open an event creation window where an event title and basic parameters may be set up according to the type of the event. Google Calendar offers creation of five types of events: Event, Out of office, Reminder, Task, and Appointment slots. For a usual event, date and event duration, location and conferencing (on Hangouts Meet), and event description can be configured. When creating "Out of Office" type of event, date and event duration, sharing – if the event is public, private or if it should keep default visibility of the calendar, and if new and existing meetings should be automatically declined, altogether with settings of the message that will be sent to another user who is trying to make a meeting. If the user creates a reminder type of an event, the following parameters can be set: date and starting time, repetition and an all-day duration. For the creation of a task, task description, date and start time can be set, and the user can choose a task list, and if it is an all-day task. Appointment slots can be set by date, time duration and duration of every slot – as an illustration can serve a scenario when a teacher

decides to have appointments from 1 p.m. to 3 p.m. on Tuesday, with appointments slots duration of 20 minutes, Calendar will automatically create six appointment slots in a separate external calendar where students can register. When creating a usual event, more options can be added by clicking on the corresponding More Options button that redirects the user to a webpage with event details. On the event webpage, there are additional event options, such as mobile push notifications or by email at a specific time (multiple notifications can be set), if a person is busy or free, event visibility, event repetition and if the event has all day duration, and a time zone where the event happens. Guests can be added with three optional privileges: if the guest can modify the event, invite other users, and if the guest can see a guest list.

2.2.1.3 Drive

Google Drive is a cloud file storage service, accessible on multiple platforms, and its purpose is to create, view, manage, backup, and share documents and files, initially launched on April 24, 2012 (Pichai, 2012). Besides the website application, it is available on macOS and Windows computers, and Android and iOS smartphones and tablets. The main disadvantage of cloud file storages is the necessity to be online when accessing files. However, this problem can be served according to a platform that is used. For Windows and macOS computers, the application Backup and Sync synchronise selected folders from Drive, and furthermore can backup folders and files from hard drives, such as Downloads and Desktop, or other more specific locations (Kastrenakes, 2017). Besides that, Backup and Sync can backup removable media (flash drives, external hard drives, SD cards) and update the backup automatically every time, after inserting the media. If users do not want to download any files to their computer, Google offers the Drive File Stream application that accesses all Drive files on demand (stream) without downloading, but it can also cache files for offline access, synchronising them back with Drive after reconnection to have the latest version always available. Concerning Android and iOS devices, the Google Drive application is available for download at Google Play and App Store, with function to make files available offline to view and edit, synchronising with the Drive after reconnecting to the Internet.

In 2016, the latest improvements altogether with refining user interface were made to the Drive interface of the website application. As in the other Google Apps, the logo and the search bar were redesigned, and the "New" button was added to the left side panel.

Besides, the primary colour of the interface was changed from red to blue and new download features, and better Google Forms handling were added (Whitwam, 2016). Searching in Drive can be specified by the following parameters:

- type of the searched item – various file types such as documents, images, or folders;
- the owner – if the file belongs to anyone, the user, if it is not owned by the user, or if it belongs to a specific person searched by email address or by a name from contacts;
- location – whether the file is anywhere in Drive, user's drive, shared with the user, in the bin, or if the file is visible to anyone in the organisation (vutbr.cz);
- date modified – the date a file was last edited – any time, previous time-period (yesterday, last week, or last month), or date range can be specified;
- item name – a term that matches a part of the file name;
- includes the words – searches for words and phrases within the file;
- shared with – name or email address of who can view, comment, or edit the file;
- follow up – if the file has action items assigned to the user or suggestions in the files you own.

Files and folders in the body of the webpage can be viewed in two forms – a list view, showing all files and folders in the list with the owner and date of last modification details, or as a grid view illustrated in Figure 11. At the top of the left side panel, the New button offers creation of a new folder, uploading a file and a folder, or creation of files with Google Applications (Docs, Sheets, Slides, Forms, etc.). Below the button, there are categories for quick navigation in the Drive structure and files, enabling navigation in the user's drive, team drives, to see shared, recent and starred files and folders, to see deleted files in the bin, and storage information indicating how much of space is being used. Above the folders and files in the body of the webpage, the quick access slider is showing lately opened and edited files, and a slider showing information details about selected folders and files or editing activity information can be opened.
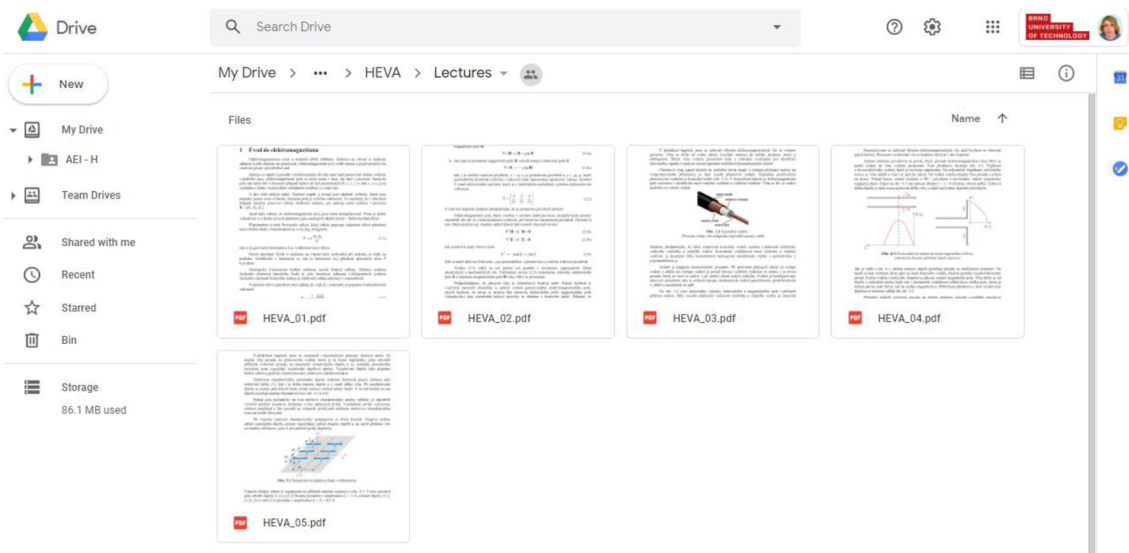
Figure 11. Drive web interface – the grid view. Reprinted from
https://drive.google.com/drive/u/0/my-drive

The main feature of Drive is a file sharing with multiple privilege levels. The sharing is mainly based on sharing the links that the owner can send to collaborators, colleagues, friends, and other people. Link sharing has the following options:

- on – public on the web (no sign-in required, anyone on the Internet can find and access),
- on – anyone with the link (no sign-in required),
- on – organisation (anyone at an organisation who has the link can access),
- on – anyone at an organisation with the link (only people from the organisation who has the link can access),
- off – specific people.

When link sharing is turned off, the owner can invite specific people by their names or email addresses with two options: the collaborators can only view folders and files, or they will be able to organise, add and edit files and folders with additional settings to prevent editors from changing access rules and adding new people. When the owner invites collaborators, an email with an invitation and a direct link to the shared content is automatically sent.

Another option of collaboration between multiple people with different permissions is Team Drives. The manager can set permissions only to view (Viewer); to comment (Commenter); to add and edit (Contributor); to add, edit, move and delete files (Content

Manager); or to manage content, members and settings (Manager). The difference between collaboration based on link sharing and in Team Drives is that Team Drives have more sharing options as was described, and the main difference is when someone uploads files to link shared folders, the uploader is the owner of the files (not necessarily the folder structure owner), whereas when using Team Drives, the files and folders belong to everyone in the team. Practically said, when the uploader decides to delete files in the link shared folders, other collaborators (including the owner of a folder) cannot restore it but in Team Drive they can.

2.2.1.4 Google Docs, Google Sheets, and Google Slides

These three Google applications are included as a part of the Google Drive service, and as the names of the three applications suggest, Google Docs, Google Sheets and Google Slides are a free alternative to more traditional Microsoft Office applications, while they are available as web applications accessible on several platforms and mobile applications for devices running Android, iOS, Windows, Blackberry and as a ChromeOS desktop application. The main feature of this set of applications is that users can share files with others on three permission levels (editing, commenting, and viewing), while they can collaborate and see what other users are editing, or commenting in real-time. Google Application files have a "version history" feature that displays all previous versions of the file and can quickly preview and display user's changes distinguished by colours and restore a version if necessary. Many applications that enhance the functionality of Google Applications can be installed from G Suite Marketplace.

Google Docs is a word processor that enables users to create and edit documents online while collaborating with other users in real-time. It enables real-time creation and editing of documents via a web browser, or in applications in smart devices. Several people can edit and view the document simultaneously, and all changes are saved automatically after a few seconds. It is possible to insert images, create tables and graphs, and to format and edit texts as with other word processors. Co-workers can communicate together through integrated chat, or they can add comments to the documents. Created documents are downloadable in several file formats (Word, PDF, RTF, OpenDocument, HTML, etc.). PDF and Microsoft Word documents can also be imported, converted and edited. A noteworthy advantage of Google Docs is the voice input feature in several languages such as English, German, French, Italian, Japanese, Russian, Chinese or Czech. Another benefit

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of Google Docs is the ability to translate the entire document, again in many languages. Google Docs are integrated with other Google Applications, most importantly, Gmail, which uses Docs for viewing attached files.

Google Sheets is a spreadsheet that offers a more advanced solution for working with graphs and sheets than Google Docs. Sheets can be formatted, sorted (by multiple levels) and filtered. Sheets can be formatted in colour, conditional formatting can be used, and services as functions and pivot tables are also available. Users can operate with a total of 491 functions, leaving out only six non-functioning functions from other spreadsheet programs – mainly because Sheets is not linked to any operating system, or some functions may not work on all supported devices (Google, 2019). When operating with pivot tables, it is possible to choose what is in the rows, columns, and the centre of the table, with more possible fields in each section. The table can be filtered, collapsed, expanded and summarised using the functions Count, Sum, Max, Min, Average, etc. Google Sheets is compatible with external systems such as Microsoft Office, making it easier to work with multiple data sources. Sheets also supports real-time creation and viewing of documents with collaborators, automatic saving after a few seconds, multiple rights levels to collaborators (to copy, download, or print documents), and Sheets also provides access to useful statistics.

Google Slides is a presentation program with which users can create and edit presentations, collaborate in real-time with other users. As well as working with other Google Docs, the owner has control of access and edit permissions to the document. Collaborators can edit slides of a presentation in many ways – editing their shapes and overall appearance (by many available templates), adding texts, videos, pictures, tables and graphs.

2.2.1.5 Other Google Applications: Google Forms, Google Sites, Keep, and others

Google Forms is an online tool for creating and distributing surveys and questionnaires. It is also possible to convert the document to a quiz. The developer creates a survey on one webpage, where he can also customise its overall appearance, settings, and add collaborators. The Form can be divided into sections, which can be interconnected in desired actions; sections are then divided into questions. Images, videos can be added to questions, and it is also possible to require an answer for a question. There are multiple types of answers to questions, which can be chosen accordingly to the developer needs:

short answer; paragraph; multiple choice; checkboxes; drop-down; linear scale; multiple-choice grid; tick box grid; date; time; or respondents can upload a file. Questions and sections can be moved by dragging them with a mouse. The main advantage of Google Forms is that the developer sees responses to the form on the webpage, where they are automatically evaluated and displayed in graphs. Responses are collected in Google Sheets file, where they can be sorted and analysed.

Google Keep is a tool for using notes and reminders. Notes can be, for example, labelled, coloured, shared with other users, and copied to Google Docs, etc. Important notes can be pinned to the top, and notes can be displays is a list of notes or in a grid view. The main advantage of Google Keep is that it is available on multiple platforms – Android, iOS, and installed with Google Chrome browser. In this way, the user has available notes on all his smart devices, synchronised in real-time. When using Google Chrome, it is possible to install Google Keep Chrome Extension for saving URLs, texts, and images to Google Keep in a single click.

With Google Sites users can build team sites, public-facing websites without any skills in PHP or HTML programming. It is possible to cooperate with other users when creating a website, and to set sharing permissions, e.g. publish the website for everyone on the Internet, share it with only desired people. Google Sites are designed to be responsive, making it optimised for computers, smartphones, and tablets (Google, 2020).

Google Contacts can be useful when using an Android phone. It can be installed as an application for managing contacts in a user's smartphone – enabling to add multiple types of information about contacts, e.g. multiple email addresses, phone number, company, label, group, photo of contact. Contacts are also accessible and editable via a web browser when is the user signed in. The Contacts are synchronised across other Google Apps – for example, when adding recipient of an email, the only identificatory that is needed is only the name of a contact. Since all contacts are synchronised with Google services, it is convenient when the user loses or destroys his phone – he will not permanently lose all his contacts.

Google Meet is a videoconferencing application for G Suite users, which enables real-time video and audio communication of up to 250 participants. It is accessible via a web browser on computers and smartphones (by installing the application). Google made the

premium version of Meet free in 2020 to help businesses and schools work remotely due to coronavirus (Zaveri, 2020).

2.2.1.6 Security and privacy of G Suite

When entrusting data to one of the "Tech Giants"[8], many people think about the security and privacy of entrusted data. G Suite offers a SaaS model (Software as a Service) of cloud computing – G Suite applications are accessible via the Internet. When using Saas, users should think of data confidentiality, the availability of data and services, data reversibility, and proception of data against theft. Not only these factors should be analysed and discussed, especially when speaking of using G Suite for university purposes. Besides virtual security, physical security of data should also be considered because when using Saas, the data centre is not located at the university but in datacentre of Saas provider. Google data centres are built with a focus on security and protection of stored data – secured with electronic access cards, vehicle access barriers, alarms, metal detectors, and biometrics. Data centres floor is also secured with laser beam intrusion detection, interior and exterior are monitored with security cameras, etc. (Kava, 2016). Data centres are backed up with diesel engine generators, and moreover, every action made in Google applications is simultaneously duplicated in two data centres – in case of one of the data centre fails, all data are backed up at the second centre located in a geographically different location (in the event of a disaster, service continuity is maintained) (Sheth, 2010). As reported by Quach (2019), these events may happen to result in rerouting traffic with the possibility of elevated latency due to physical damage to fibre-optic cables connecting Google Cloud Services in its ue-east1 region. Google also claims that G Suite offers a 99.9 % of availability for covered services, exceeding this promise in 2013 by achieving 99.978 % availability of Gmail service (Google, n.d.). Before hiring new employees, Google is verifying an individual's previous employment and education, perform internal and external reference checks, and can also conduct criminal, immigration, credit and security checks based on the desired position.

G Suite accounts are fundamentally different from public Goggle accounts in terms of data security, privacy, and availability. All data stored in G Suite for Education cloud is owned

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[8] „Tech Giants" or its synonym „Big Tech" is a term used to refer to five most dominant and largest technology companies - Amazon, Apple, Google, Facebook and Microsoft. The total value of the five technology companies is over five trillion American dollars (Lekkas, 2020).

and managed by a university, or individual users at university – not Google. Google employees will access data stored on Google Apps only when domain (university) administrator grants explicit permission to Google employee for troubleshooting purposes – by a unique identifying support PIN that is held by domain administrators. According to Morel (2011), "to ensure strict privacy, data is both encrypted and stored on servers in a non-contiguous manner. For even greater security, file names are randomized. For instance, it is totally impossible to reconstruct all files belonging to one user. To prevent hacking, the Google security team works in close collaboration with companies specializing in security to continuously optimize its infrastructures. Most of Google's software infrastructure is not standard but was developed specifically by Google for its own purposes. On the software side, each server is equipped with the strict minimum that is necessary to perform the tasks to which it is dedicated." Contrarily Afifi-Sabet (2019) acknowledges that Google and IT admins can monitor staff activity and have extensive access to files stored within G Suite – data not protected by end-to-end encryption and be upon request shared with law enforcement. There is no advertising when using G Suite Applications, and Google does not collect, scan or use users' data for advertising purposes. Two-step verification is a valuable benefit for the security of G Suite accounts, adding an extra layer of security – users are required to enter a verification code in addition to username and password. The verification codes are delivered to a user's smart device (by using an authentication application, such as Google Authenticator) on a one-time basis. This feature eliminates unauthorised access if a user's password is compromised. Two-step verification can be turned on by administrator of G Suite domain (university). However, as Newman (2019) points out, after the years of using G Suite by millions of users, it was discovered that Google stored some of G Suite passwords in plain text since 2005, meaning bug existed unnoticed for 14 years. In case the employee loses his phone, Matthew (2017) comments that "Google can even keep logs of your team emails for compliance purposes if needed, or let you remotely wipe an employee's device if it gets lost or stolen—one of the many advantages of using G Suite over personal Gmail accounts".

G Suite meets several security regulations and standards. It meets the certifications for cloud services ISO27001, ISO27017, ISO 27018, which are issued by the International Organization for Standardization in Switzerland It also meets the requirements of the US government's FedRAMP cloud security standard. To comply with the PCI DSS standard,

customers can set information leakage protection policies to prevent, for example, sending e-mails containing credit card information. It also complied with the SOC 2 and SOC 3 audit system, which is based on the principles of trustworthiness, security, the integrity of processing and confidentiality. Other certificates and regulations include FISC, ENS, HIPAA, GDPR, POPI. Each of these regulations oversees a particular area of safety or is specific to a specific country. Extensive user access management capabilities and management of various devices, and international security certificates have proven that Google fulfils the aspect of security.

3 PRACTICAL PART

3.1 The aim of the research

The practical part consists of quantitative research based on an online questionnaire survey, which provides an efficient and relatively quick way of obtaining information from the targeted audience, i.e. students at several Czech universities.

The objective of the research was to identify how the students at particular universities are familiar with the information systems of their university, its modules and how students use its functions and modules. The research also analyses which properties and features of schedule, email and file storage modules students seek; whether students use Google Apps to consider how complicated conversion of university information systems to G Suite could be.

The intermediate objectives were the following:

    a) to determine how the students evaluate the clarity of the information system of their university and whether the information and features are sufficient or not;

    b) to determine in which form the students actively use the schedules of their study, how they access emails and messages and whether they use available file services;

    c) to determine if the students already use some of the Google Apps;

    d) to identify if the students are familiar with possibilities of synchronisation and whether they use it or would be interested in using it.

Therefore, the following research questions for the objectives were defined:

    RQ1: How do the students evaluate the clarity of the information system of their university and is the information and features sufficient or not?

    RQ2: In which form do the students actively use the schedules of their study, how do they access emails and messages, and do they use available file services?

    RQ3: Do the students already use some of the Google Apps?

    RQ4: Are the students familiar with possibilities of synchronisation, do they use it, or would they be interested in using it?

In the following chapters, the development of a questionnaire will be described, research sample characterised, and the gathered data analysed and interpreted.

3.2 Development of the questionnaire

Before the development of the questionnaire, it was necessary to analyse thoroughly targeted universities. This analysis was done during the research and development of the theoretical part of this bachelor's thesis. In February 2019, I started to design the questionnaire with a focus on modules described in the theoretical part according to a specific university. Because of the complexity of the questionnaire and topic of this thesis, I chose the Google Forms to develop this questionnaire. A pilot version was launched in order to analyse whether respondents have any problems in understanding or answering questions. The pilot version revealed minor issues, mainly because of wrong wording and misleading formulations. Based on the respondents' feedback, the final version of the questionnaire was designed and published. The questionnaire was distributed at individual universities by first-year students in private messages, groups chats, and among Facebook groups for students of the bachelor's degree study programmes. It could explain the considerable representation of respondents of the second (22.6 %) and third (19.4 %) year of the bachelor's degree study programmes. These mentioned circumstances give a reason for these less represented groups of respondents – there were not enough communication channels to distribute the questionnaire to the groups of students. Overall, 90 people participated in the questionnaire.

Since every analysed information system is different, it was necessary to develop a questionnaire that directs the respondents to different sections according to their university. This sorting was based on a question that determined at what university did respondent study. Logically, it was necessary to situate the question at the beginning of the questionnaire – to the general section, altogether with questions determining gender and year of study. Every university part of the questionnaire was divided into sections according to individual modules – schedules; emails and messages; and file storages. Only Tomas Bata University in Zlín part of the questionnaire have file storages and emails section combined since students at this university can only use Microsoft Outlook as a communication tool and TBU file system as file storage. Every section was further divided into multiple questions asking evaluation and clarity of IS modules, active usage of every module, and whether the students would consider synchronising each module with their smart device. Some of the questions were made as "school" evaluation by marks, some of the questions were the multiple-choice type with free-form answers, and

in some questions, only one answer was possible. The final versions of the questionnaire for each university are included in Appendices B–E.

After completing IS-related sections of the questionnaire, the respondents were redirected to the second part of the general section concerning Google Apps. In this section, respondents answered whether they use Google Apps in their personal life, e.g. Gmail, Google Calendar, Google Drive, Google Docs, and Google Keep. This part of the questionnaire also contained a question about overall synchronisation of course and examination schedules, emails and files with Google services (see Appendix A).

The questionnaire was oriented mainly to the students at the universities described in the theoretical part of the thesis; however, the questionnaire was designed to handle the situation when a student of any other university wanted to fill in the questionnaire. In this situation, the questionnaire redirected the respondents straight to the last part of the questionnaire concerning Google Apps to identify which Google Apps they are using and whether they would consider overall synchronisation of modules with Google services.

3.3   Research sample characteristics

Considering the objectives of this bachelor's thesis, the purposive sampling was chosen as the type of sampling – the questionnaire ought to be targeted at university students, not the general population. The research sample consisted mainly of students at the following universities: Brno University of Technology, Masaryk University, Mendel University in Brno, and Tomas Bata University in Zlín. Additionally, two students at the University of Pardubice and one student of Institute of Technology and Business in České Budějovice filled in the questionnaire. The research sample consisted of both female and male genders; and students of the first, second, and third year of the bachelor's degree study programme, as well as students of the first and second year of the master's degree study programme. Some of the respondents already graduated/finished university, and one student who did not finish his studies.

3.4   Data presentation and interpretation

In this chapter, the collected data are presented, described, analysed and interpreted. The data from the questionnaires were statistically analysed using Google Forms and Google Sheets. The analysis and interpretation are divided into five subchapters based on the

university, namely Brno University of Technology, Masaryk University, Tomas Bata University in Zlín, and the Mendel University of Brno, and a general section of the questionnaire located at the beginning with a section dealing with Google Apps. For more coherent orientation, every subchapter is further divided into sections based on the analysed module; in the same way, the questionnaires were presented to the respondents. For a more accurate idea, see Chapter 8 containing all the appendices.

3.4.1   General Section, Google Apps

Question 1. What is your gender?

Figure 12 shows that the representation of men and women in the questionnaire was almost at the same level. Females comprised the majority of respondents (51.6 %) in comparison to 48.4 % of males who comprised a comparatively lower proportion of respondents.
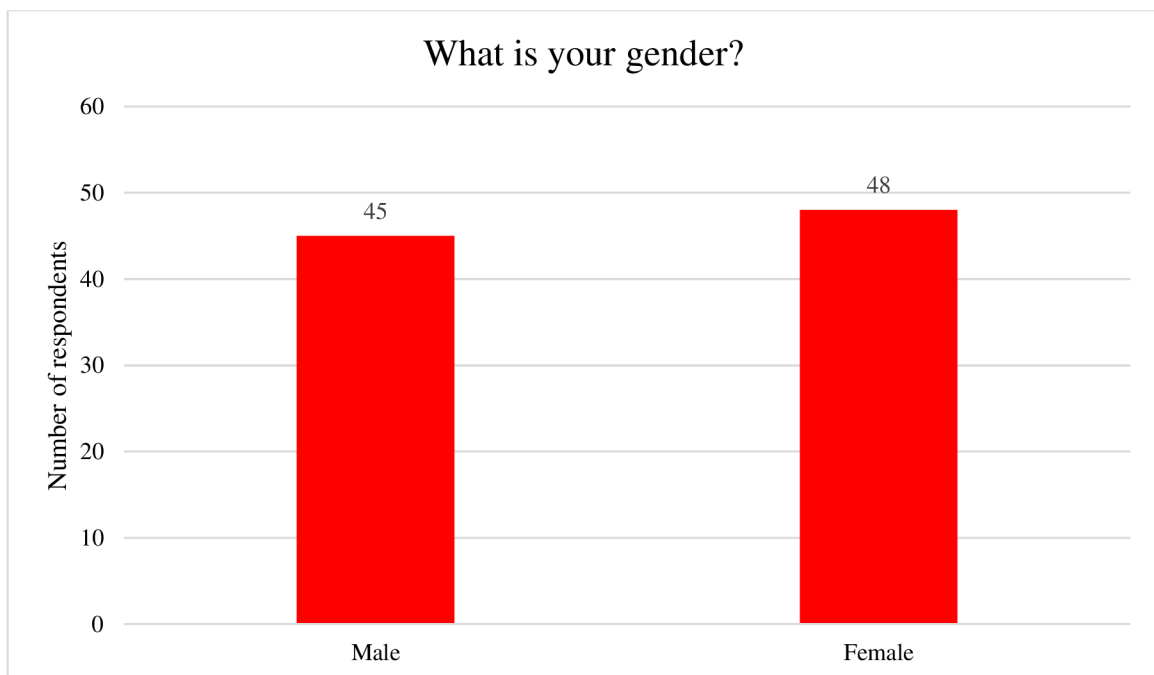
Figure 12. Gender of respondents.

Question 2. In what year do you study?

As Figure 13 indicates, the vast majority of respondents (45.2 %) studied the first year of the bachelor's degree study programme during the questionnaire survey. This is understandable since the questionnaire was distributed at individual universities by first-year students, as is described in Chapter 3.2. Since the questionnaire was also distributed

among Facebook groups for students of the bachelor's degree study programmes, it explains the considerable representation of respondents of the second (22.6 %) and third (19.4 %) year of the bachelor's degree study programme. The circumstances mentioned above give a reason for less represented groups of respondents – there were not enough communication channels to distribute the questionnaire to the groups of students. The minority of respondents studied the first year of the master's degree study programme (5.4 %) and the second year of the master's degree study programme (3.2 %) altogether with 3.2 % of respondents who had already graduated or finished university. Since there was a free-form answer, 1.1 % of respondents filled in that they had not finished their studies.
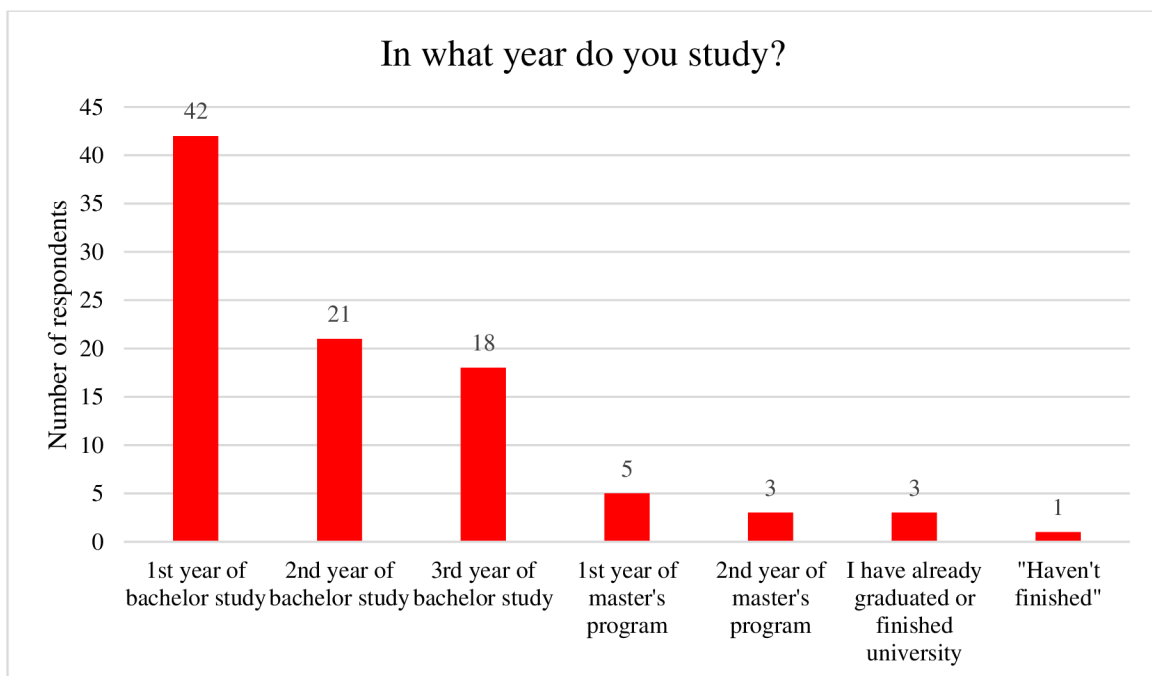
Figure 13. Year of study of respondents.

Question 3. At what university do you study/have you studied?

As we can see from Figure 14, students at Brno University of Technology represented the majority (35.5 %) of respondents. It is highly understandable since a student at this university made the questionnaire. Followed by students at Masaryk University (24.7 %), students at Mendel University in Brno (19.4 %) and students at Tomas Bata University in Zlín (17.2 %) represented a sufficient sample for the evaluation of the questionnaire. The questionnaire was focused mainly on previously mentioned universities, but 2.2 % of respondents studied at the University of Pardubice, and 1.1 % of respondents studied at the

Institute of Technology and Business in České Budějovice. As is described in Chapter 3.2, those students were directly redirected to Google Apps section of the questionnaire.
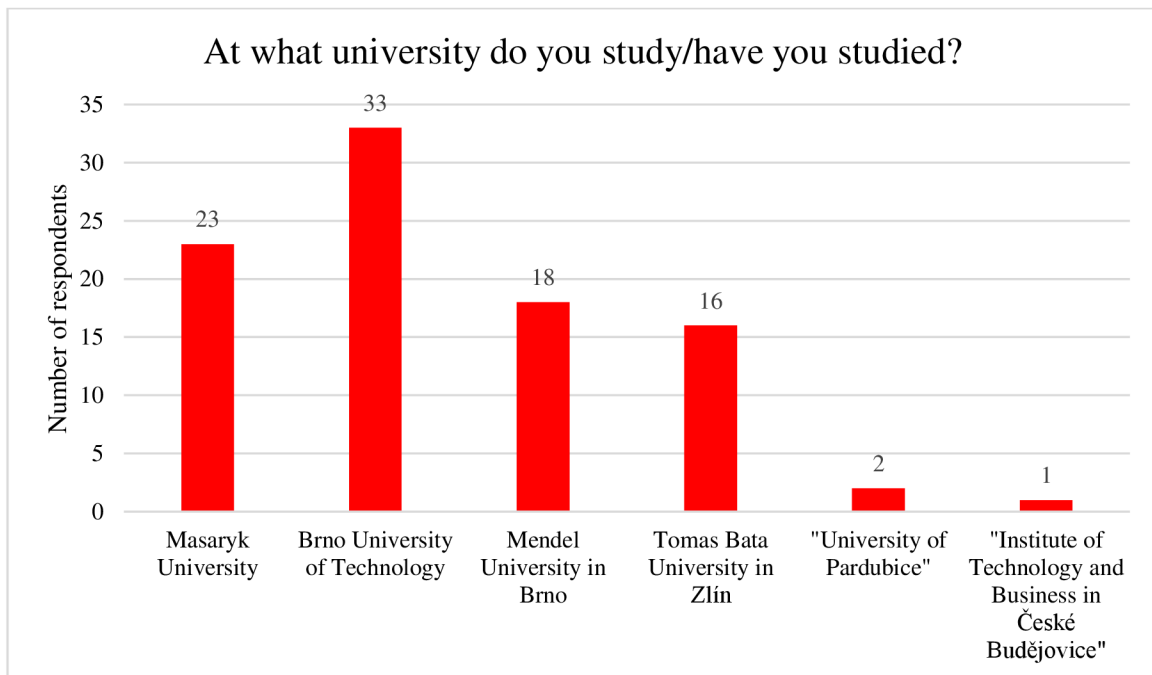
Figure 14. Representation of universities of respondents.

Question 4. Do you use Google Apps in your personal life?

Figure 15 represents the usage of Google Apps in the personal life of all respondents of the questionnaire. This question was crucial since when students use Google Apps in their personal life, it would be uncomplicated for them to adapt to using Google Apps for university purposes. As we can see, the most used (by 85.6 % of respondents) Google application was Gmail. The second most used application was Google Drive by 72.2 % of users, together with 61.1 % of respondents who were using Google Docs, which are part of Google Drive. Google Calendar did not have such a significant representation among respondents – only 38.9 % were using it. Predictably, only 16.7 % of respondents claimed that they used Google Keep (notes) since the application is not installed default by smartphone manufacturers and people often tend to use preinstalled application for taking notes.
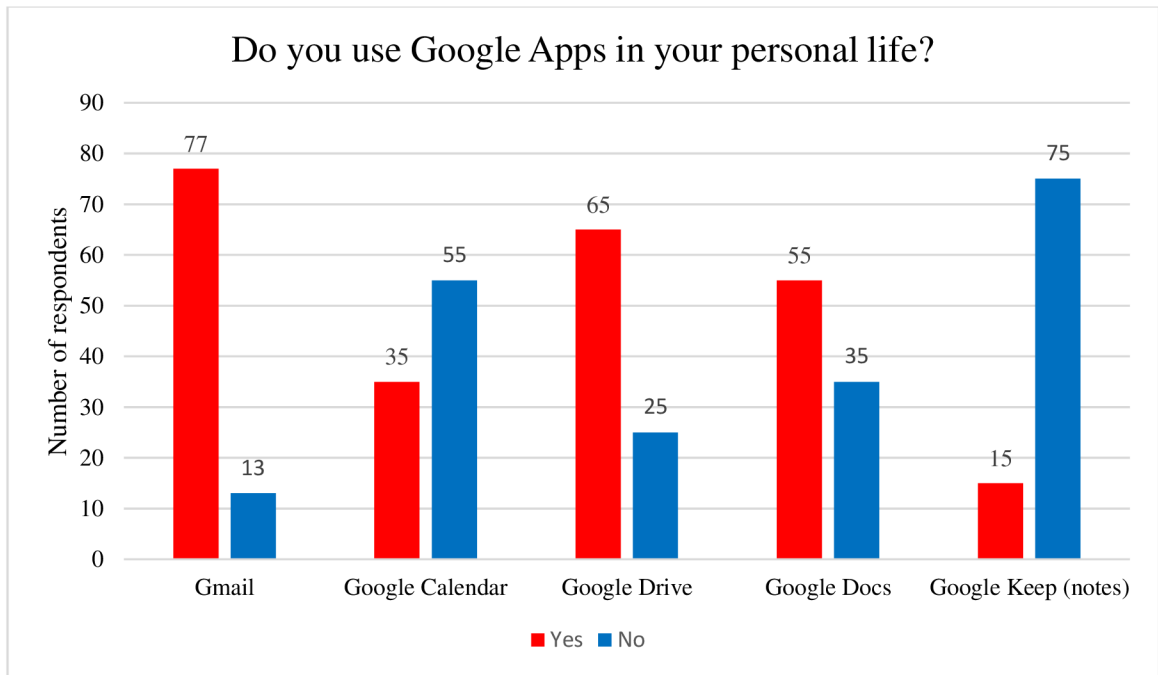
Figure 15. Usage of Google Apps in the respondent's personal life.

Question 5. If your university would offer easy synchronisation of course and examination schedules, emails and files with Google, would you take advantage of this opportunity?

Figure 16 shows whether respondents from all universities would take advantage of synchronisation of all modules – course and examination schedules, emails and files with Google Apps. As we can see, the majority of respondents (74.4 %) replied with positive answers – 54.4 % of students responded "yes", and 20 % of students responded "rather yes". The minority of respondents (17.8 %) responded with negative answers – only 2.2 % of students answered No and 15.6 % of students responded Rather no. As can also be seen from Figure 16, 7.8 % of respondents already use synchronisation between Google Apps and the information system of their university to some extent.
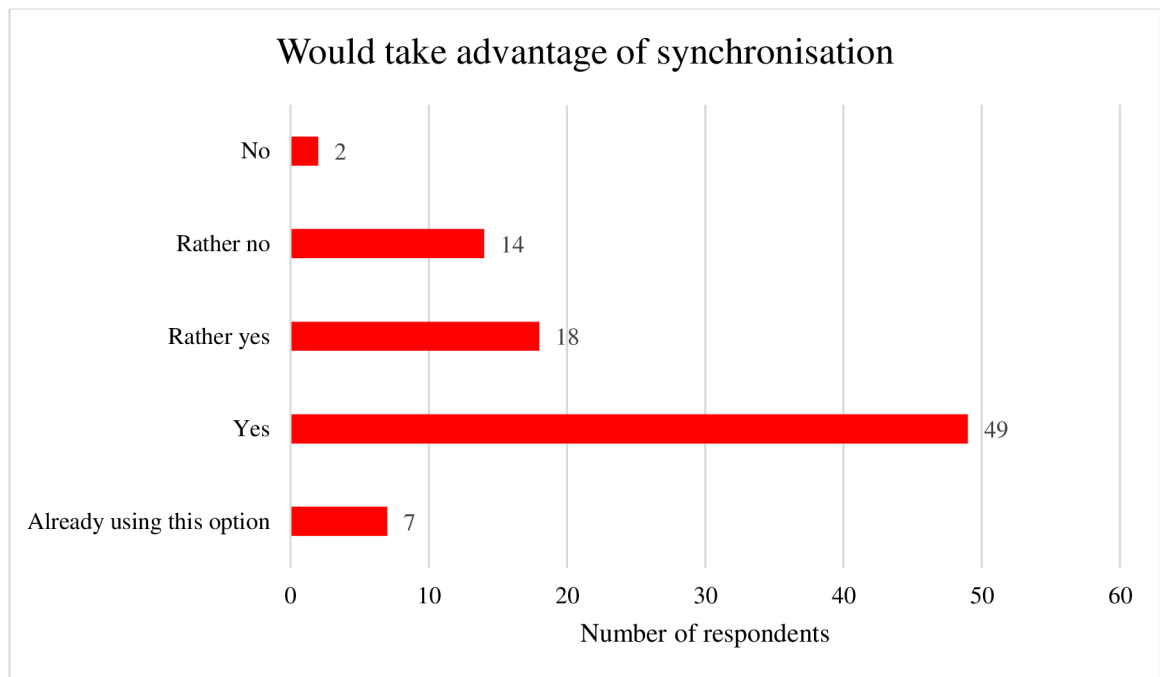
Figure 16. All respondents and the possibility of considering synchronisation of all modules.

3.4.2 Brno University of Technology

3.4.2.1 Individual Schedule

Question 1. How do you evaluate the clarity of the teaching schedule in Studis?

As seen from Figure 17, the majority of BUT students evaluated the clarity of the teaching schedule in Studis positively. This question was made as evaluation in school – from 1 (very clear) to 5 (confusing). The majority of respondents (45.5 %) thought that the clarity of the schedule module is "very clear". Second biggest group (39.4 %) of respondents rated the clarity with a grade of 2 – it could also be marked as "clear". Grade of 3 that can be marked as "neutral rating" chose 9.1 % of students and 6.1 % of respondents replied with a grade of 4 – "not clear". None of the BUT students thought that teaching schedule in Studis is "confusing" (grade of 5).
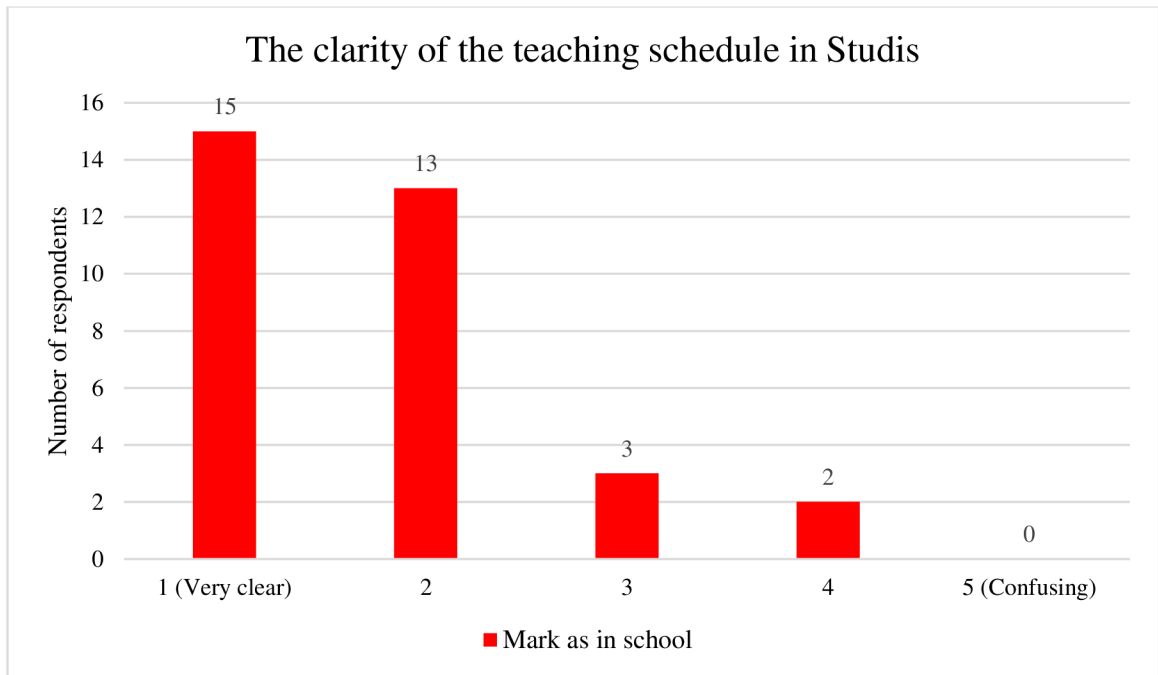
Figure 17. Evaluation of the clarity of the teaching schedule in Studis.

Question 2. Schedule information and features on the website are for me:

It is also an essential factor if students could find sufficient information in the information system easily and if it has enough necessary features. As Figure 18 shows, the majority of respondents (36.4 %) thought that schedule information and features are sufficient (grade of 1). 33.3 % of students marked the sufficiency with a grade of 2, while 21.2 % of respondents chose a grade of 3. The minority of respondents tended to evaluate rather negatively – 6.1 % replied to the sufficiency of schedule information and features with a grade of 4, and 3 % of students classified it as insufficient – grade of 5.
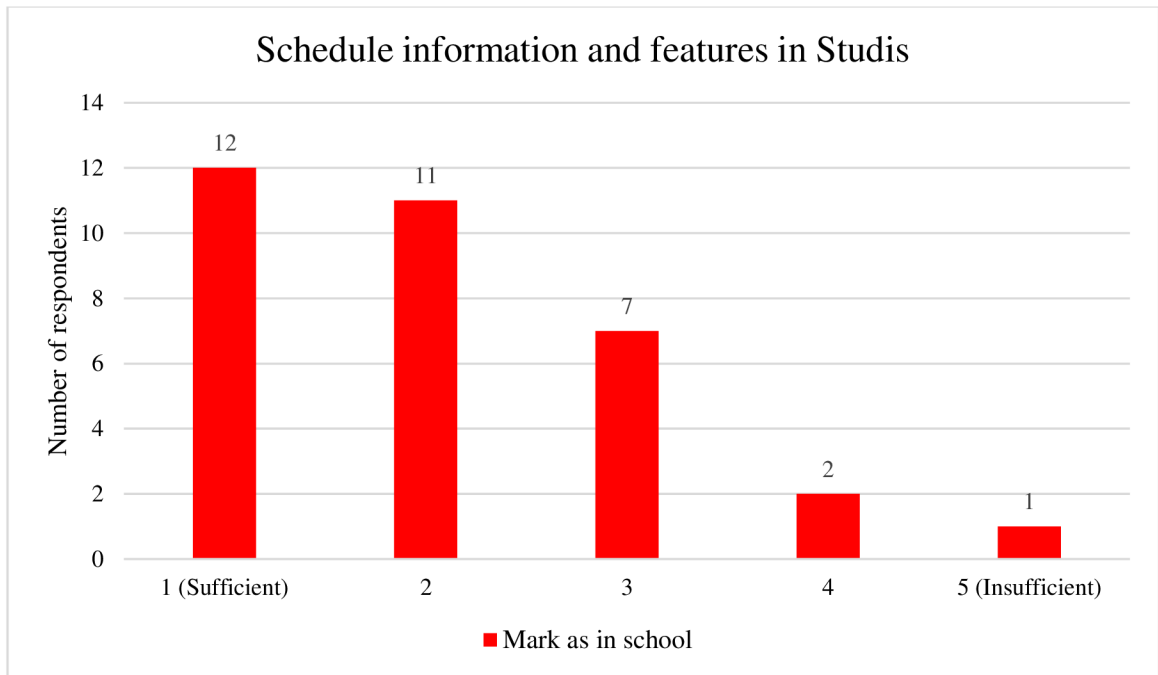
Figure 18. Evaluation of schedule information and features sufficiency in Studis.

Question 3. In what form do you actively use the teaching schedule?

As can be seen from Figure 19, students who use the digital form of teaching schedule composed the majority at BUT in this multiple-choice type of question. Respondents who access the schedule on BUT website via a computer or smart device represented 93.9 % of responses. Students capable of setting-up synchronisation with Google calendar or another calendar application comprised 21.2 %. Only 3 % of respondents printed the schedule from BUT website and used it in a paper form, and 15.2 % of respondents rewrote their schedules to a paper diary.
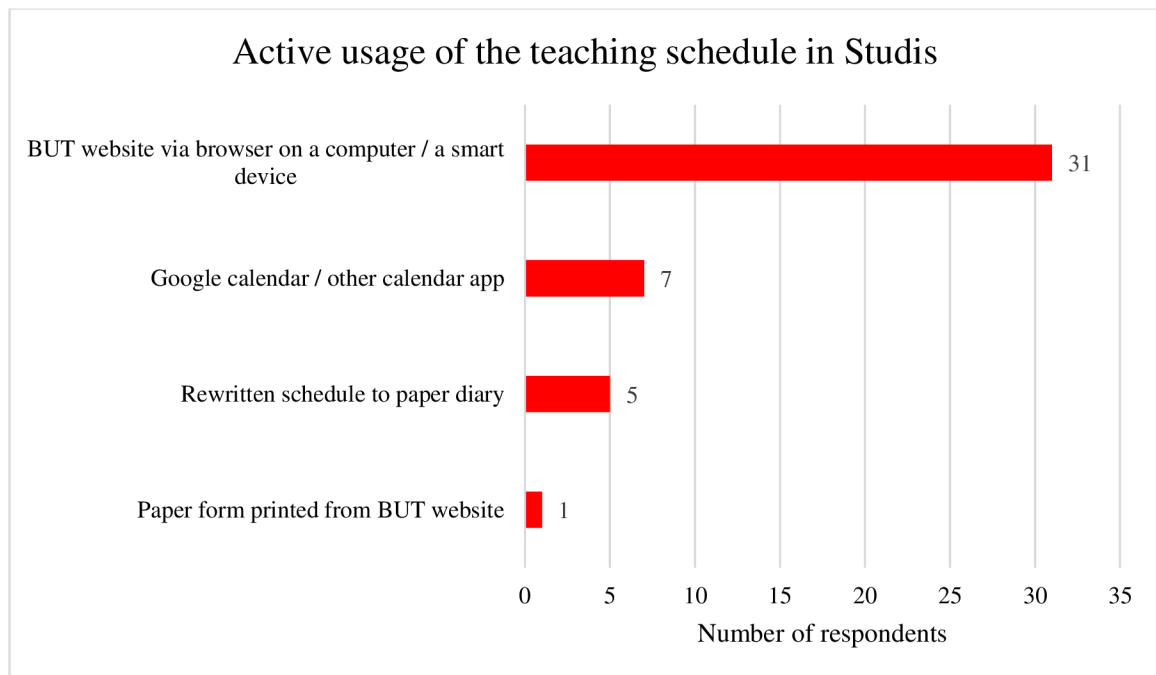
Figure 19. Active usage of the teaching schedule in Studis.

Question 4. Assuming you could synchronise your individual schedule to a smart device (phone) with a few clicks, would you consider this option?

The last question in BUT schedules oriented part of the questionnaire asked if students would consider synchronisation of schedules with their smart device (smartphone). Respondents who replied Yes (51.5 %) formed the majority in this question. Another 21.2 % of respondents chose the second positive option – they would more likely synchronise their schedules with their smart devices. As Figure 20 shows, 18.2 % of respondents were already using the synchronisation; however, we can observe this number varies in Figure 19 – seven respondents actively used their schedule in some calendar application, but six students answered they already use this option in Figure 20. Negative responses were comprised of 6.1 % of students who answered with No, and 3 % of respondents who replied with Rather no.
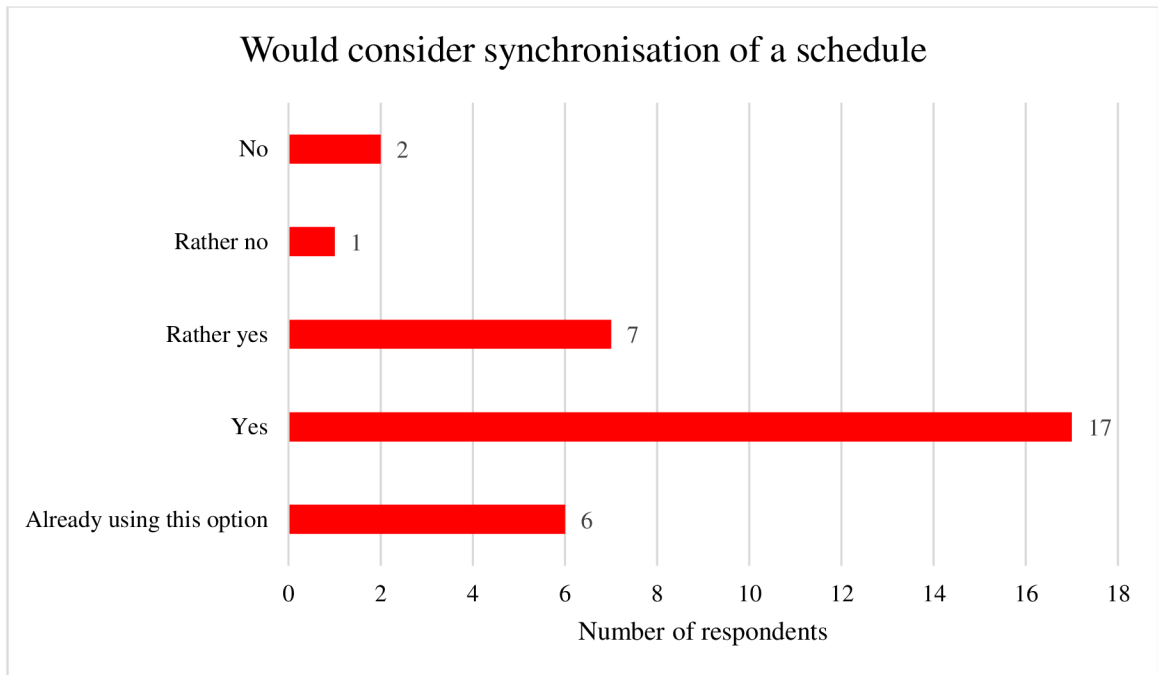
Figure 20. BUT students and the possibility of considering synchronisation of a schedule.

3.4.2.2 Emails

Question 5. What options do you use to read and send school messages and emails?

From Figure 21, we can see that the majority of BUT students (54.5 %) were accessing the school messages and emails via Gmail, as described in Chapter 2.1.2.2. As this was a multiple-choice type of question, it is odd that only 30.3 % of respondents used BUT News in Intraportal, as this is the only option how to read BUT registration confirmation email messages. Students using the default type of email client (Horde, Roundcube) represented 21.2 % of respondents and another 21.2 % of respondents forwarded their emails and messages to Microsoft Office 365 applications (Outlook) on a smartphone or computer. The minority of respondents (12.1 %) imported their communication to a personal email.
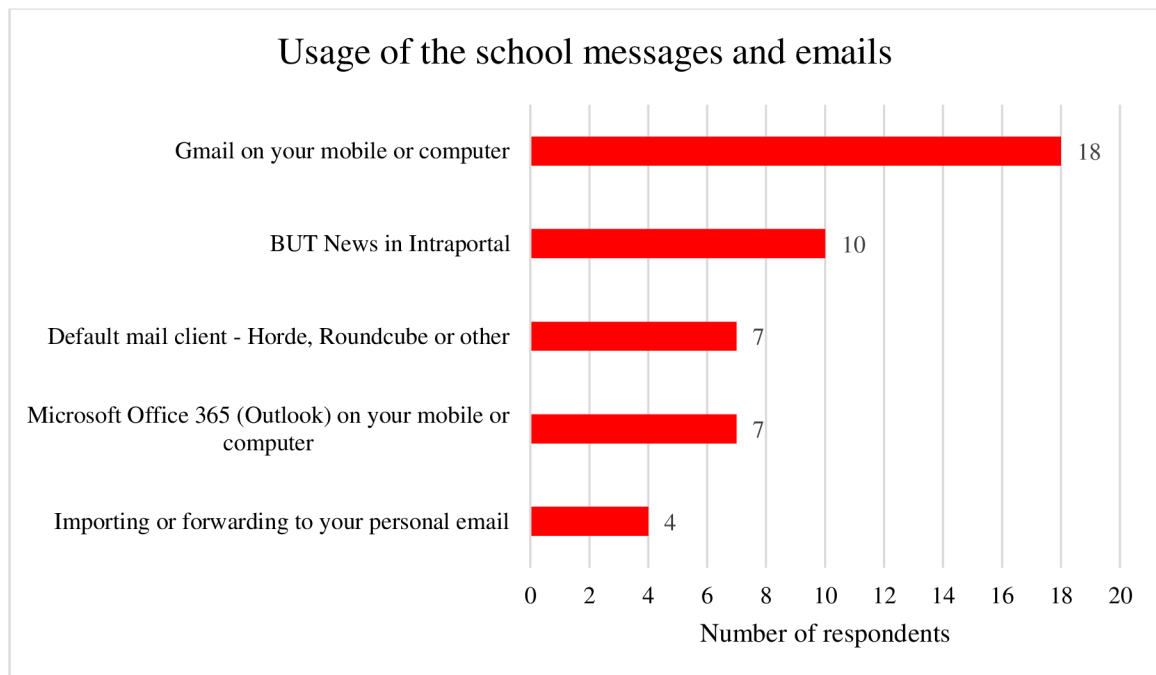
Figure 21. Usage of the school messages and emails by BUT students.

Question 6. The email client's searched properties for you are:

Using emails is an integral part of communication at universities – sometimes the only option of communication. As Figure 22 demonstrates, every person searches and favours different properties of an email client when using emails. Logically, the majority of today's students (66.7 %) favoured mobile phone application accessibility, altogether with the clarity of the client searched by 60.6 % of respondents. If a person uses more than one email address, the sought property is a possibility to have multiple accounts logged in one email client – feature wanted by 57.6 % of students. Security and privacy of communication were essential to 42.4 % of respondents, and the possibility to send large attachments (files) was vital to 30.3 % of respondents. 18.2 % of respondents prefered the total capacity of email storage. One student (3 % of respondents) added that he searches for "simplicity of operation", and another student (3 % of respondents) added that he requires the "possibility to send one to two emails per month". This question was again a multiple-choice type.
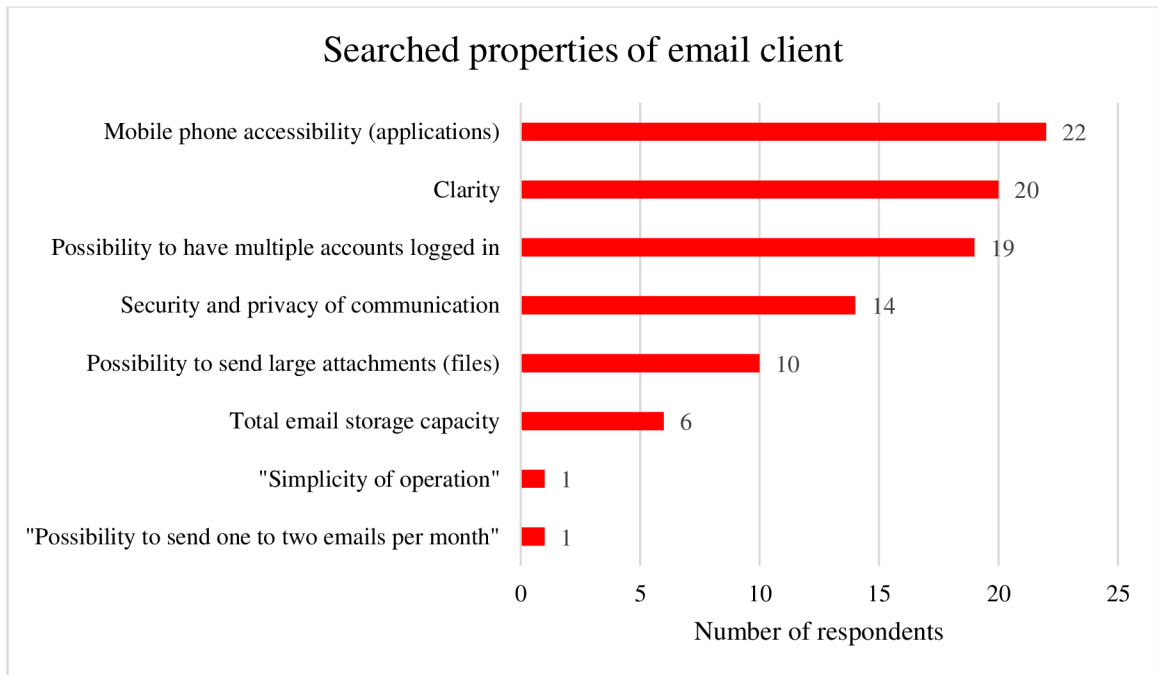
Figure 22. Searched properties of email client by BUT students.

Question 7. Assuming you could link whole school email communication to a smart device (phone) with a few clicks, would you consider this option?

The last question in BUT emails oriented part of the questionnaire examined if students would consider linking their university communication to a smart device. Figure 23 illustrates that the majority of respondents (97 %) confirmed the question with their answers – 51.5 % of students would consider this option, 33.3 % of them were already using this option, and 12.1 % of respondents replied with Rather yes. The minority with only 3 % of respondents answered No, confirming that majority of BUT students would consider using their smart device to communicate at the university.
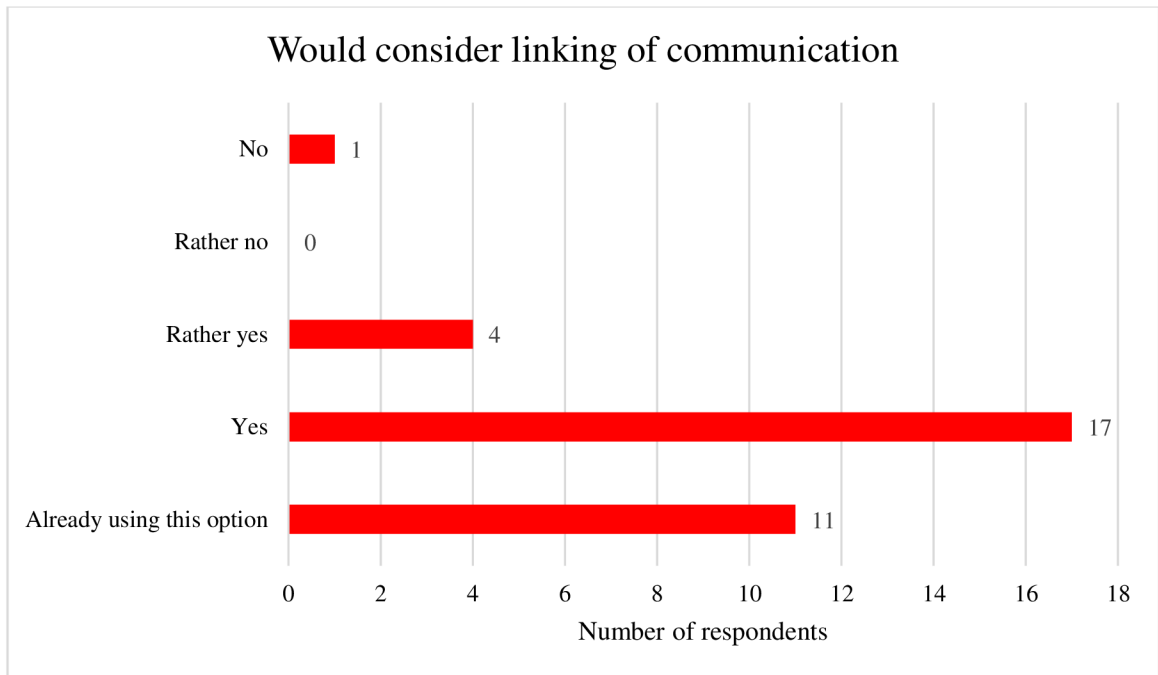
Figure 23. BUT students and the possibility of considering linking of communication.

3.4.2.3 File storages

Question 8. Which storage options do you use?

As is described in Chapter 2.1.1.3 and Figure 24, BUT students have four alternatives for storage options. The majority of respondents (78.8 %) used Google Drive, and none of them used Cesnet ownCloud that provides the smallest total storage capacity of possible cloud storage options for BUT students. Since this was a multiple-choice type of question, it is clear that some respondents use more storage options. Microsoft OneDrive was used by 36.4 % of students, besides BUT Drive was used by 36.4 % of respondents – Figure 25 demonstrates for what purposes.
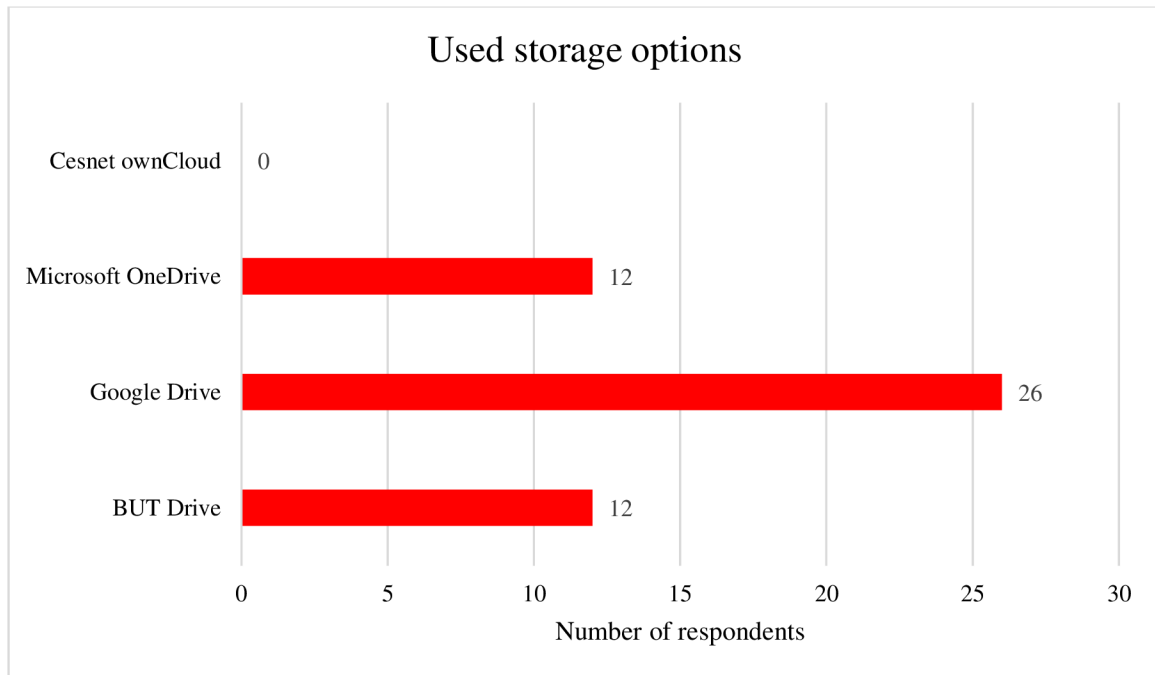
Figure 24. Used storage options by BUT students.

Question 9. If you use a BUT Drive, for what purpose?

Figure 25 represents answers for multiple-choice question about student's purpose of using the BUT Drive. The surprising fact is that the majority of students (48.5 %) did not use the BUT Drive at all. The second most selected option (36.4 % of students) shows that BUT students used this storage option for saving files in laboratory exercises. 24.2 % of respondents used the BUT Drive randomly and occasionally when they needed it, and 18.2 % of respondents used it to save all school files, e.g. protocols, essays, presentations. Only 9.1 % of students accessed the BUT Drive from home by using a VPN. None of the students shared files with other students on the BUT Drive.
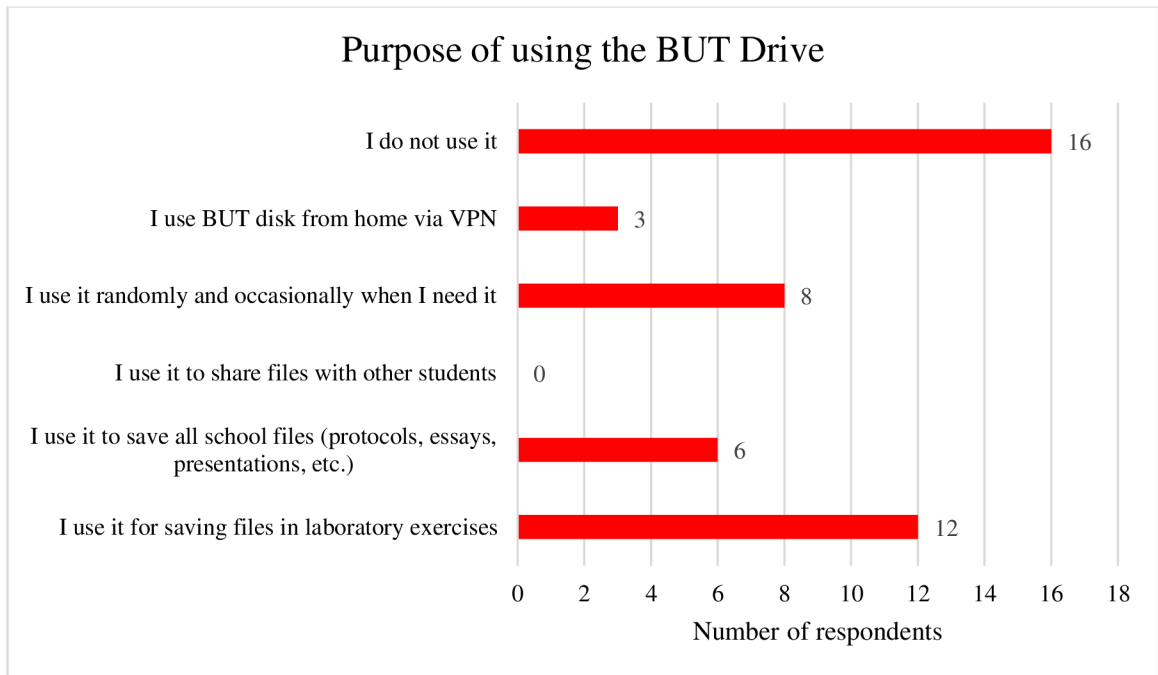
Figure 25. Student's purpose of using the BUT Drive.

Question 10. The file storage's searched properties for you are:

Figure 26 shows that BUT students searched properties of file storage were balanced to the almost same degree. The most searched characteristics (chosen by 57.6 % of respondents) in this multiple-choice question was mobile phone accessibility (application), as same as in Figure 22. 51.5 % of respondents looked for an ability to upload large files, and security and privacy of uploaded files was vital to 51.5 % of respondents. Total storage capacity was relevant to 48.5 % of students, and 48.5 % of respondents thought that file storage application (client) should be easily understandable. Easiness of file sharing with other people was vital to 45.5 % of respondents. As in Figure 22, one respondent (3 %) added that file storage should be simple to operate and 3 % of respondents added answer "You can see it from the web", which could be understood as the file storage should be accessible through a web browser.
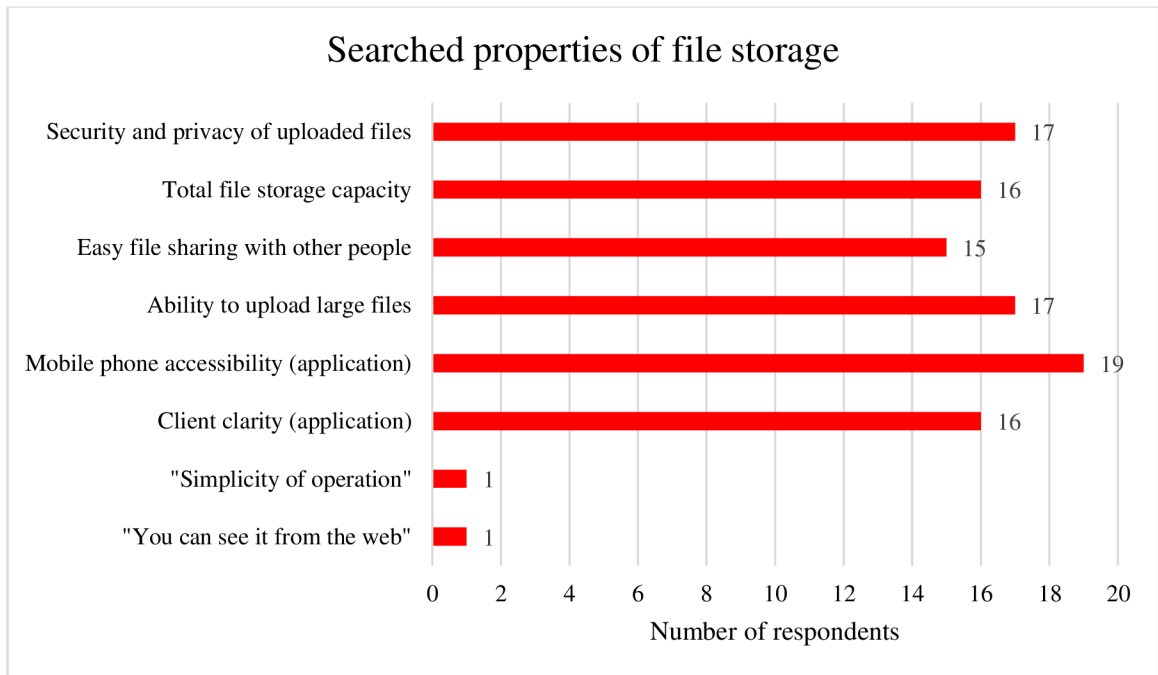
Figure 26. Searched properties of file storage by BUT students.

Question 11. Assuming you could access your school files from a smart device (phone) from anywhere, would you consider this option?

As can be seen from Figure 27, 45.5 % of respondents would consider the possibility of accessing school files from a smart device. Students who already accessed files from a smart device represent 27.3 % of respondents. 15.2 % of students would probably consider the possibility; nevertheless, 3 % would not access files from a smart device, and 9.1 % of respondents would probably not consider this option.
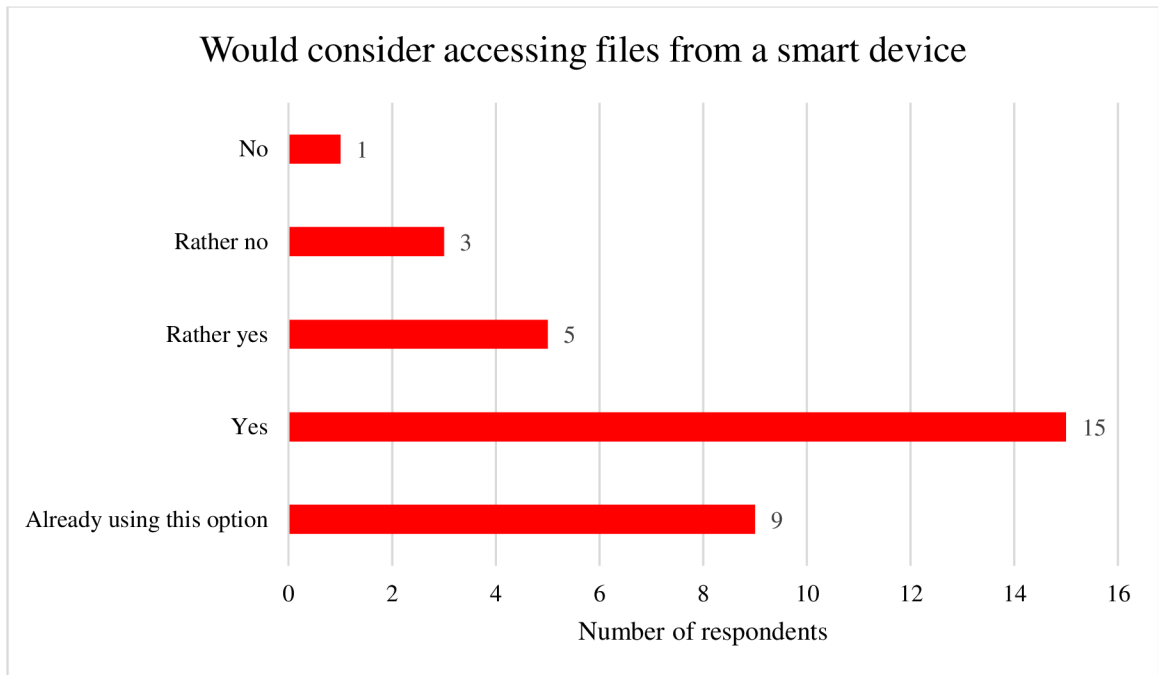
Figure 27. BUT students and the possibility of accessing files from a smart device.

3.4.3 Masaryk University

3.4.3.1 Teaching Schedule

Question 1. You rather use:

Figure 28 shows the choice of MUNI students whether they use My Timetable or My Calendar – these options are described in more detail in Chapter 2.1.2.1. The majority of respondents (95.7 %) was using My Timetable version of displaying Teaching Schedule, whereas only 4.3 % of students used My Calendar, which is based on Google Calendar.
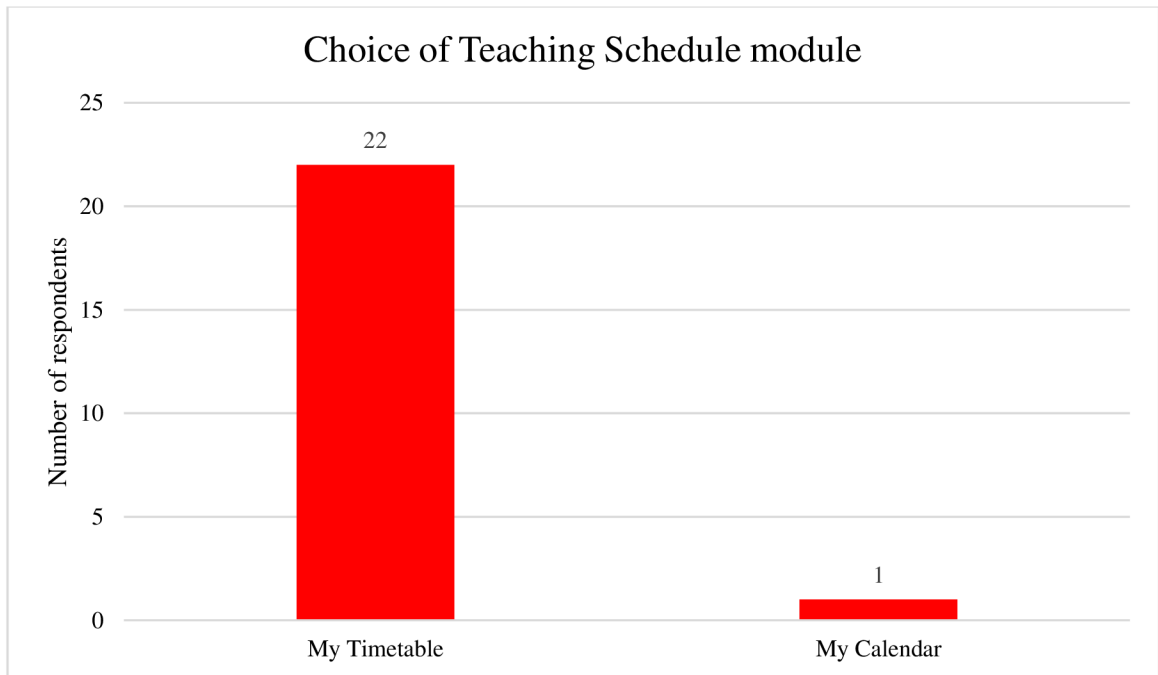
Figure 28. Choice of Teaching Schedule by MUNI students.

Question 2. How do you evaluate the clarity of teaching schedules in MUNI IS?

Figure 29 demonstrates an evaluation of the clarity of the teaching schedules in MUNI IS, which is marked with grades as in school. The clarity of teaching schedules described 17.4 % of respondents as "very clear" with a grade of 1. The majority of respondents (52.2 %) evaluated the clarity with a grade of 2, while 17.4 % of students replied with a grade of 3. Only 4.3 % of respondents described the clarity of the teaching schedule in MUNI IS as confusing (grade of 5), and 8.7 % of respondents marked it with a grade of 4.
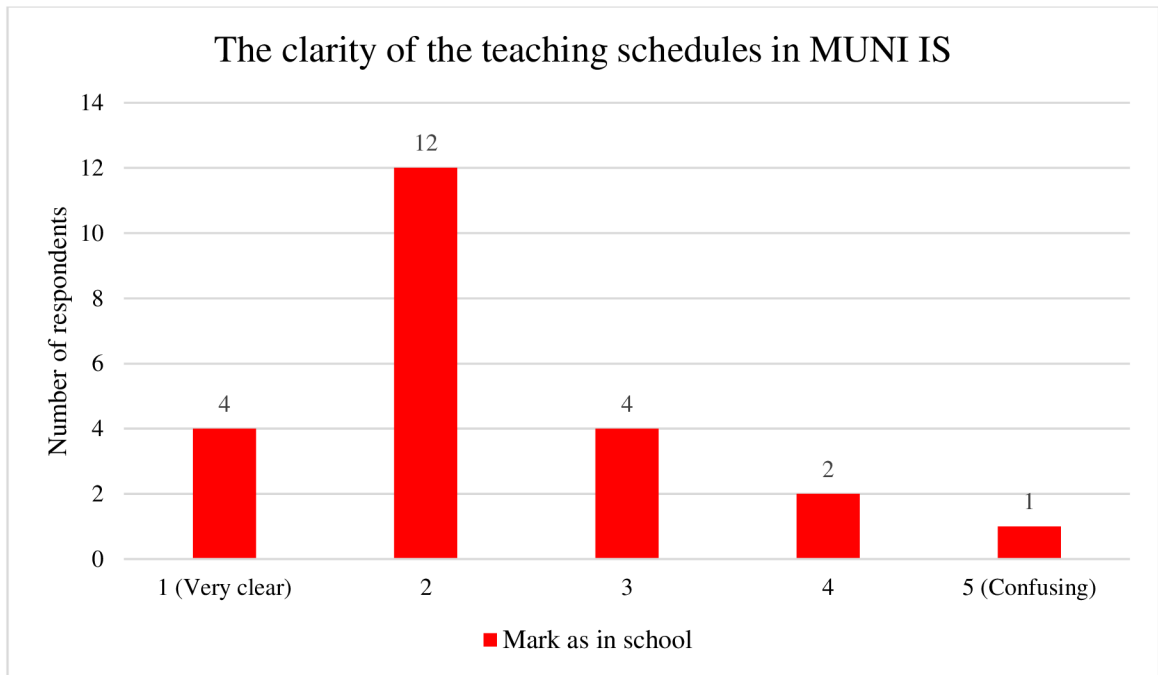
Figure 29. Evaluation of the clarity of the teaching schedules in MUNI IS.

Question 3. Schedule information and features on the website are for me:

From Figure 30, we can see that 26.1 % of respondents evaluated schedule information and features in MUNI IS as sufficient. The majority of respondents (43.5 %) marked the sufficiency with a grade of 2, while 26.1 % of respondents selected a grade of 3. None of the students responded with a grade of 4, and only 4.3 % of students evaluated the schedule information and features as insufficient – grade of 5.
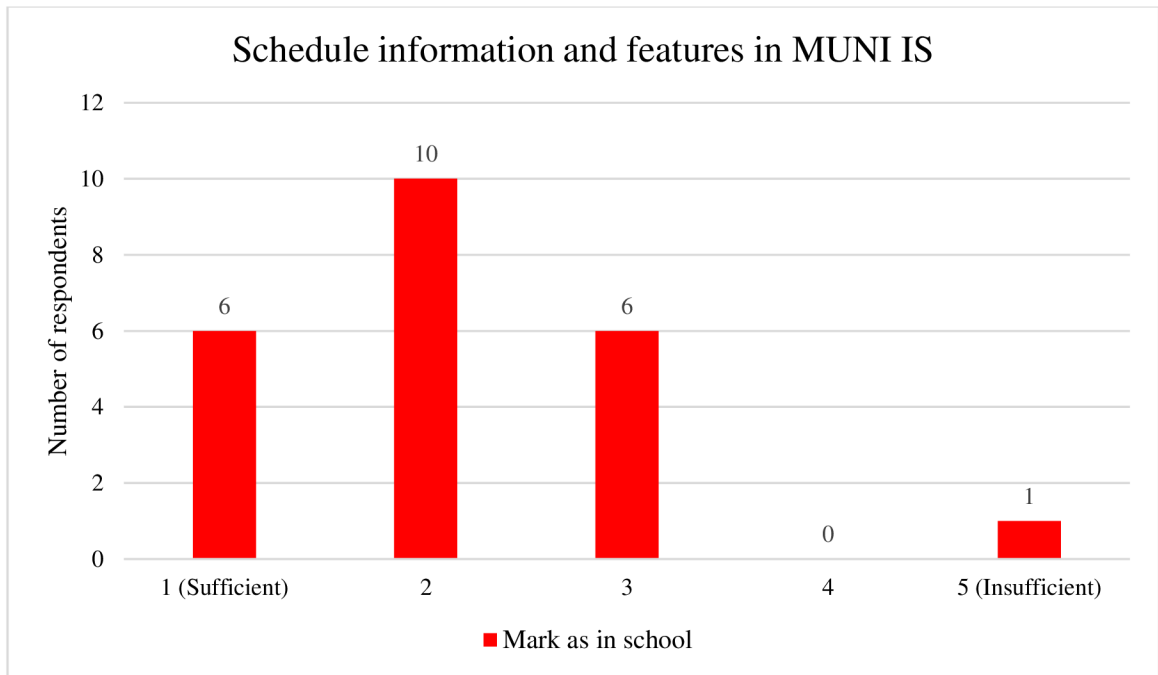
Figure 30. Evaluation of schedule information and features sufficiency in MUNI IS.

Question 4. In what form do you actively use the teaching schedule?

As Figure 31 shows, MUNI students also tended to use the teaching schedule in a digital form, as same as BUT students and their answers in Figure 19. The majority of respondents (82.6 %) accessed the teaching schedule via a web browser on a computer or a smart device. However, this usage has some disadvantages, which are discussed in Chapter 3.6. It is questionable why only 4.3 % of MUNI students synchronised their teaching schedules with Google calendar or other calendar application if My Calendar module of MUNI IS is offering iCal exportation of schedules, exams, etc. 34.8 % of respondents printed their schedules from MUNI website, and 26.1 % of students rewrote their schedules to a paper diary.
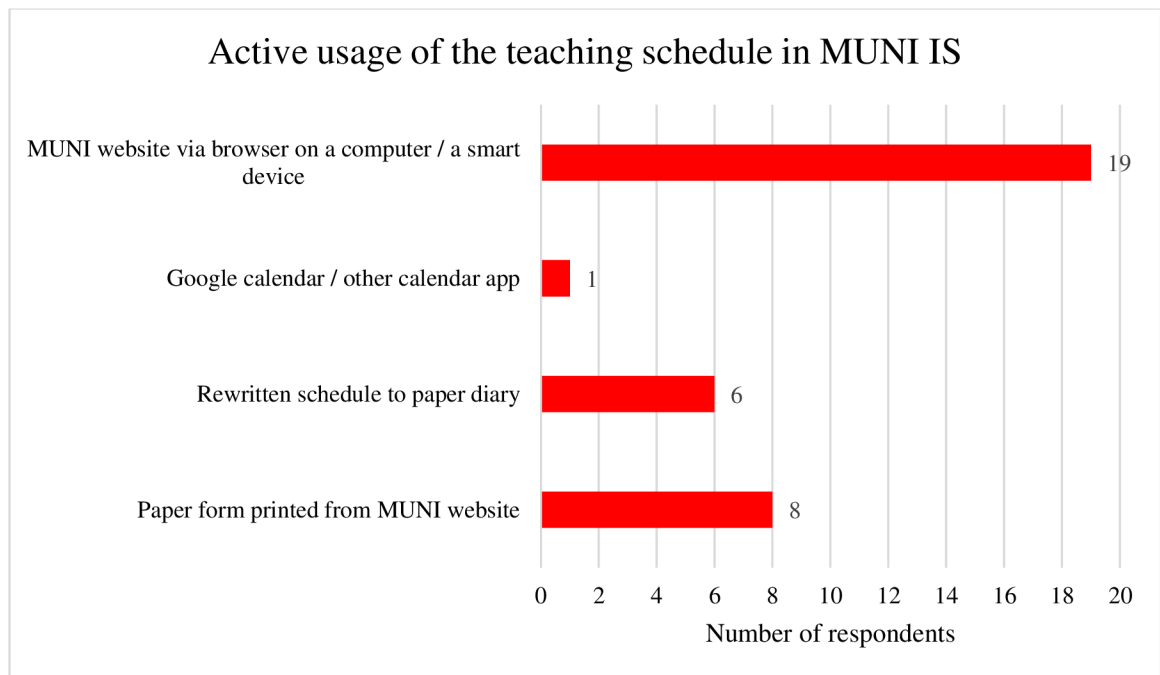
Figure 31. Active usage of the teaching schedule in MUNI IS.

Question 5. Assuming you could synchronise your individual schedule to a smart device (phone) with a few clicks, would you consider this option?

Figure 32 displays the last question in MUNI schedules oriented part of the questionnaire: If MUNI students would consider synchronisation of a schedule with a smart device. The majority of respondents (60.9 %) answered that they would consider this option, and 13 % of students would probably consider this option. One of the students (4.3 %) already took advantage of synchronisation; moreover, 21.7 % of respondents would probably not consider the synchronisation.
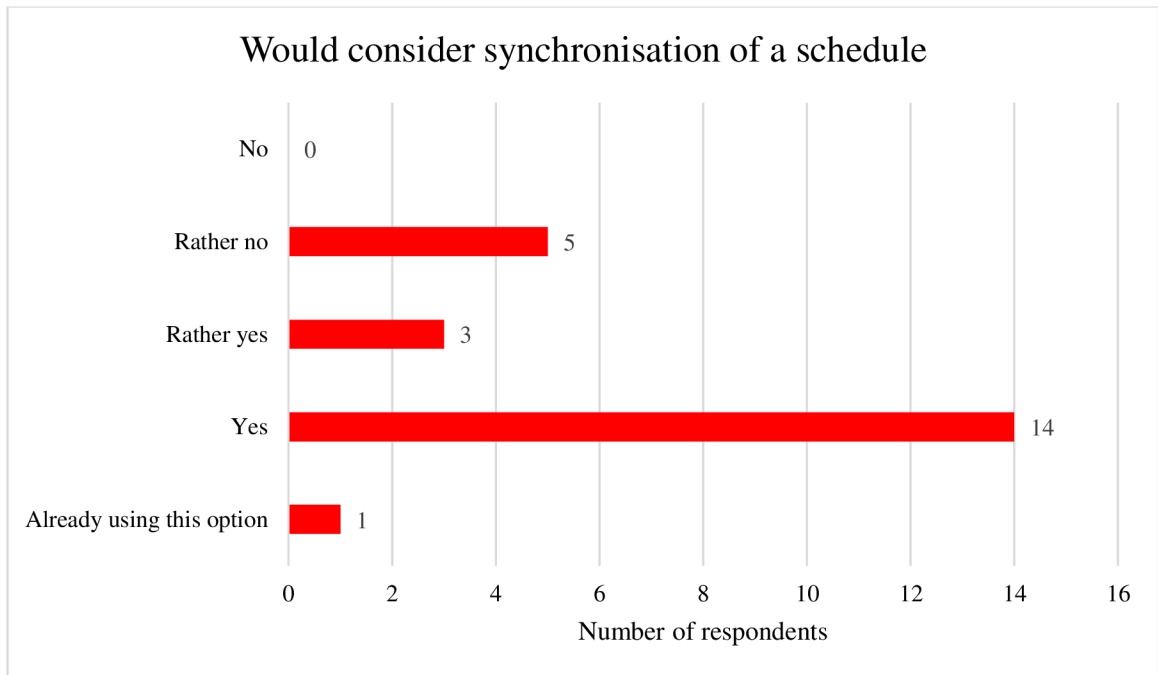
Figure 32. MUNI students and the possibility of considering synchronisation of a schedule.

3.4.3.2 Emails

Question 6. What options do you use to read and send school messages and emails?

Figure 33 presents data related to the usage of the school message and emails by MUNI students. As we can see, the majority of respondents (73.9 %) was using the default option – accessing the My Mail application in MUNI IS. Another group of respondents (21.7 %) imported or forwarded the university communication to their personal email account, and 17.4 % of MUNI students accessed it in Gmail application on a smartphone or a computer.
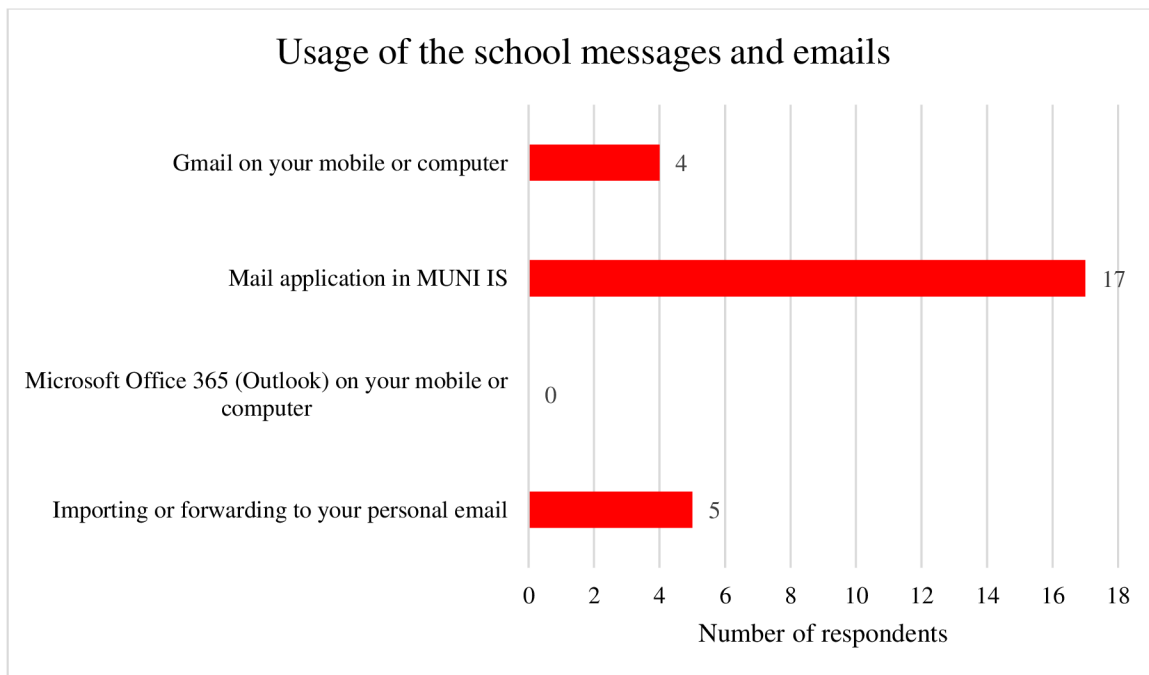
Figure 33. Usage of the school messages and emails by MUNI students.

Question 7. The email client's searched properties for you are:

We can see from Figure 34 that most searched property (by 73.9 % of respondents) of email client by MUNI students was the clarity of the client, followed by mobile phone accessibility (applications) that was wanted by 60.9 % of responding students. The third most favoured (by 56.5 % of respondents) characteristics was the security and privacy of communication; whereas only 30.4 % of respondents sought the possibility to send large file attachments. Unlike 57.6 % of responding BUT students (presented in Figure 22), the MUNI students seemed to not look for the possibility to have multiple accounts logged in – this feature was searched by 21.7 % of MUNI respondents. In this multiple-choice question, total email storage capacity was one of the least searched (by 21.7 % of MUNI students) property of email client.
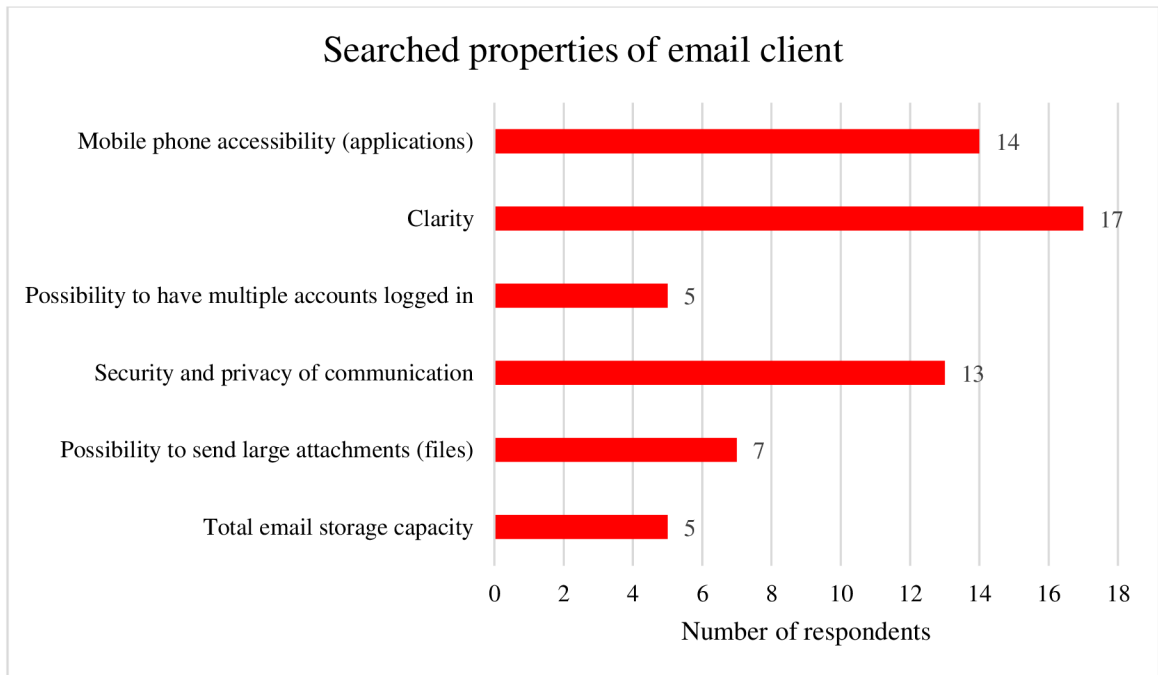
Figure 34. Searched properties of email client by MUNI students.

Question 8. Assuming you could link whole school email communication to a smart device (phone) with a few clicks, would you consider this option?

The last MUNI email oriented part of the questionnaire analyses if students at this university would consider linking of school email communication to a smart device. As can be seen from Figure 35, the majority of respondents (60.9 %) would consider this option, and another 8.7 % of respondents would probably look at this possibility. This option was already used by 17.4 % of MUNI students, on the other hand, 8.7 % of students would probably not consider linking communication, and 4.3 % of respondents would not consider it at all.
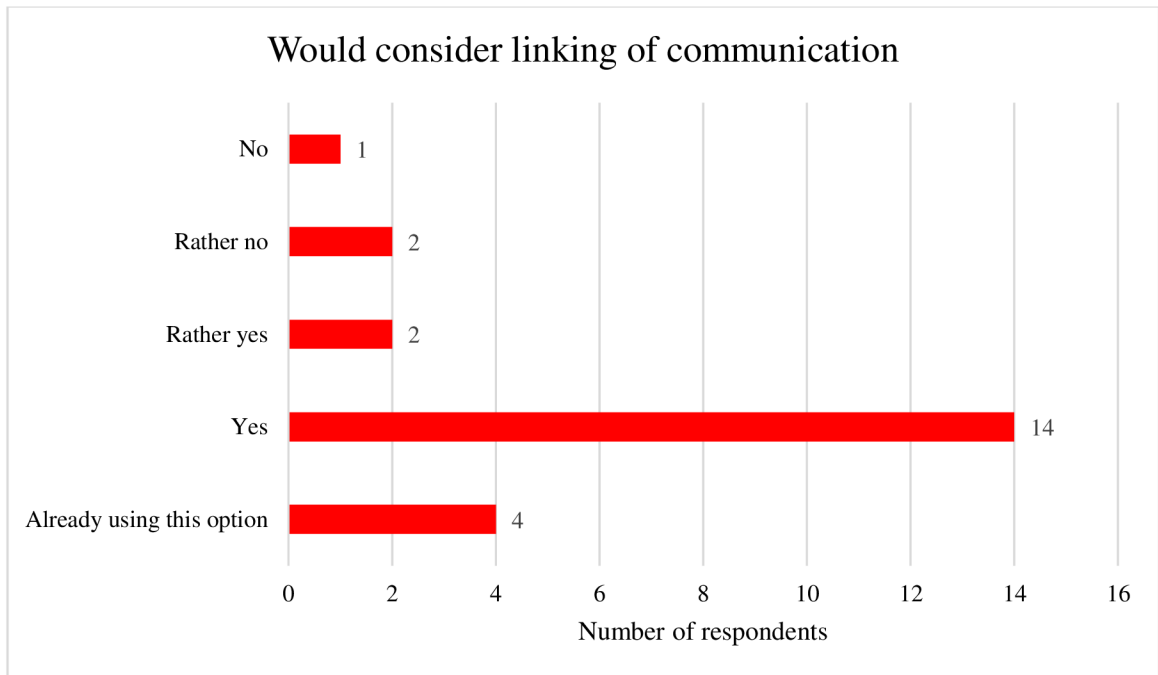
Figure 35. MUNI students and the possibility of considering linking of communication.

3.4.3.3 File storages

Question 8. Which storage options do you use?

Figure 36 shows used storage options, described in Chapter 2.1.2.3, by MUNI students. The majority of students (69.6 %) worked with Google Drive and as same as BUT students, none of the MUNI students used Cesnet ownCloud. Only 4.3 % of respondents used My Web storage with 1 gigabyte of capacity, and the other MUNI web-based storage option (File depository) used 21.7 % of respondents. 21.7 % of respondents worked with OneDrive by Microsoft.
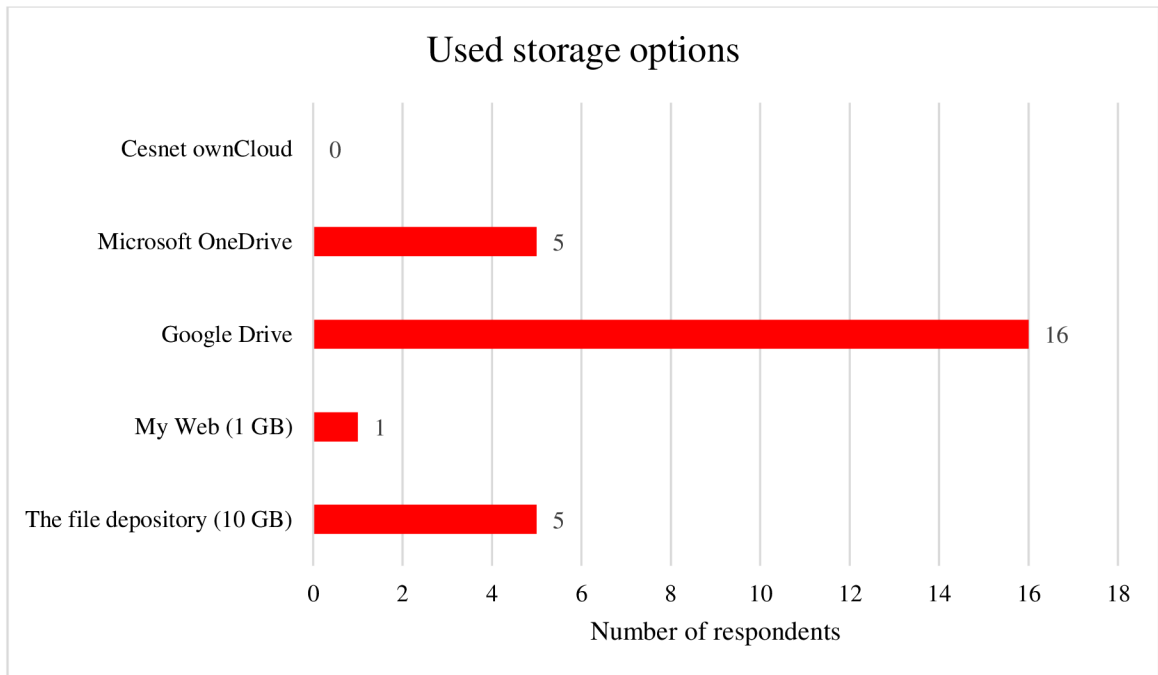
Figure 36. Used storage options by MUNI students.

Question 9. If you use the file depository or My Web, for what purpose?

Figure 37 shows a multiple-choice question about the usage of MUNI web-based file storages. As we can see, the majority of respondents (82.6 %) did not use either of them. Only 4.3 % of students used it for saving files in laboratory exercises, and 13 % of students used it randomly and occasionally when they need it.
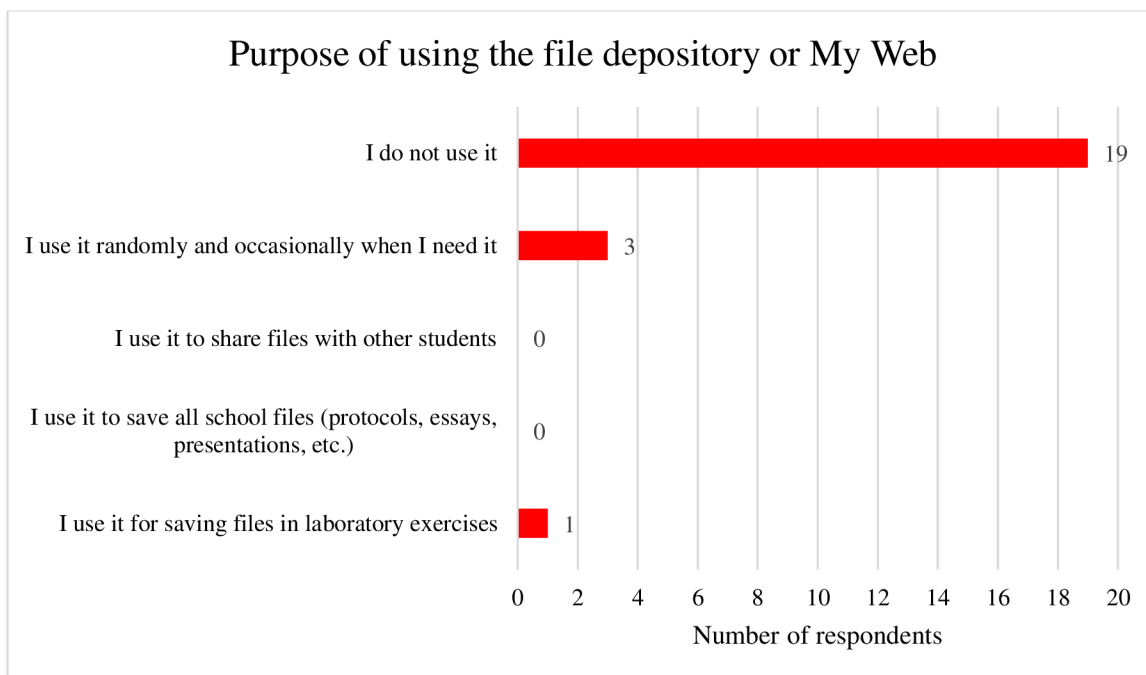
Figure 37. Students' purpose of using the file depository or My Web.

Question 10. The file storage's searched properties for you are:

As Figure 38 shows, MUNI students' searched properties of file storage slightly varied in this multiple-choice type of question. Security and privacy of users' uploaded files were favoured characteristic by the majority of respondents (69.6 %), followed by 60.9 % of respondents who wanted to be able to upload large files. 56.5 % of asked students looked for easy file sharing with other people. Mobile phone accessibility by using an application was relevant to 52.2 % of respondents, while 43.5 % of students searched for total storage capacity, and clarity of application was chosen by 39.1 % of respondents. One of the respondents added that she does not use any file storage.
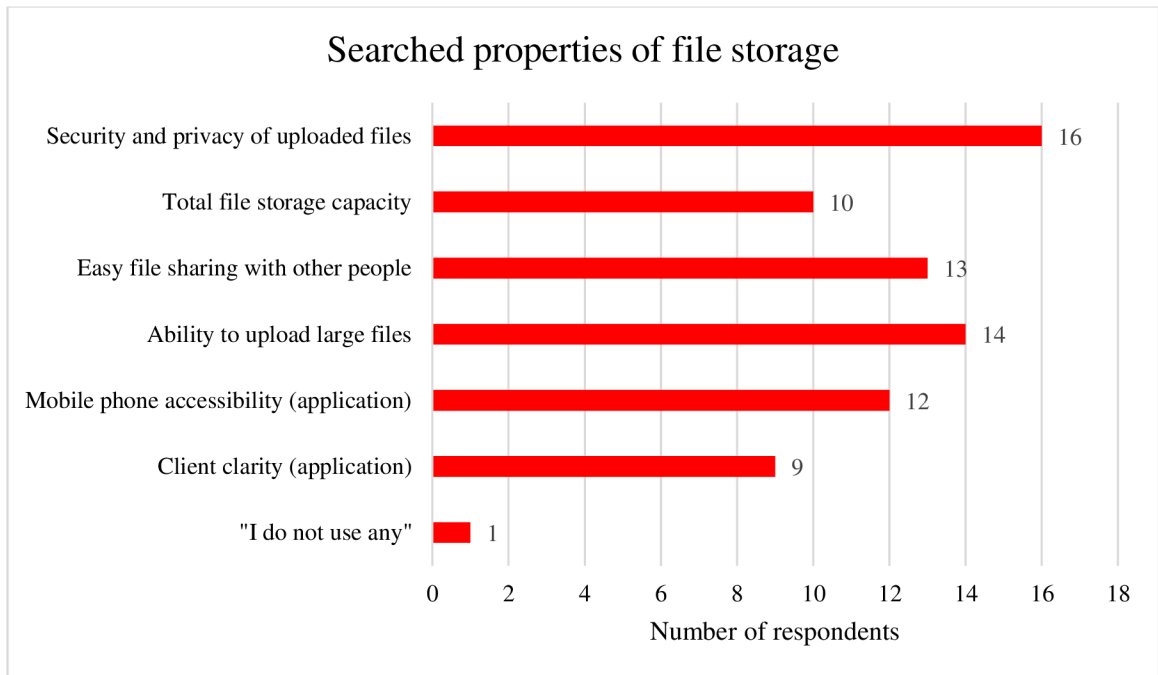
Figure 38. Searched properties of file storage by MUNI students.

Question 11. Assuming you could access your school files from a smart device (phone) from anywhere, would you consider this option?

When were MUNI students asked, whether they would consider the option to access school files from a smart device, we can see from Figure 29 that 43.5 % of respondents would. Another 17.4 % of respondents would probably consider the possibility, and 26.1 % of respondents claimed that they already use this option. Only 13 % of students responded negatively – 8.7 % of them would probably not try this option, together with 4.3 % of students who would not try accessing school files from a smart device.

Would consider accessing files from a smart device

Category	Number of respondents
No	1
Rather no	2
Rather yes	4
Yes	10
Already using this option	6

Number of respondents
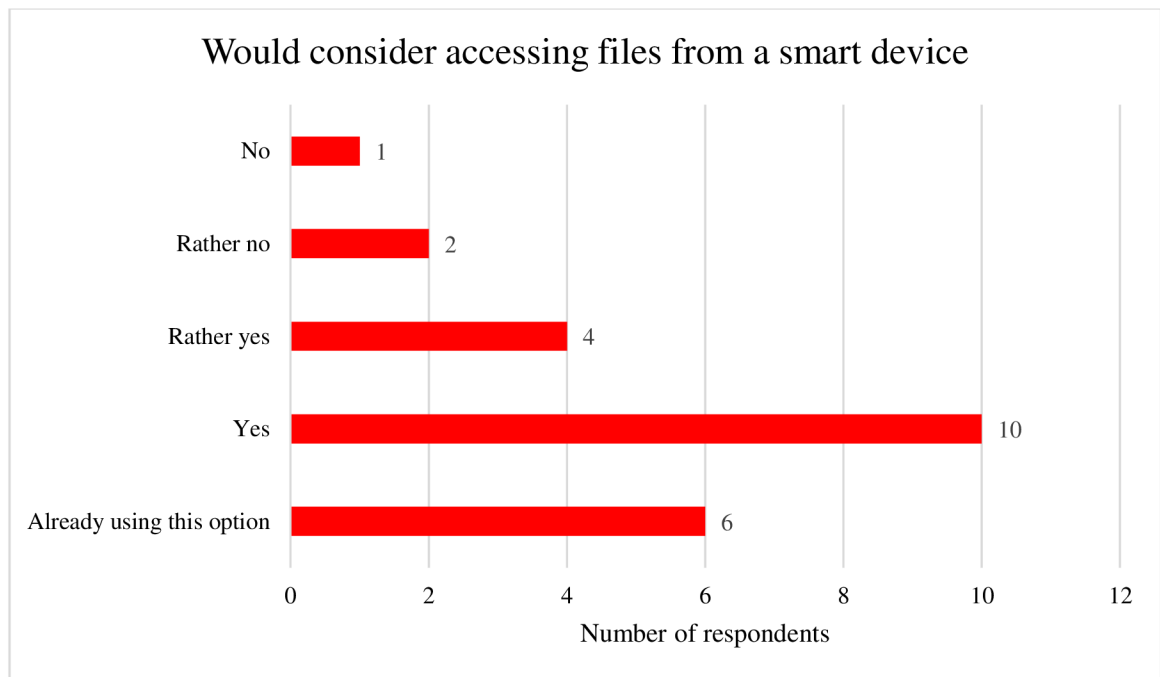
Figure 39. MUNI students and the possibility of accessing files from a smart device.

3.4.4 Tomas Bata University in Zlín

3.4.4.1 Schedule of Lessons

Question 1. How do you evaluate the clarity of the teaching schedule in IS/STAG?

Unlike MUNI and BUT students who thought that their information systems were understandable (mostly rated with a grade of 1 or 2), we can see from Figure 40 that TBU students responded with rather mean grades. The majority of students (31.3 %) described the clarity of IS/STAG neutrally with a grade of 3. Grade of 4 was chosen by 25 % of respondents, whereas 18.8 % of students replied with a grade of 3. As "very clear" was IS/STAG described by 12.5 % of respondents, and another 12.5 % of respondents evaluated it as "confusing".
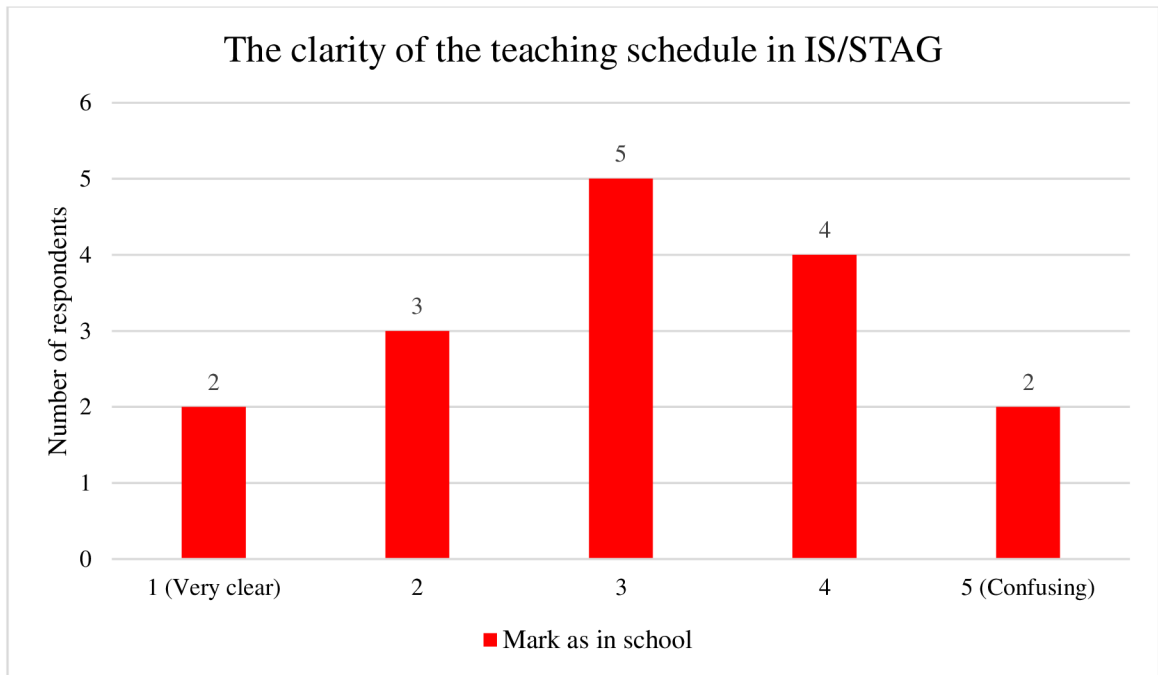
Figure 40. Evaluation of the clarity of the teaching schedule in IS/STAG.

Question 2. Schedule information and features on the website are for me:

As we can see from Figure 41, none of the TBU students evaluated schedule information and features as sufficient (grade of 1). Most respondents (50 %) marked sufficiency with a grade of 2, while 31.3 % of respondents chose to a grade of 3. Another 12.5 % of respondents replied with a grade of 4, and 6.3 % of students classified it as insufficient – grade of 5.
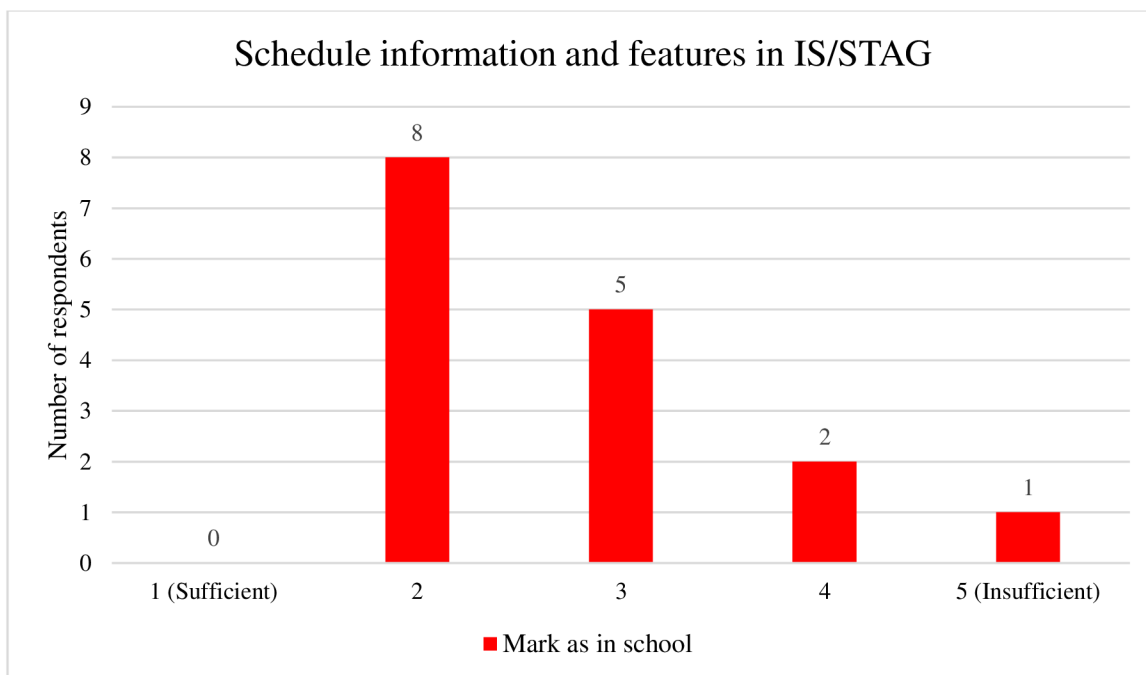
Figure 41. Evaluation of schedule information and features sufficiency in IS/STAG.

Question 3. In what form do you actively use the teaching schedule?

We can see from Figure 42 that the majority of students (81.3 %) tended to access their teaching schedules via a browser on a computer or a smart device in IS/STAG. The group using "paper" form of schedules represented 43.8 % of respondents: firstly 18.8 % of students who printed schedules on a paper (from IS/STAG website), and secondly students who rewrote schedules to a paper diary. Only 6.3 % of respondents used Google calendar or another calendar app. Since this was a multiple-choice type of question a free-form answer, two respondents added their (own) answers. One of the students (6.3 % of respondents) added that he uses the screenshot from IS/STAG, while the other one student responded that he uses a screenshot of a schedule in his wonderful phone. These two answers could be summarized up, representing 12.6 % of respondents since they do have the same meaning.
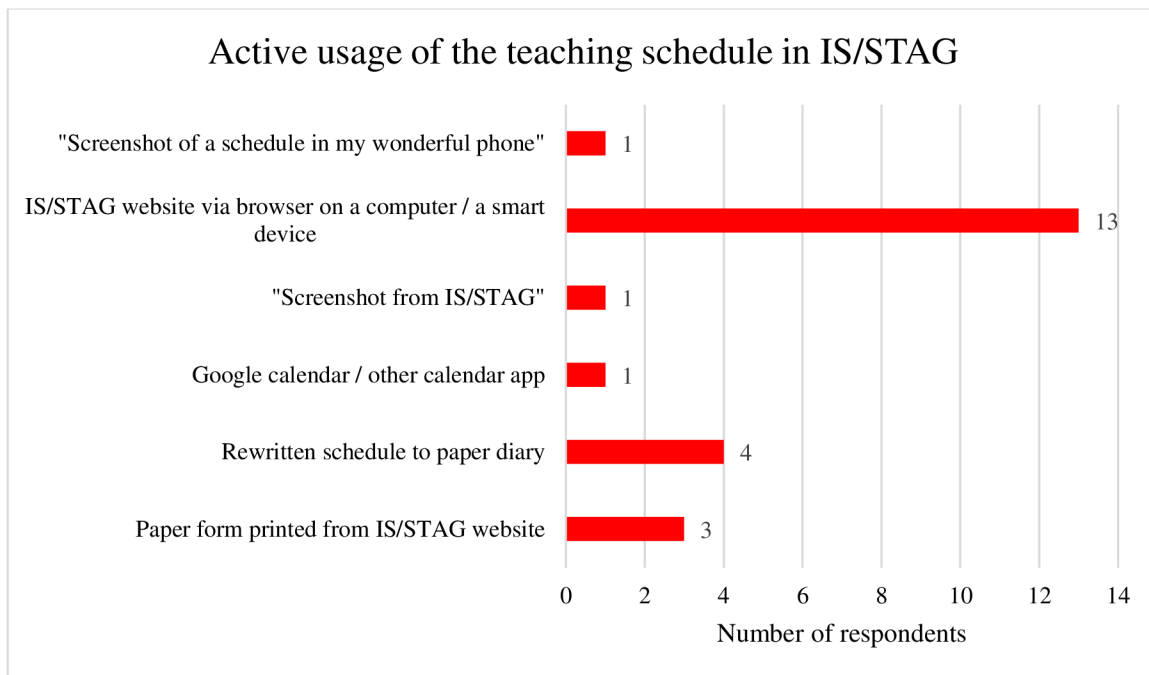
Figure 42. Active usage of the teaching schedule in IS/STAG.

Question 4. Assuming you could synchronise your individual schedule to a smart device (phone) with a few clicks, would you consider this option?

Figure 43 illustrates that the majority of TBU students (56.3 %) would consider the synchronisation of their schedules. Additionally, 25 % of respondents said they already use this option, and 12.5 % of respondents would probably consider this possibility. The minority with only 6.3 % of students responded they would probably not consider synchronisation of schedules. None of the respondents replied with No, confirming that majority of TBU students favour synchronisation of schedules with a smart device.
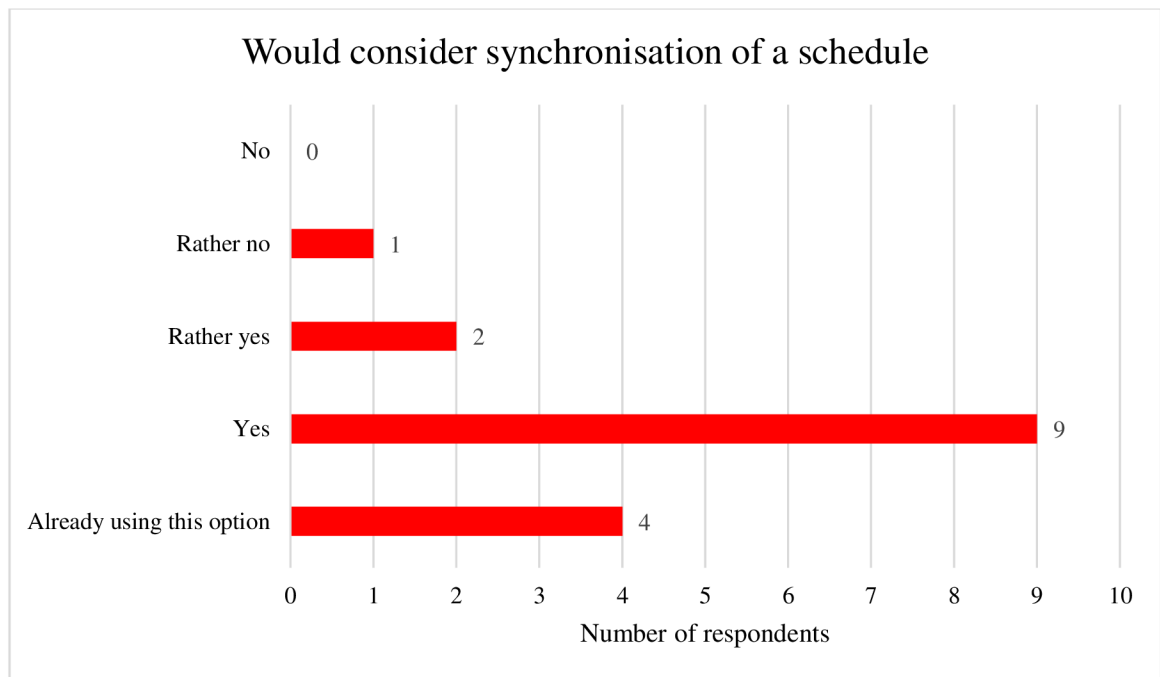
Figure 43. TBU students and the possibility of considering synchronisation of a schedule.

3.4.4.2 Emails and Files

Question 5. The email client's searched properties for you are:

As is described in Chapter 2.1.3.2, students at TBU do not have any other option of email communication than Microsft Outlook. Chapter 3.2 describes why TBU questionnaire concerning emails and files differs from other universities. Figure 44 represents searched properties of email client by TBU students. As same as the majority of Brno University of Technology students, the majority of TBU students (75 %) favoured mobile phone accessibility via applications. Security and privacy of communication were essential to 56.3 % of respondents. Since this was the multiple-choice type of question, 50 % of respondents chose three vital properties of email client to them: possibility to send large attachments (files); possibility to have multiple accounts logged in; and client clarity. Total email storage capacity was searched by 37.5 % of respondents, and one student (6.3 % of respondents) added that he sought the possibility to set up custom filters and automatic sorting.
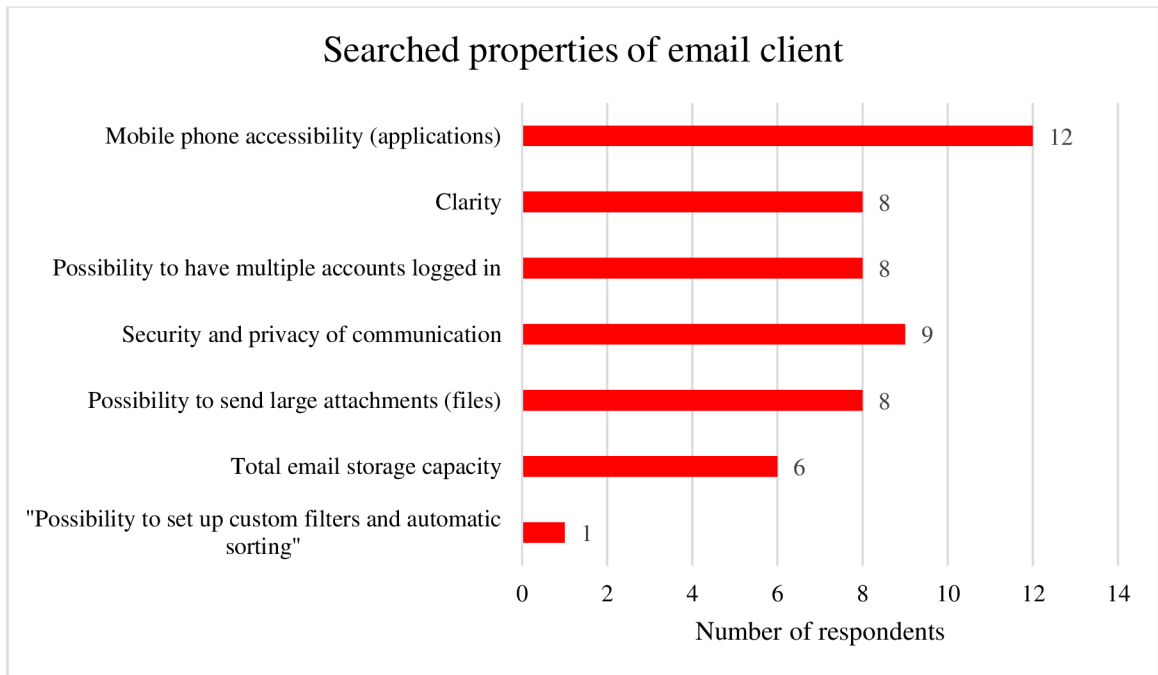
Figure 44. Searched properties of email client by TBU students.

Question 6. Assuming you could link whole school email communication to a smart device (phone) with a few clicks, would you consider this option?

As was mentioned before, TBU students have the only option of email communication – Microsoft 365 (Outlook) – this was probably the cause why 50 % of respondents already had linked their school communication with a smart device. Another 31.3 % of respondents would consider this option, and 6.3 % of respondents would probably consider it. Only 12.6 % of respondents replied with more negative answers: 6.3 % of respondents would probably not consider linking of school communication, while another 6.3 % of respondents would not consider it.
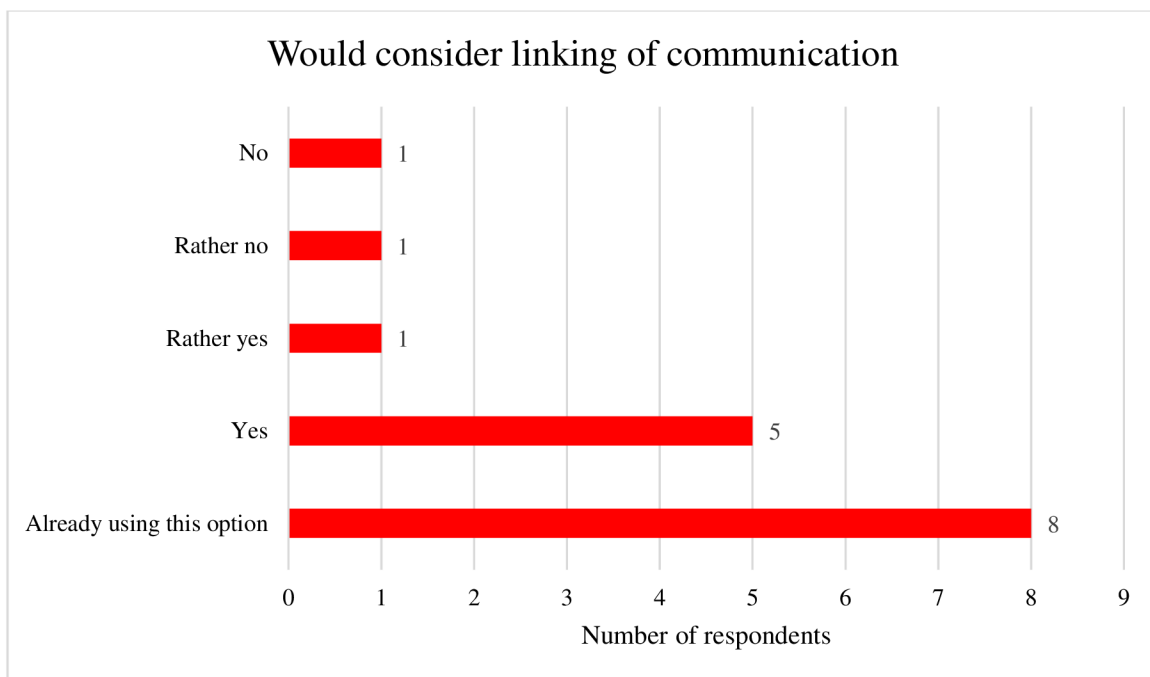
Figure 45. TBU students and the possibility of considering linking of communication.

Question 7. If you use the TBU file system, for what purposes?

As is described in Chapter 2.1.3.2, students at TBU have access to OneDrive by Microsoft and their university file system. As we can see from Figure 46, the majority of respondents (43.8 %) used the TBU file system randomly and occasionally when they needed it. Some of the respondents claimed that they do not use the TBU file system – they represent 37.5 % of respondents. Since the TBU file system is accessible from computers located in the university, 31.3 % of students used it for saving files in laboratory exercises, and 18.8 % of students used it to save all school files, e.g. protocols, essays, and presentations. None of the respondents accessed the TBU file system from home via VPN.
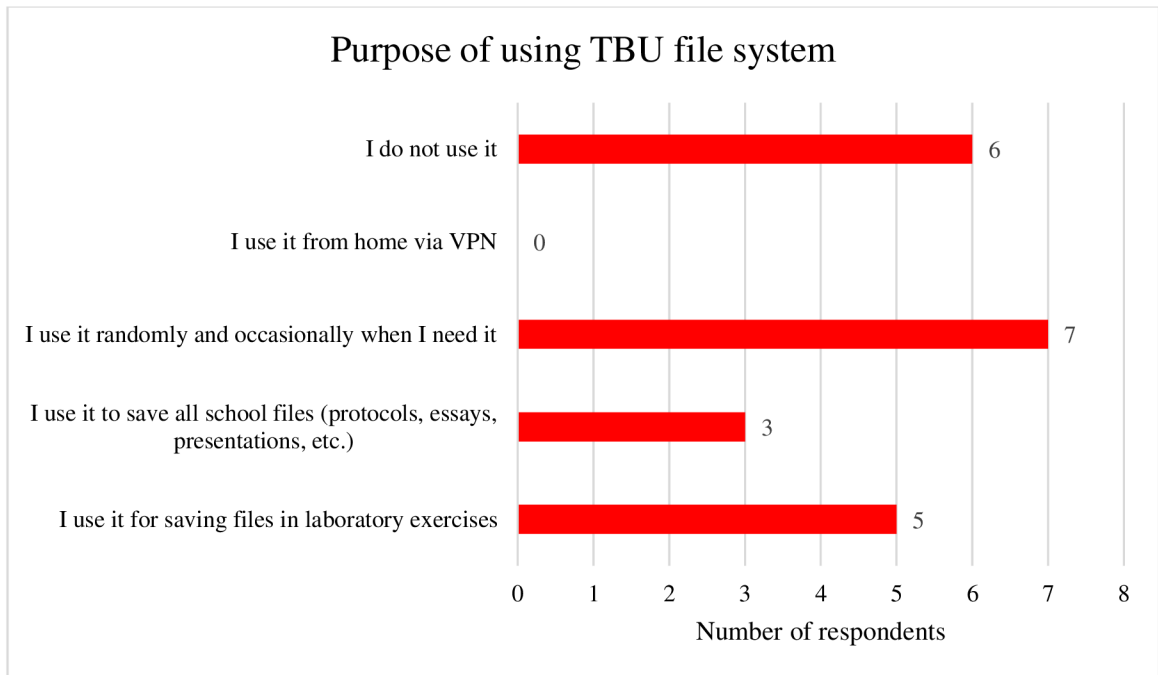
Figure 46. Student's purpose of using the TBU file system.

Question 8. The file storage searched properties for you are.

Figure 47 clarifies searched properties of file storage for TBU students. As we can see, easy file sharing with other people was important to the majority (75 %) of students. Because this was the multiple-choice type of question, 43.8 % of respondents chose three vital properties of file storage to them: security and privacy of uploaded files; ability to upload large files; together with mobile phone accessibility by using an application. Clarity of client application was searched by 31.3 % of respondents, whereas total file storage capacity was relevant to 25 % of respondents. One student (6.3 % of respondents) added that he "does not know" answer for this question.
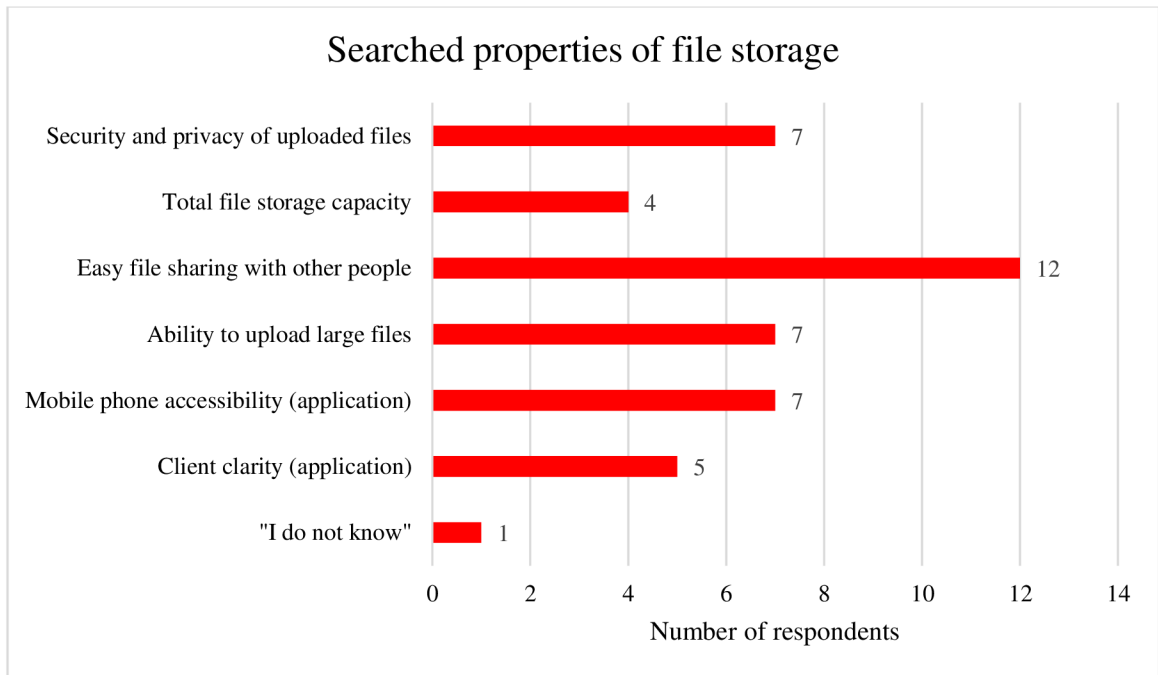
Figure 47. Searched properties of file storage by TBU students.

Question 9. Assuming you could access your school files from a smart device (phone) from anywhere, would you consider this option?

Unlike students at the previous universities, TBU students tended to respond more positively when asked whether they would consider accessing school files from a smart device. As Figure 48 shows, the majority of respondents (50 %) would consider the possibility, while 25 % of respondents were already using this option. Additional 25 % of students responded that they would probably try the possibility. None of the students responded that they would not consider or would probably not consider the possibility of accessing files from a smart device.
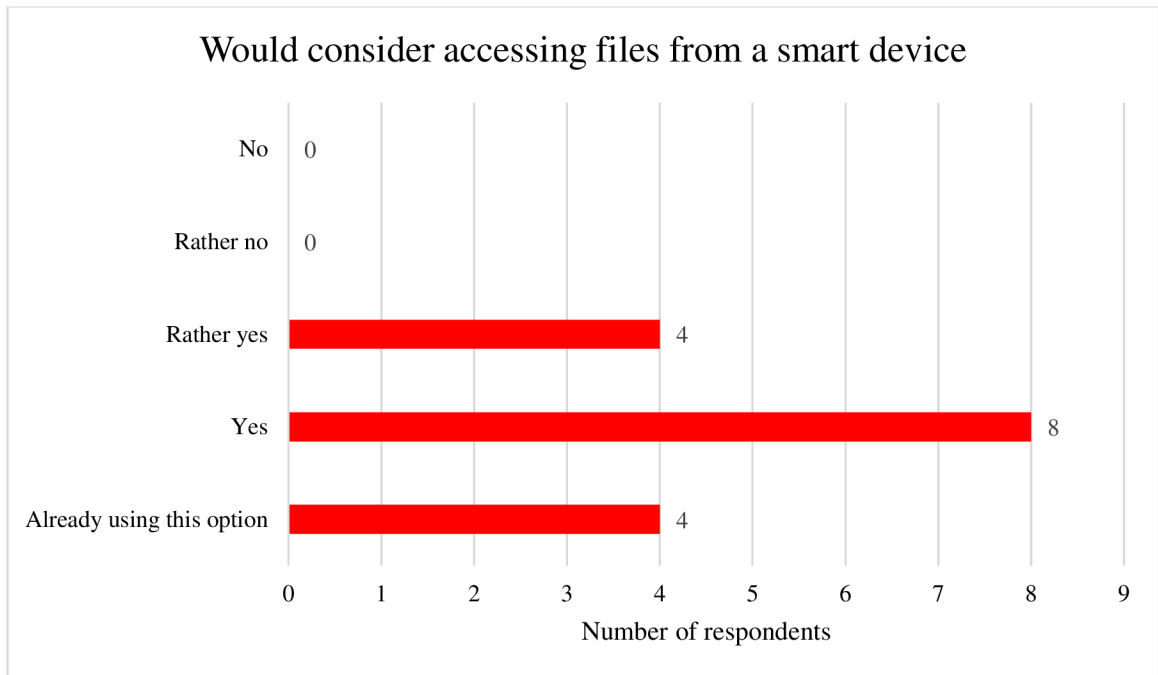
Figure 48. TBU students and the possibility of accessing files from a smart device.

3.4.5 Mendel University of Brno

3.4.5.1 Teaching Schedule

Question 1. How do you evaluate the clarity of the teaching schedule in UIS Mendelu?

As seen from Figure 49, the majority of Mendelu students (38.9 %) evaluated the clarity of the teaching schedules with a grade of 1 (as "very clear"). The second biggest group of respondents (33.3 %) rated the clarity of the schedule as "clear" – with a grade of 2. Grade of 3 that could be labelled as "neutral rating" chose 16.7 % of students, whereas 11.1 % of respondents replied with a grade of 4 – "not clear". None of the Mendelu students evaluated the clarity of the teaching schedules in UIS Mendelu as "confusing".
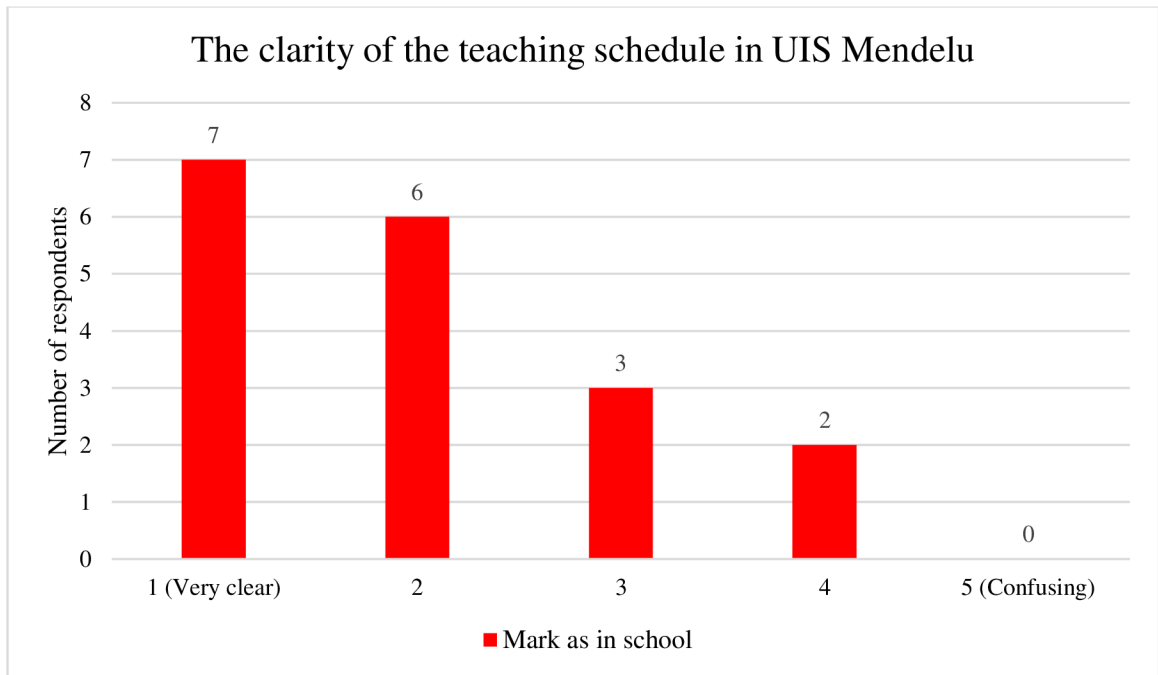
Figure 49. Evaluation of the clarity of the teaching schedules in UIS Mendelu.

Question 2. Schedule information and features on the website are for me:

Figure 50 illustrates the evaluation of schedule information and features sufficiency in UIS Mendelu. As we can see, the majority of students (44.4 %) replied with a grade of 2, followed by 38.9 % of respondents who marked schedule information and features as sufficient (grade of 1). Another 11.1 % of respondents evaluated sufficiency with a grade of 4, and 5.6 % of respondents replied with a grade of 3. None of the Mendelu students labelled sufficiency of schedule information and features in UIS Mendelu as insufficient.
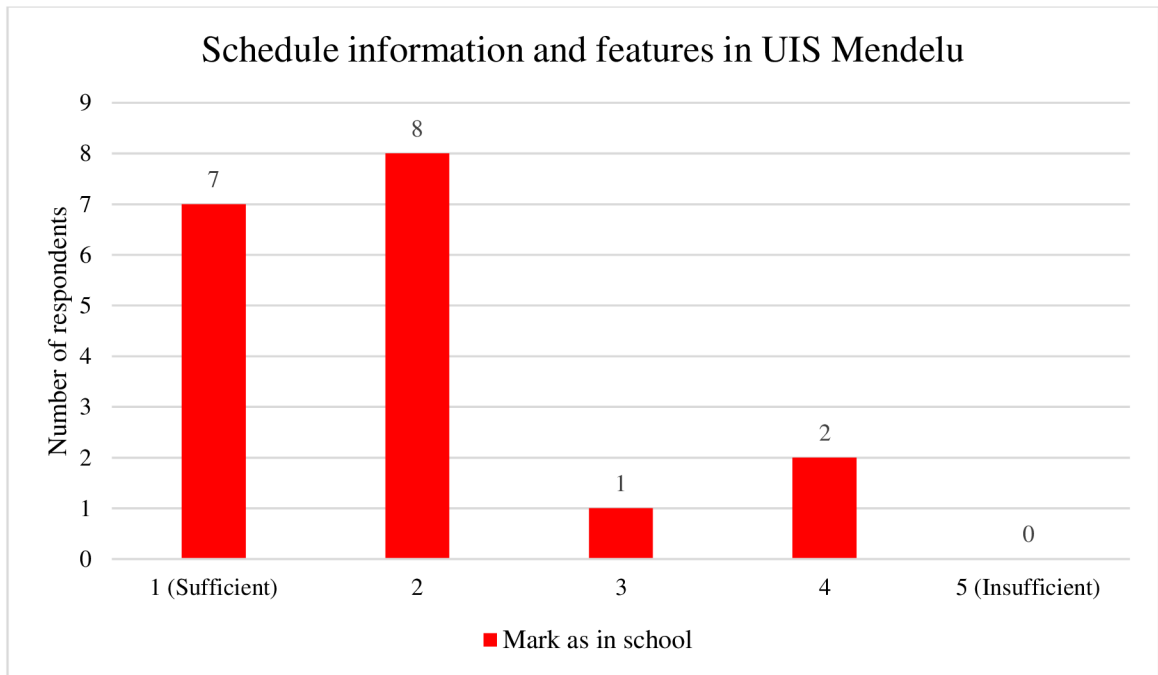
Figure 50. Evaluation of schedule information and features sufficiency in UIS Mendelu.

Question 3. In what form do you actively use the teaching schedule?

Figure 51 shows that the majority of Mendelu students (77.8 % of respondents) tended to access the teaching schedule at UIS Mendelu website via the browser on a computer or a smart device, whereas calendar applications were using 16.7 % of respondents. The paper form of schedule printed from UIS Mendelu was used by 22.2 % of students, and 22.2 % of respondents also used to rewrite their schedule to a paper diary.
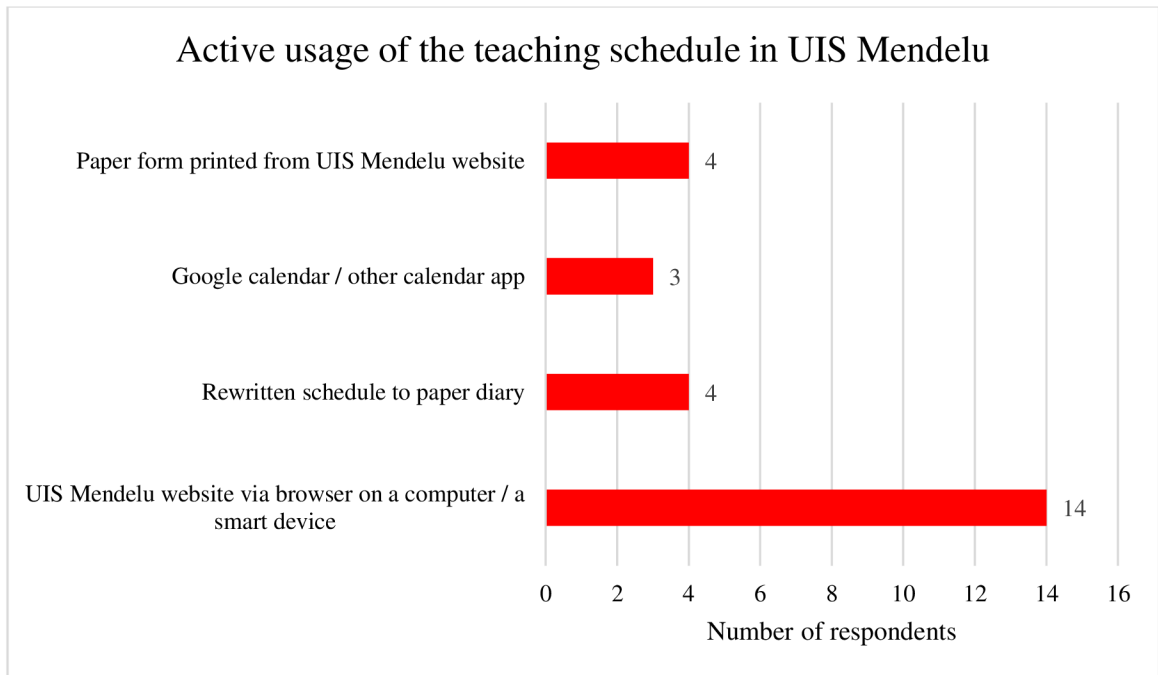
Figure 51. Active usage of the teaching schedule in UIS Mendelu.

Question 4. Assuming you could synchronise your individual schedule to a smart device (phone) with a few clicks, would you consider this option?

As we can see from Figure 52, there would be, to some extent, interest in synchronisation of a schedule with a smart device by Mendelu students. The majority of students (55.6 %) would consider synchronisation of schedules, and 16.7 % of respondents would probably also consider it. Another 16.7 % of respondents would probably not consider this option, while 11.1 % of respondents already used the possibility of synchronisation with a smart device.
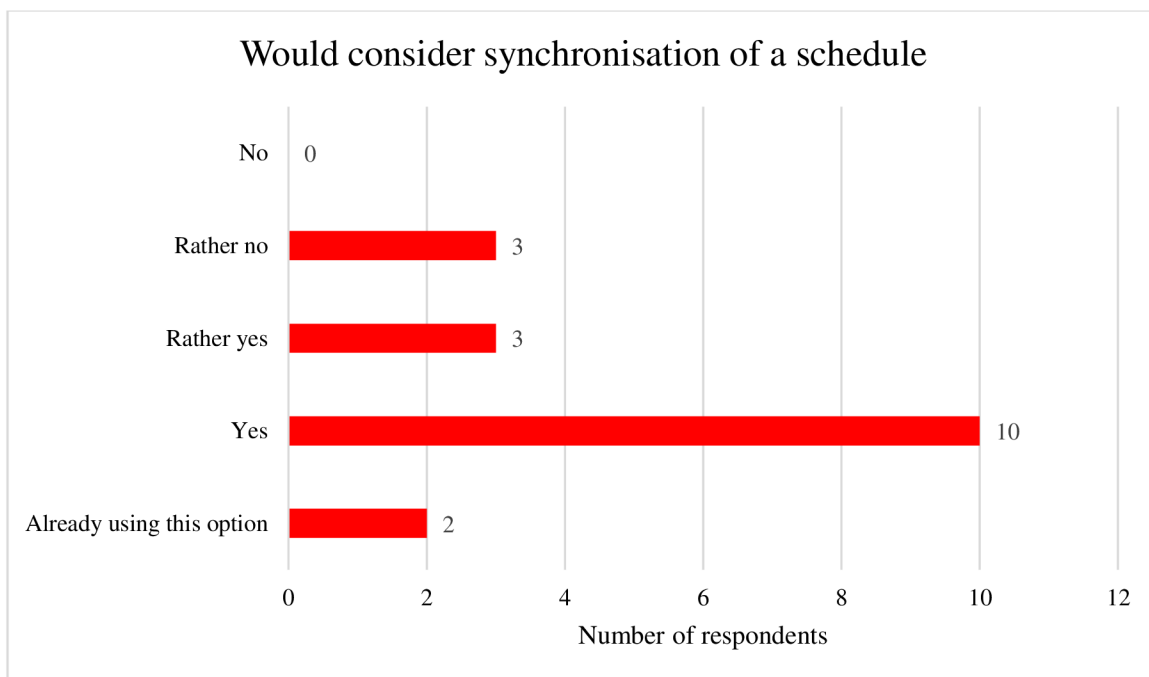
Figure 52. Mendelu students and the possibility of considering synchronisation of a schedule.

3.4.5.2 Emails

Question 5. What options do you use to read and send school messages and emails?

As is said in Chapter 2.1.4.2, UIS Mendelu offers multiple options where to access the school emails and messages. As we can see, the majority of students (66.7 %) tended to use the default option of UIS – mailbox in UIS Mendelu (available at is.mendelu.cz). Since this was the multiple-choice type of question, it is logical that some of the respondents used more options of how to read and send school emails. Microsoft Outlook on mobile or computer was used by 55.6 % of respondents, while 44.4 % of students tended to use Gmail on their devices. Importing or forwarding to a personal email was practised by 27.8 % of students, and two alternatives of Mailbox in UIS Mendelu were used by 11.1 % of respondents – firstly, Mail (available at mail.mendelu.cz) and secondly, Akela (at akela.mendelu.cz).
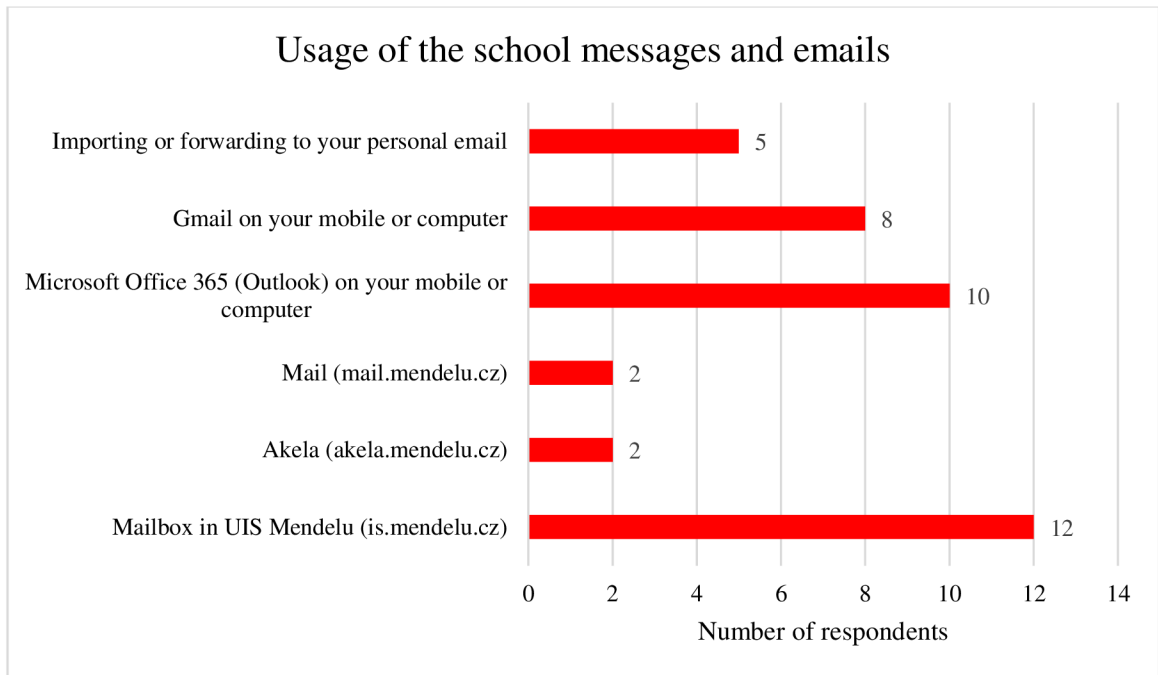
Figure 53. Usage of the school messages and emails by Mendelu students.

Question 6. The email client's searched properties for you are:

As Figure 54 demonstrates, the majority of Mendelu respondents (83.3 %) searched mobile phone accessibility with an application, while the clarity of an email client was essential to 72.2 % of respondents. Security and privacy of communication were vital to 55.6 % of respondents, and 50 % of students searched the possibility to send large attachments. 38.9 % of Mendelu students also replied with the possibility to have multiple accounts logged in, while 33.3 % of respondents looked for total email storage capacity.
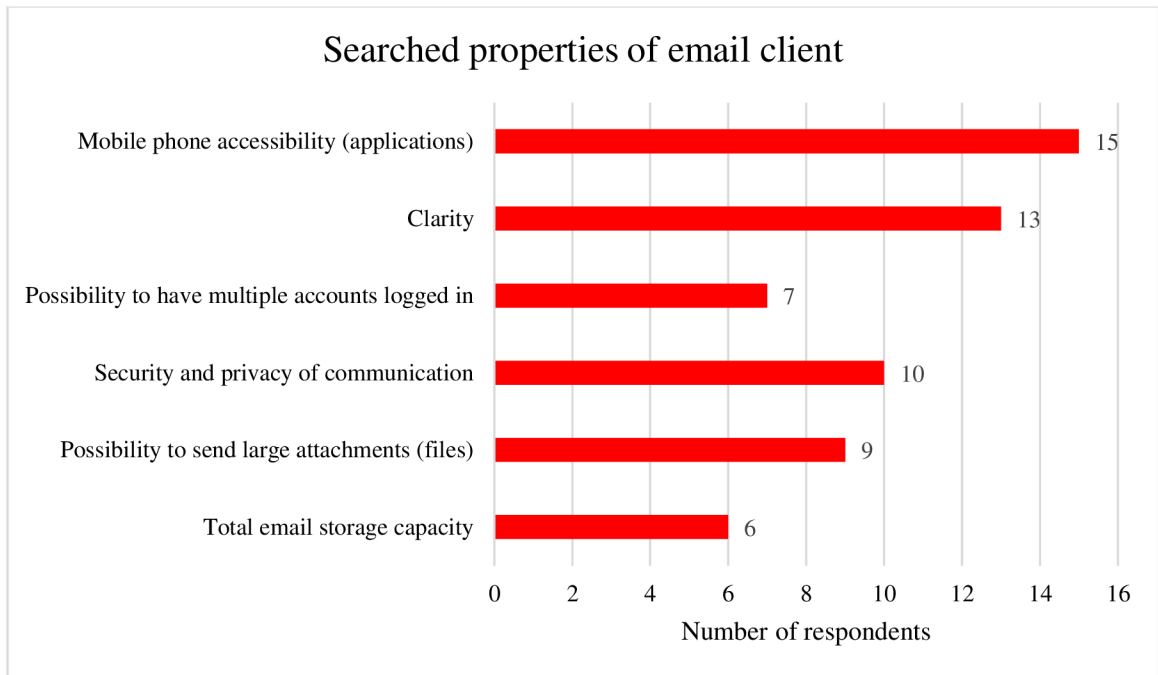
Figure 54. Searched properties of email client by Mendelu students.

Question 7. Assuming you could link whole school email communication to a smart device (phone) with a few clicks, would you consider this option?

From Figure 55, we can see that the majority of students also favours the possibility of linking the school communication with a smart device. Mostly chosen answer for this question (by 61.1 % of respondents) was Yes – meaning that these students would consider this possibility. Another 27.8 % of respondents replied that they were already using the synchronisation of school emails and messages. None of the students responded with No (would not consider), and two groups representing 5.6 % of respondents answered with less definite answers: Rather no; Rather yes.
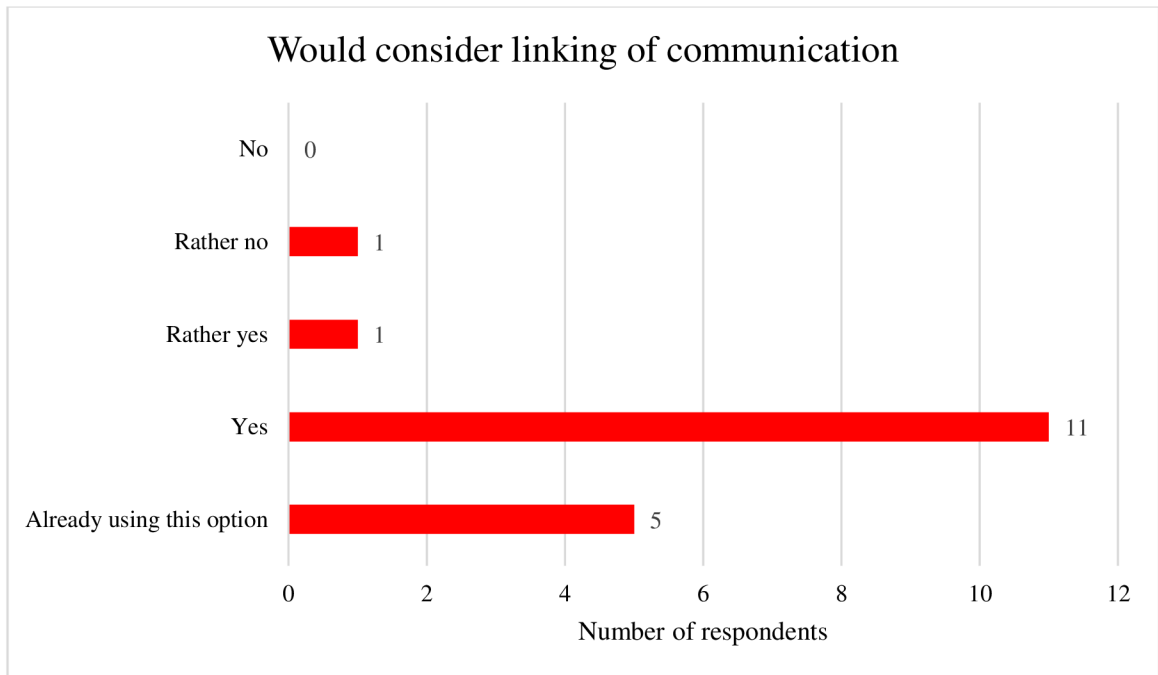
Figure 55. Mendelu students and the possibility of considering linking of communication.

3.4.5.3   File storages

Question 8. Which storage options do you use?

We can see from Figure 56 that Mendelu students did not use Cesnet ownCloud storage, as same as BUT and MUNI students. Microsoft OneDrive was used by 27.8 % of respondents, but the majority of Mendelu students used Disk Server provided by the university.
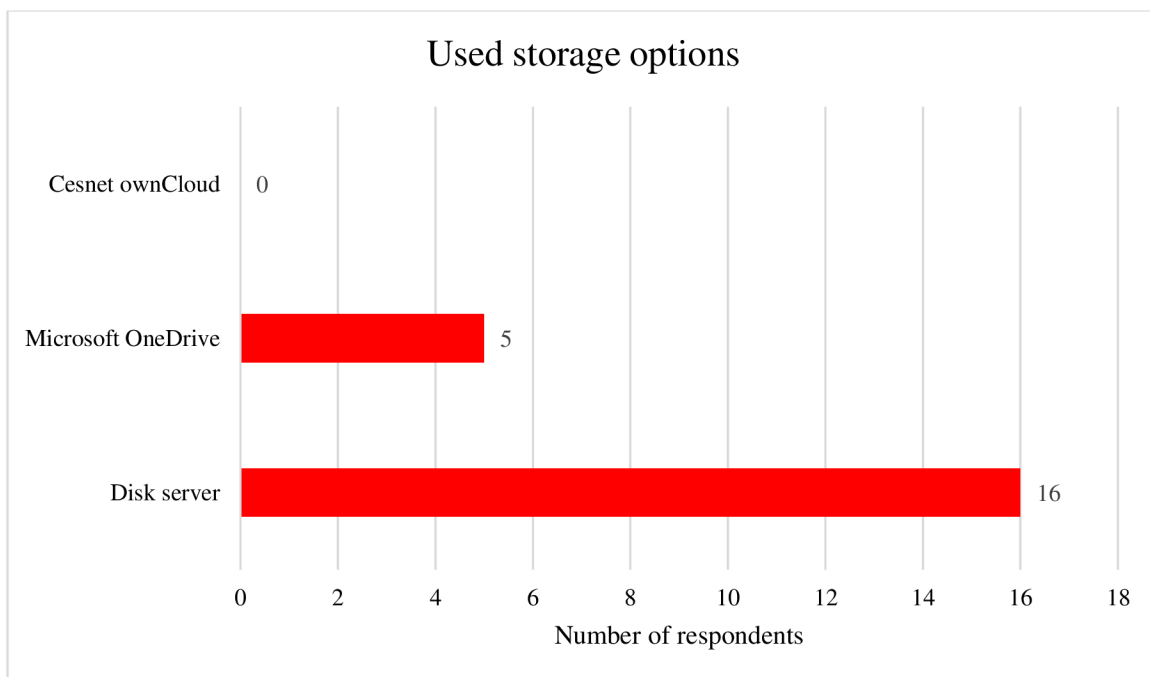
Figure 56. Used storage options by Mendelu students.

Question 9. If you use the Disk Server, for what purpose?

Figure 57 demonstrates answers to the multiple-choice type of question concerning the purpose of using Disk Server by Mendelu students. Two mostly chosen answers (by 50 % of respondents) were that students used it randomly and occasionally when they needed it and also used it for saving all school files, e.g. protocols, essays, presentations. Possibility to save files in laboratory exercises was used by 44.4 % of students, and 5.6 % of respondents did not use the Disk Server. As same as BUT students using their university storage via VPN, 22.2 % of Mendelu students also accessed Disk Server from home via VPN.
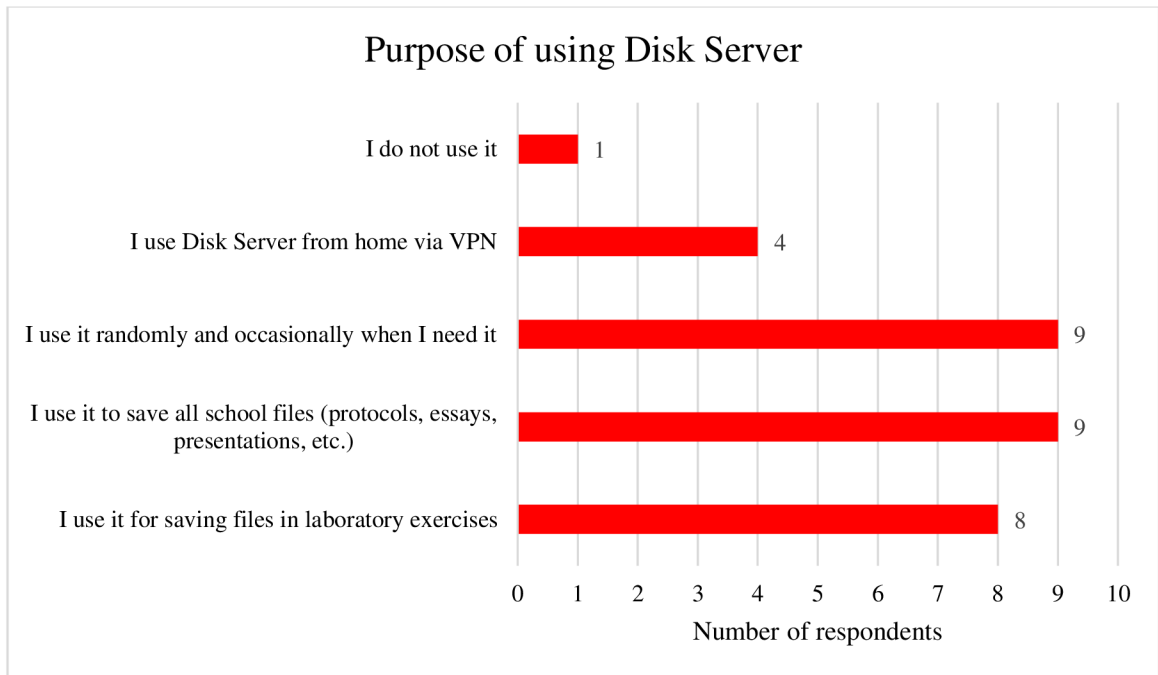
Figure 57. Student's purpose of using Disk Server.

Question 10. The file storage's searched properties for you are:

Figure 58 displays the properties of file storage searched by Mendelu students. The most searched characteristics (chosen by 55.6 % of respondents) were total file storage capacity and mobile phone accessibility. The second most sought properties by 44.4 % of respondents were: security and privacy of uploaded files; easy file sharing with other people; and ability to upload large files. Client (application) clarity was searched by 33.3 % of respondents.
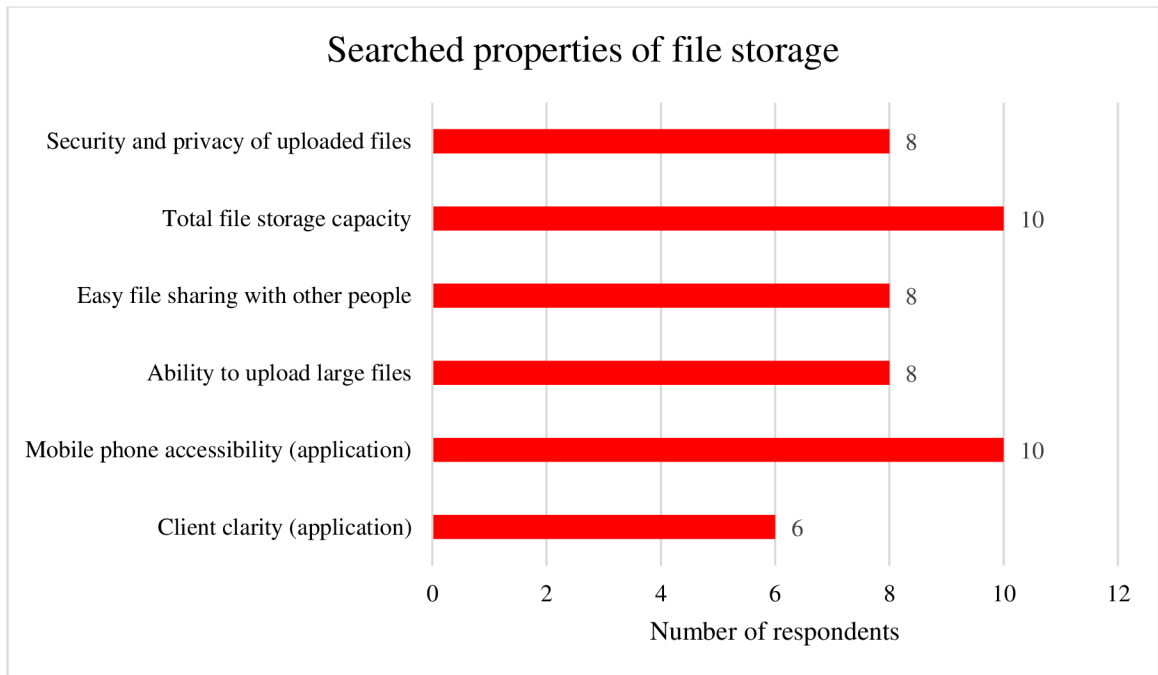
Figure 58. Searched properties of file storage by Mendelu students.

Question 11. Assuming you could access your school files from a smart device (phone) from anywhere, would you consider this option?

As can be seen from Figure 59, the majority of respondents (55.6 %) would consider accessing files from their smart device, and another 16.7 % of respondents were already using the possibility of remote access. Mendelu students who would probably consider this option represented 22.2 % of respondents, while 5.6 % of respondents answered that they would probably not consider it.
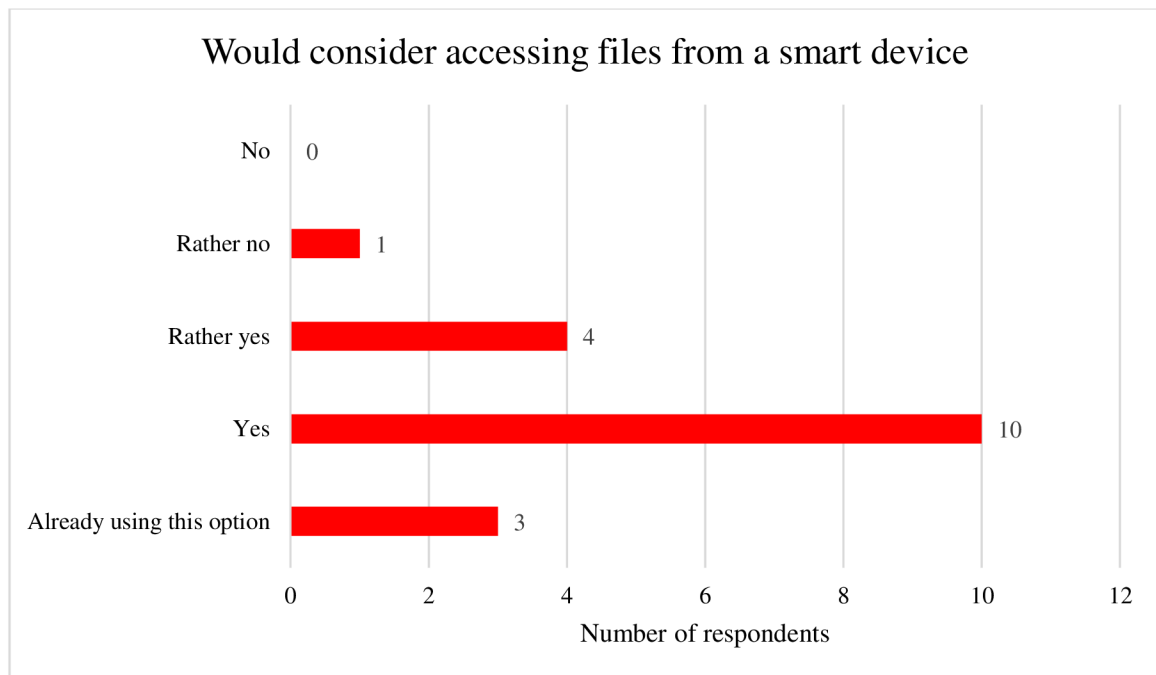
Figure 59. Mendelu students and the possibility of accessing files from a smart device.

3.5 Discussion

The online questionnaire presented in the previous chapters has shown that the majority (74.4 %) of all respondents favours synchronisation of all modules – course and examination schedules, emails and files with Google Apps and 7.8 % of respondents already synchronise modules of IS to some extent. The clarity and schedule information and features of the information systems described in Chapters 2.1.1, 2.1.2, 2.1.3, and 2.1.4 were evaluated with relatively satisfying results. The results of the questionnaire may be affected by some of the following factors: a rather insufficient number of respondents of some of the universities (18 Mendelu students and 16 TBU students); unbalanced distribution of students between bachelor's and master's degree study programmes; an insufficient number of communication channels to students at other universities than BUT, as is mentioned in Chapter 3.2.

With the present-day technical possibilities, it is presumable that students will mostly work with the teaching schedule in a digital form. The results of the questionnaire confirm this presumption, as the majority of respondents use the websites of IS to view their schedules. This is highly understandable since paper forms of the schedule cannot provide students with up-to-date information about changes in lessons and exams. Besides, more than 70 % of all respondents responded with a positive type of answer when asked about concerning

the possibility of synchronisation of schedules. When talking about current possibilities of synchronising of schedules with a calendar application, we divide students of four described universities into two groups. Firstly, for BUT and TBU students iCal file exportation is the only option (besides manual creating all events), however, this is not the desired solution because the uploaded schedule to the calendar application is not connected to the IS, thus not displaying any changes in schedules or developing exams. Secondly, Mendelu and MUNI students have access to more variable options. As described in Chapter 2.1.2.1, MUNI students can display the schedule in the form of Calendar (based on Google Calendar) with a possibility of copying iCal URL address, which can be imported into a calendar application, resulting in a dynamic feed (displaying all changes) of schedules and exams. Mendelu students have the option of exporting the desired types of events to the Office 365 Calendar in Outlook Web App, as is described in Chapter 2.1.4.1.

The questionnaire parts concerning email communication present different results regarding the usage of school emails and messages. BUT students favour using Gmail, MUNI students mostly use My Mail application in MUNI IS, and Mail Box application of IS Mendelu is used most by Mendelu students. But as we can see, students at all universities mostly search for properties as mobile phone accessibility (by applications), clarity, security and privacy of communication, and the possibility to have multiple accounts logged in. When using IS modules for email communication on a smart device (smartphone), the responsiveness of the website and clarity may not be fulfilled. As outcomes of the questionnaire suggest, more than 80 % of all university students would consider synchronisation with their smart device. The options of synchronisation of emails and communication are described in chapters of the corresponding university.

When speaking of file storage services of universities, we can see that Google Drive is the most used file storage option at universities which provides this service (BUT and MUNI). This may be the result of the unlimited storage capacity for G Suite users provided by Google, or the fact that Google Drive is a preinstalled application on Android phones. When using file storages provided by universities and describing their searched properties, students responded with various answers. BUT and MUNI students mostly do not use it, while TBU, Mendelu and BUT students use it randomly when they need it. However, since these file storages are accessible from computers located at the university, many students use it for saving school files (protocols, essays, presentations, etc.). From file storages,

students seek mobile phone accessibility, security and privacy of uploaded files, total file storage, easy sharing of files with other people, and client clarity.

Using of G Suite or SaaS may be advantageous by many factors. The main advantage is that the management, support, repairs and all updates are taken care of by the provider (Google). G Suite Admin Console allows administrators of G Suite at the university easily manage everything from one single place – managing users and groups, domains, manage devices, configure security features (such as two-factor authentication). G Suite is also supported by many languages, as same as other Google services. With all the security and privacy features described in chapter 2.2.1.6, it is convenient that the university does not have to handle security risks and maintain all the necessary hardware at the university facilities. As Coughlan (2019) describes, universities may be target objects of hackers who can breach the security and obtain personal data, finance systems and research networks. Of course, the considerable advantage of using G Suite is integration with all Google products (applications) available on all smart device operating systems. As the second part of the general section of the questionnaire (see Appendix A) suggests, students are familiar with using Google Apps in their personal life, and over 80 % of them would consider the synchronisation of IS modules with Google Apps (or they already use it), the usage of G Suite at universities would be convenient for students. Another advantage is that Google applications can be used offline on smart devices – to read and send emails (emails are sent after connection to the Internet), view the calendars and access files that are made available offline.

The disadvantage is the dependence on the provider – if you are interested in changing provider, it may not be possible to transfer the applications. The problem can also occur in organizations with more demanding software requirements, which may not be available at all within the SaaS model. Another disadvantage is the necessity of Internet connection for the most application to function – such as Google Drive, Google Docs and Sheets. Theoretically speaking, if a university would use Google Drive as primary file storage for students available at university computers, the usage of such file storage would be limited by the bandwidth, connection response and other Internet limitations. Speaking of Google Docs and Sheets, these applications are purely a web-based platform, meaning they also need an Internet connection to be used – opposed to widely used Microsoft Office products that can be used offline (without Internet connection).

When migrating to G Suite, Morel (2011) explains that many factors should be considered: the size of the organisation, type of its users, existing email platform, which migrating strategy should be used, etc. Before migrating of the whole university to a new platform, users (university employees) should be adequately trained – by direct training of users and training of "ambassadors" who will help regular users with any question related to Google Apps. A rollback plan should also be set up – when a problem occurs during the migration to the new platform. G Suite offers many products to migrate from, depending on the source environment and the number of users to migrate – Google offers migration product matrix for administrators who want to migrate their system to G Suite (Google, n.d.). Data can be migrated to Gmail, Google Drive, Google Calendar, Google Contacts, depending on the source platform.

4 CONCLUSION

This bachelor's thesis was focused on describing and comparing information systems at different universities, G Suite and its applications and on analysing risks and benefits of G Suite in order to consider a possible conversion of university information systems to G Suite. As the described information systems of Czech universities were chosen four different Czech universities: Brno University of Technology, Masaryk University, Tomas Bata University in Zlín, and the Mendel University of Brno.

Firstly, four information systems were described with a focus on its modules for teaching management – schedules, emails, file storages, and learning management systems. Then, the theoretical part focused on G Suite and its applications – mainly applications which can serve as modules for teaching management: Google Calendar for organising schedules, Gmail for university emails and communication, and Google Drive for maintaining file storage. Security and privacy of data and using G Suite was also considered in this part of the thesis.

Literary and empirical research was conducted for this bachelor's thesis. Literary research was done by studying materials about information systems, G Suite, and Google Applications. In the empirical part, I examined, analysed and described information systems of four chosen universities, and I also conducted a survey with the help of the questionnaire using Google Forms. The Internet questionnaire consisted of questions based on the analysis of four information systems – students were asked the questions related to the information system of their university. The questions were designed to obtain information about usage and evaluation of IS modules used on a regular basis – schedules, emails, and file storages.

The practical part of this thesis revealed that the majority of students would consider synchronisation of IS modules with a smart device by using applications, such as Google Apps. The questionnaire also analysed the active usage of these modules – in which form students actively use schedules, access their university email communication, and which options of file storages they use and whether they use their internal university file storages and for what purposes.

Current possibilities of IS modules synchronisation with Google Apps were discussed and described, risks and benefits of using G Suite were discussed, altogether with considering of a possible conversion of university information systems to G Suite. In conclusion, the

survey pointed out that students would be interested in accessing the IS modules with Google Apps; however, many security and privacy question should be raised when considering migration to G Suite.

5 LIST OF FIGURES

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8 APPENDICES

Appendix A: Questionnaire – General Section, Google Apps (located at the end of the questionnaire)

University information systems and Google applications

Hello,
I would like to ask you to fill in the questionnaire, which is part of my bachelor thesis "G Suite at universities: possible benefits and risks".
In this questionnaire, your task is to answer the questions raised about the use of the information systems and its modules, such as mail and teaching schedules.
The questionnaire is completely anonymous.

Many thanks for your willingness and time.
Martin Macek, 3rd year student of bachelor's degree, English in Electrical Engineering and Informatics at BUT.

What is your gender? *

◯ Male

◯ Female

In what year do you study? *

◯ 1st year of bachelor study

◯ 2nd year of bachelor study

◯ 3rd year of bachelor study

◯ 1st year of master's program

◯ 2nd year of master's program

◯ I have already graduated or finished school

◯ Jiné:

At what university do you study/have you studied? *

○ Masaryk University

○ Brno University of Technology

○ Mendel University in Brno

○ Tomas Bata University in Zlín

○ Jiné: _____

The last part of the questionnaire concerns Google applications.

Do you use Google Apps in your personal life? *

	Yes	No
Gmail	○	○
Google Calendar	○	○
Google Drive	○	○
Google Docs (on the Drive)	○	○
Google Keep (notes)	○	○

If your university would offer easy synchronisation of course and examination schedules, emails and files with Google, would you take advantage of this opportunity? *

○ I am already using this option

○ Yes

○ Rather yes

○ Rather no

○ No

Appendix B: Questionnaire – Brno University of Technology

The first part of the questionnaire concerns the module "Individual Schedule".

How do you evaluate the clarity of the teaching schedule in Studis? *
Rate mark as in school.

	1	2	3	4	5	
Very clear	○	○	○	○	○	Unclear

Schedule information and features on the website are for me: *
Rate mark as in school.

	1	2	3	4	5	
Sufficient	○	○	○	○	○	Insufficient

In what form do you actively use the teaching schedule? *
You can mark multiple answers or add your own.

☐ BUT website via browser on computer / smart device

☐ Google calendar / other calendar app

☐ Paper form printed from BUT website

☐ Rewritten schedule to paper diary

☐ Jiné:

Assuming you could synchronise your individual schedule to a smart device (phone) with a few clicks, would you consider this option? *

○ I am already using this option

○ Yes

○ Rather yes

○ Rather no

○ No

The second part of the questionnaire concerns email communication.

What options do you use to read and send school messages and emails? *

You can mark multiple answers or add your own.

☐ Default mail client - Horde, Roundcube or other

☐ Gmail on your mobile or computer

☐ Microsoft Office 365 (Outlook) on your mobile or computer

☐ Importing or forwarding to your personal email

☐ BUT News in Intraportal

☐ Jiné:

The email client's searched properties for you are: *

You can mark multiple answers or add your own.

☐ Security and privacy of communication

☐ Possibility to send large attachments (files)

☐ Clarity

☐ Possibility to have multiple accounts logged in

☐ Total email storage capacity

☐ Mobile phone accessibility (applications)

☐ Jiné:

Assuming you could link whole school email communication to a smart device (phone) with a few clicks, would you consider this option? *

○ I am already using this option

○ Yes

○ Rather yes

○ Rather no

○ No

The third part of the questionnaire concerns file storages.

Which storage options do you use? *

You can mark multiple responses.

☐ BUT Drive

☐ Google Drive

☐ Microsoft OneDrive

☐ Cesnet ownCloud

If you use a BUT drive, for what purpose? *

All students have access to the BUT drive (Gigadisk) as soon as they log on to the school PC or through VPN from their home. You can mark multiple answers or add your own.

☐ I use it for saving files in laboratory exercises

☐ I use it to save all school files (protocols, essays, presentations, etc.)

☐ I use it to share files with other students

☐ I use it randomly and occasionally when I need it

☐ I use BUT disk from home via VPN

☐ I do not use it

☐ Jiné: _____

The file storage's searched properties for you are: *

You can mark multiple responses.

- [ ] Client clarity (application)
- [ ] Total file storage capacity
- [ ] Easy file sharing with other people
- [ ] Ability to upload large files
- [ ] Security and privacy of uploaded files
- [ ] Mobile phone accessibility (application)
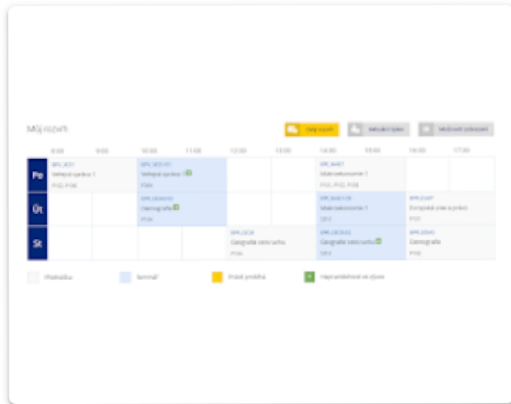- [ ] Jiné: _____

Assuming you could access your school files from a smart device (phone) from anywhere, would you consider this option? *

- ( ) I am already using this option
- ( ) Yes
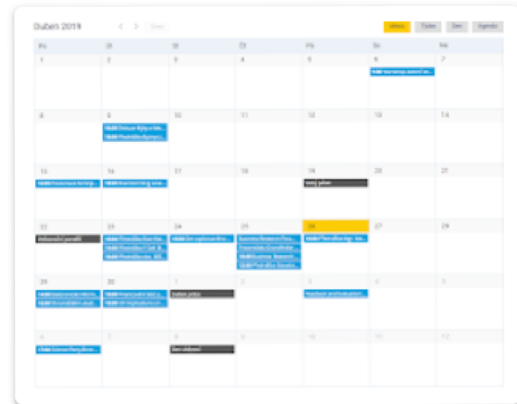- ( ) Rather yes
- ( ) Rather no
- ( ) No

Appendix C: Questionnaire - Masaryk University

The first part of the questionnaire relates to the teaching schedule module.

You rather use: *

⚪ My Timetable

⚪ My Calendar

How do you evaluate the clarity of teaching schedules in MUNI IS? *
Rate mark as in school.

	1	2	3	4	5	
Very clear	⚪	⚪	⚪	⚪	⚪	Unclear

Schedule information and features on the website are for me: *
Rate mark as in school.

	1	2	3	4	5	
Sufficient	⚪	⚪	⚪	⚪	⚪	Insufficient

In what form do you actively use the teaching schedule? *
You can mark multiple answers or add your own.

☐ MUNI website via browser on a computer / a smart device

☐ Google calendar / other calendar app

☐ Paper form printed from MUNI website

☐ Rewritten schedule to paper diary

☐ Jiné:

Assuming you could synchronise your individual schedule to a smart device (phone) with a few clicks, would you consider this option? *

○ I am already using this option

○ Yes

○ Rather yes

○ Rather no

○ No

The second part of the questionnaire concerns email communication.

What options do you use to read and send school messages and emails? *
You can mark multiple answers or add your own.

☐ Mail application in MUNI IS

☐ Gmail on your mobile or computer

☐ Microsoft Office 365 (Outlook) on your mobile or computer

☐ Importing or forwarding to your personal email

☐ Jiné: _____

The email client's searched properties for you are: *
You can mark multiple answers or add your own.

☐ Total email storage capacity

☐ Possibility to send large attachments (files)

☐ Clarity

☐ Possibility to have multiple accounts logged in

☐ Security and privacy of communication

☐ Mobile phone accessibility (applications)

☐ Jiné: _____

Assuming you could link whole school email communication to a smart device (phone) with a few clicks, would you consider this option? *

○ I am already using this option

○ Yes

○ Rather yes

○ Rather no

○ No

The third part of the questionnaire relates to the storage of files.

Which storage options do you use? *
You can mark multiple answers

☐ The file depository (10 GB)

☐ My Web (1 GB)

☐ Google Drive

☐ Microsoft OneDrive

☐ Cesnet ownCloud

If you use the file depository or My Web, for what purpose? *
You can mark multiple answers or add your own.

☐ I use it for saving files in laboratory exercises

☐ I use it to save all school files (protocols, essays, presentations, etc.)

☐ I use it to share files with other students

☐ I use it randomly and occasionally when I need it

☐ I do not use it

☐ Jiné:

The file storage's searched properties for you are: *

You can mark multiple answers.

☐ Mobile phone accessibility (application)

☐ Ability to upload large files

☐ Easy file sharing with other people

☐ Security and privacy of uploaded files

☐ Total file storage capacity

☐ Client clarity (application)

☐ Jiné: _____

Assuming you could access your school files from a smart device (phone) from anywhere, would you consider this option? *

○ I am already using this option

○ Yes

○ Rather yes

○ Rather no

○ No

Appendix D: Questionnaire - Mendel University

The first part of the questionnaire concerns schedules.

How do you evaluate the clarity of the teaching schedule at UIS Mendelu? *
Rate mark as in school.

	1	2	3	4	5	
Very clear	◯	◯	◯	◯	◯	Unclear

Schedule information and features on the website are for me: *
Rate mark as in school.

	1	2	3	4	5	
Sufficient	◯	◯	◯	◯	◯	Insufficient

In what form do you actively use the teaching schedule? *
You can mark multiple answers or add your own.

☐ UIS Mendelu website via browser on a computer / a smart device

☐ Google calendar / other calendar app

☐ Paper form printed from UIS Mendel website

☐ Rewritten schedule to paper diary

☐ Jiné:

Assuming you could synchronise your individual schedule to a smart device
(phone) with a few clicks, would you consider this option? *

◯ I am already using this option

◯ Yes

◯ Rather yes

◯ Rather no

◯ No

The second part of the questionnaire concerns email communication.

What options do you use to read and send school messages and emails? *

You can mark multiple answers or add your own.

☐ Mailbox in UIS Mendelu (is.mendelu.cz)

☐ Akela (akela.mendelu.cz)

☐ Mail (mail.mendelu.cz)

☐ Microsoft Office 365 (Outlook) on your mobile or computer

☐ Gmail on your mobile or computer

☐ Importing or forwarding to your personal email

☐ Jiné:

The email client's searched properties for you are: *

You can mark multiple answers or add your own.

☐ Mobile phone accessibility (applications)

☐ Security and privacy of communication

☐ Total email storage capacity

☐ Possibility to send large attachments (files)

☐ Clarity

☐ Possibility to have multiple accounts logged in

☐ Jiné:

Assuming you could link whole school email communication to a smart device (phone) with a few clicks, would you consider this option? *

○ I am already using this option

○ Yes

○ Rather yes

○ Rather no

○ No

The third part of the questionnaire relates to the storage of files.

Which storage options do you use? *
You can mark multiple answers.

- ☐ Disk server
- ☐ Microsoft OneDrive
- ☐ Cesnet ownCloud

If you use the Disk Server, for what purpose? *

Disk is accessible to all students as soon as they log on to the school PC or help VPN from home. You can mark multiple answers or add your own.

- [ ] I use it for saving files in laboratory exercises
- [ ] I use it to save all school files (protocols, essays, presentations, etc.)
- [ ] I use it randomly and occasionally when I need it
- [ ] I use Disk server from home via VPN
- [ ] I do not use it
- [ ] Jiné: _____

The file storage's searched properties for you are: *

You can mark multiple responses.

- [ ] Mobile phone accessibility (application)
- [ ] Ability to upload large files
- [ ] Client clarity (application)
- [ ] Security and privacy of uploaded files
- [ ] Total file storage capacity
- [ ] Easy file sharing with other people
- [ ] Jiné: _____

Assuming you could access your school files from a smart device (phone) from anywhere, would you consider this option? *

- ( ) I am already using this option
- ( ) Yes
- ( ) Rather yes
- ( ) Rather no
- ( ) No

Appendix E: Questionnaire - Tomas Bata University in Zlín

The first part of the questionnaire relates to the schedule of lessons.

How do you evaluate the clarity of the teaching schedule in IS / STAG? *
Rate mark as in school.

	1	2	3	4	5	
Very clear	○	○	○	○	○	Unclear

Schedule information and features on the website are for me: *
Rate mark as in school

	1	2	3	4	5	
Sufficient	○	○	○	○	○	Insufficient

In what form do you actively use the teaching schedule? *
You can mark multiple answers or add your own.

☐ IS/STAG website via browser on a computer / a smart device

☐ Google calendar / other calendar app

☐ Paper form printed from IS/STAG website

☐ Rewritten schedule to paper diary

☐ Jiné:

Assuming you could synchronise your individual schedule to a smart device (phone) with a few clicks, would you consider this option? *

○ I am already using this option

○ Yes

○ Rather yes

○ Rather no

○ No

The second part of the questionnaire concerns email communication and files.

The email client's searched properties for you are: *

You can mark multiple answers or add your own.

☐ Security and privacy of communication

☐ Total email storage capacity

☐ Possibility to send large attachments (files)

☐ Clarity

☐ Mobile phone accessibility (applications)

☐ Possibility to have multiple accounts logged in

☐ Jiné:

Assuming you could link whole school email communication to a smart device (phone) with a few clicks, would you consider this option? *

○ I am already using this option

○ Yes

○ Rather yes

○ Rather no

○ No

If you use the TBU file system, for what purposes? *

This file repository can be accessed by all students as soon as they log on to the school PC or VPN. You can mark multiple answers or add your own.

☐ I use it for saving files in laboratory exercises

☐ I use it to save all school files (protocols, essays, presentations, etc.)

☐ I use it to share files with other students

☐ I use it randomly and occasionally when I need it

☐ I use it from home via VPN

☐ I do not use it

☐ Jiné:

The file storage's searched properties for you are: *

You can mark multiple responses.

☐ Client clarity (application)

☐ Total file storage capacity

☐ Mobile phone accessibility (application)

☐ Easy file sharing with other people

☐ Ability to upload large files

☐ Security and privacy of uploaded files

☐ Jiné:

Assuming you could access your school files from a smart device (phone) from anywhere, would you consider this option? *

○ I am already using this option

○ Yes

○ Rather yes

○ Rather no

○ No

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