

New Era in Medical Education

NEWMED

2020-1-CZ01-KA226-HE-094424

Intellectual output: 02
Output Title: Methodological manual
Delivery date: August 2022
Status: Draft/~~Final~~
Under review

NEWMED Team

Disclaimer: "The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein."

Contents

1 Intellectual output 2	5
1.1 Output identification.....	5
1.2 Output definition	5
1.3 Division of work.....	5
2 Structure of methodological manual of online education for academic staff of medical faculties	7
3 Online teaching and learning – overview of the teaching methods available	11
3.1 Background from survey.....	11
3.2 Forms of online education.....	11
3.2.1 Synchronous online courses	11
3.2.2 Asynchronous online courses.....	12
3.2.3 Hybrid courses (blended courses)	14
3.3 Suitable form of teaching for different types of courses	14
4 Technical requirements for online education	17
4.1 Background from survey.....	17
4.2 Software used for online education.....	17
4.2.1 E-learning platforms.....	18
4.2.2 Other applications or software tools used for the purpose of online teaching activities	25
4.3.1 Obligatory equipment.....	27
4.3.2 Optional equipment	28
5 Technical support for online education and availability of the manuals / guidelines/ online trainings on online education	31
5.1 Background from survey.....	31
5.2 Practice guidelines for technical support for online education and availability of online trainings/ guides/ manuals on online education	31
5.2.1 General recommendations for the technical support	32
5.2.2 General recommendations on the online trainings / guides / manuals on online education	33
6 Practice guidelines for effective and attractive online teaching (considering students' and teachers' requirements, experiences and expectations from the survey)	37
6.1 Background from the survey.....	37
6.1.1 Educators' and students' needs regarding the online education	37
6.1.2 Needs and tips regarding the way to activate and/or motivate the students.....	37
6.1.3 Concentration and attention during the online educational activities.....	38
6.1.4 Communication settings	38

6.1.5 Time-constraints of online teaching and learning	38
6.1.6 Creating study materials and other activities used for online classes	39
6.1.7 Recording the online teaching activities	39
6.2 Practice guidelines for effective and attractive online teaching.....	39
6.2.1 Choice of synchronous, asynchronous or blended type of course	39
6.2.2 Tips for selection of the computing programs / platforms for education purpose	40
6.2.3 Communication setting.....	41
6.2.4 Creating and curating the content.....	44
6.2.5 The use of images, photographs, pictures, charts, animations, videos or audio recordings in presentations or publications.....	46
6.2.6 Copyright issues related to the teacher's work.....	49
6.2.7 Distributing Materials.....	49
6.2.8 Tips for preparing attractive and captivating online lectures and getting and keeping the students' attention.....	50
6.2.9 Recommendation for students attending online courses focused on solving the most frequent problems related to the online education	54
7 Practice guidelines for evaluation, examination and continuous assessment of student knowledge during online education.....	57
7.1 Background from the survey.....	57
7.1.1 Background from teachers	57
7.1.2 Background from students	58
7.1.3 Summary of the background information	59
7.2 Practice guidelines for evaluation, examination and continuous assessment of student knowledge during online education.....	59
7.2.1 General recommendations on the online assessment.....	59
7.2.2 Online assessment recordings	60
7.2.3 Preparation for examinations	60
7.2.4 Recommendations on continuous assessment.....	61
7.2.5 Recommendations on oral exams	62
7.2.6 Recommendation on written exams	62
8 Students with learning, mental and physical disabilities and online education	65
8.1 Background from survey	65
8.2 Students with disabilities and online education.....	65
8.2.1 Students with learning disabilities, attention problems, mental illnesses and/or even social-emotional needs.....	65
8.2.2 Students with physical disabilities and online education.....	67

9 Advantages and challenges of online education – what can we bring for future?.....	69
9.1 Background from the survey.....	69
9.2 Advantages of online education	70
9.3 Challenges in online education	72
9.4 What can we bring for future?	73
10 Summary	75
Main sources used	80

1 Intellectual output 2

1.1 Output identification

Output Code:	02
Output Title:	Methodological manual
Output Type:	Methodologies / guidelines – Other
Start Date:	01-09-2021
End Date:	31-07-2022
Leading Organisation:	Masarykova univerzita (MU)
Participating Organisations:	Aristotelio Panepistimio Thessalonikis (AUTH) Univerzita Pavla Jozefa Safarika v Kosiciach (UPJS)

1.2 Output definition

Based on the results of the O1 (detailed analysis) a methodological manual will be created for the target group of academics who participate in the preparation of online teaching.

The first part of the manual will focus mainly on course guarantors and will contain information on what is a suitable form of teaching for different types of courses - for lectures (preclinical, clinical), seminars and practical laboratory or clinical exercises. An important part will also be devoted to various methods of testing and oral examination and the prevention of cheating.

The next part of the material will be devoted to the preparation of study materials for online teaching, which will target all academic staff of medical faculties. Methodologists from project teams will prepare, based on the results of the analysis (O1) and on their own experience with the transition to online teaching from spring 2020, methodological manual for creating study materials that are suitable for online teaching, it will be mainly interactive textbooks, instructional videos, virtual patients, practice tests and others according to the needs identified in the analysis. The people in the project teams were chosen to cover all these areas with their experience.

The material will also include tips on how to conduct live online teaching so that it is effective and attractive enough for students to keep their attention.

An important part of the preparation of the methodological manual will be an online workshop, which will be attended by 5 academics from each partner institution. They will work under the guidance of methodologists with the prepared methodological manual and will provide real-time feedback to methodologists. Based on their comments, the methodological manual will be finalized.

The methodological manual will work in the form of an electronic portal, including modules, which will contain a smaller theoretical part and a larger practical part, including video tutorials, templates for creating study materials, instructions for creating virtual patients, and contacts to methodologists for academics. Due to this form of the methodological manual, a sufficient amount of work for technicians is included in the budget. We consider not only the interactive form of the methodological manual to be innovative, but also the fact that it will be targeted specifically at academics from the environment of medical faculties.

The extent will correspond to approximately 15 hours of academics' work with the created manual. The manual will be written in English.

1.3 Division of work

The tasks will be divided among methodologists during the second online TPM (M7). Due to the

fact that this is the most demanding intellectual output in terms of coordinating the work of the project teams, the main responsibility for the creation of O2 will have the applicant, i.e. Masaryk University.

All members of the project teams have extensive experience in online teaching and were selected based on positive results in the transition to online teaching in the spring semester of 2020. They will therefore divide the preparation of individual parts of O2 based on their expertise (see profiles of individual partner organizations).

Tasks:

- T 2.1: definition of modules and their brief content
- T 2.2: design of the technical form of the platform
- T 2.3: preparation of the content of modules by team members
- T 2.4: implementation of content into an electronic platform
- T 2.5: implementation of an online workshop for academics
- T 2.6: collecting feedback from academics
- T 2.7: preparation of the final version of the methodological manual

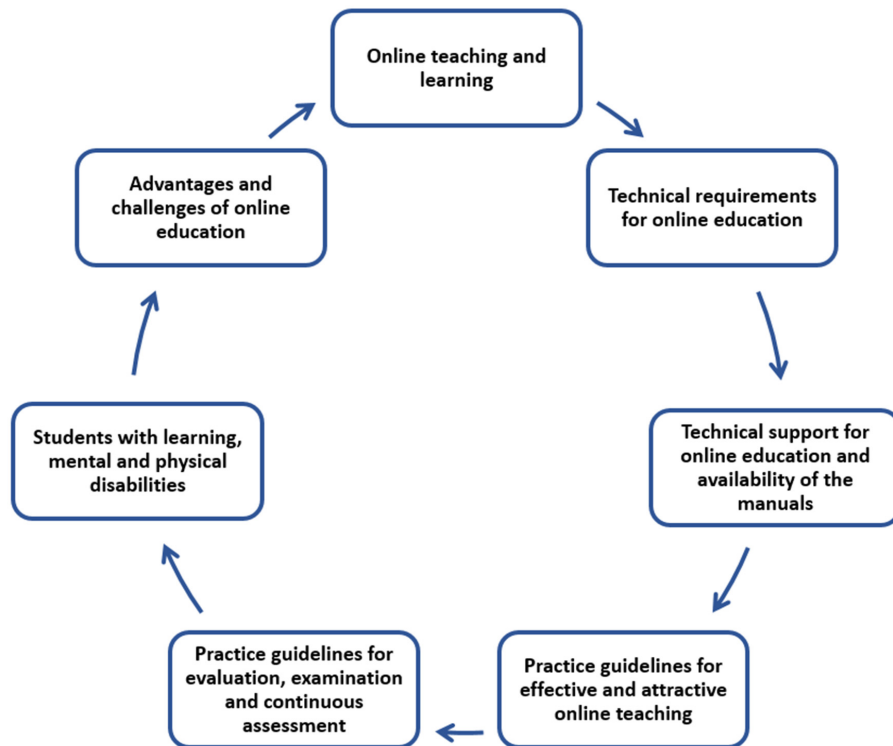
Timeline:

- T 2.1: M7-M9
- T 2.2: M7-M9
- T 2.3: M10-M14
- T 2.4: M12-M14
- T 2.5: M15
- T 2.6: M15
- T 2.7: M16-M17



2 Structure of methodological manual of online education for academic staff of medical faculties

The structure of this methodological manual consists of seven major areas. These areas can be specified by the following diagram representing continuing life cycle of an effective education in which the online elements are applied to overcome different types of obstacles the educators as well as their learners face during pandemic restrictions or distance education.



The structure of methodological manual.

1. Online teaching and learning – overview of the teaching methods available
 - a. Background from the survey: forms of education preferred by students and teachers according to their experiences with particular methods used for online education
 - b. Forms of online education (including specific tools used in each of them and advantages and challenges of particular methods)
 - i. synchronous courses
 - ii. asynchronous courses
 - iii. blended courses
 - c. Suitable form of teaching for different types of courses
 - i. Lectures
 - ii. Seminars and practical laboratory or clinical exercises
2. Technical requirements for online education
 - a. Background from the survey

- b. Software used for online education
 - i. Tips for selection of the computing programs/ platforms for educational purposes
 - ii. E-learning platforms
 1. Tips how to choose the most appropriate E-learning platform
 2. The most frequently used E-learning platforms according to the survey
 3. Examples of other E-learning platforms available (including specific features provided by particular platforms)
 4. Problems with using E-learning platforms during the real-time online education
 - iii. Other applications used for the purpose of online teaching activities:
 1. Video- and/or audio editing software
 2. Tools which may help using the already available multimedia resources
 3. Platforms for creating interactive tests or quizzes
 - c. Hardware, internet connection, other equipment needed
 - i. Obligatory equipment
 - ii. Optional equipment
 3. Technical support for online education and availability of the manuals / guidelines/ online trainings on online education
 - a. Background from the survey
 - b. Practice guidelines for technical support for online education and availability of online trainings/ guides/ manuals on online education
 - i. General recommendations for the technical support
 - ii. General recommendations on the online trainings/ guides/ manuals on online education
 4. Practice guidelines for effective and attractive online teaching (considering student/teachers' requirements, experiences, and expectations from the survey)
 - a. Background from the survey
 - i. Educators' and students' needs regarding online education
 - ii. Needs and tips regarding the way to activate and/or motivate the students
 - iii. Concentration and attention during the online educational activities
 - iv. Communication settings
 - v. Time-constraints of online teaching and learning
 - vi. Creating study materials and other activities used for online classes
 - vii. Recording the online teaching activities
 - b. Practice guidelines for effective and attractive online teaching
 - i. Choice of synchronous, asynchronous or blended type of course

- ii. Tips for selection of the computing programs/platforms for education purpose
 - iii. Communication setting
 - iv. Creating and curating the content
 - v. Distributing materials
 - vi. Tips for preparing attractive and captivating online lectures and getting and keeping the students' attention
 - vii. Recommendation for students attending online courses focused on solving the most frequent problems related to the online education
- 5. Practice guidelines for evaluation, examination and continuous assessment of student knowledge during online education
 - a. Background from the survey
 - i. Feedback from teachers
 - ii. Feedback from students
 - iii. Summary of the background
 - b. Practice guidelines for evaluation, examination and continuous assessment of student knowledge during online education
 - i. General recommendations on the online assessment
 - ii. Online assessment recordings
 - iii. Preparation for examinations
 - iv. Recommendations on continuous assessment
 - v. Recommendations on oral exams
 - vi. Recommendation on written exams
- 6. Students with learning, mental and physical disabilities and online education
 - a. Background from the survey
 - b. Students with disabilities and online education
 - i. Students with learning disabilities, attention problems, mental illnesses and/or even social-emotional needs and online education
 - ii. Students with physical disabilities and online education
- 7. Advantages and challenges of online education – what can we bring for future?
 - a. Background from the survey
 - b. Advantages of online education
 - c. Challenges in online education
 - d. What can we bring for future

3 Online teaching and learning – overview of the teaching methods available

3.1 Background from survey

The main forms of online education used by the teachers include online seminars and online lectures in real time (synchronous type of teaching) that are used in majority on daily basis or every week. Almost 80% of educators used any of these approaches at least several times a month. Online lectures and seminars/exercises in real time thus represent the most preferred method among educators, followed by videos with pre-recorded lectures (asynchronous online courses). The educators think the students prefer those two methods and according to students' answers in our survey it is true. On the other hand, the least frequently used forms of online education mentioned by the teachers were the sound recordings (mp3, podcasts), which were never used or not suitable for more than 70% of educators.

The question on other approaches used in online education was skipped by almost 90% of educators. Those who answered this question mostly mentioned particular teaching methods used in any or most types of online teaching (online tests, online discussion, e-mail communication, screen sharing, demonstration videos, and breakout rooms). Furthermore, a hybrid teaching was mentioned as preferred type of teaching by 2 teachers (1%).

The teachers' most frequently reported problems that occurred during real-time online education relate to internet connection. Most of the teachers and students, however, found no major problems with the synchronous online education process (for details, see the section focused on technical side of online education).

3.2 Forms of online education

All types of online learning are primarily delivered online and are accessible via online course modules from the students' computers, laptops, tablets or smartphones. Basic types of the online courses are the following:

- Synchronous online courses
- Asynchronous online courses
- Hybrid (blended) online courses

All methods have pros and cons and may be more suitable or appropriate for different situations, different subjects and types of course (lectures, exercise modules, practical courses, seminars and projects), and different students (according to their preferred learning style, extraversion or introversion, need of social interactions and time constraints). The brief description of particular types of online education including major advantages and disadvantages follows:

3.2.1 Synchronous online courses

- Synchronous learning environments enable students to participate in a course from a distance in real time. The class is usually a firm, weekly or even daily time commitment that cannot be rescheduled. From this point of view, this type of course resembles the in-present education in many aspects.
- These types of course require the teacher and students to interact online simultaneously mostly through the video chat, less frequently through the text or audio chat. The students thus may participate in real-time discussion, ask any question and get questions immediately answered. They can also participate on quick online surveys or quizzes, be asked by the teacher or classmates, get immediate feedback on their response and obtain

opinions from other participants. Similarly, teachers may ask students and assess their understanding of the topic, have a chance to re-explain things which were less understandable for students, and get instant feedback on their lectures. The participation of more students may, however, cause the difficulties to get the individual questions answered, since they compete for attention, similarly to the in-person education.

- The synchronous online class usually takes the form of a live video lecture or an instructor-led discussion. The students may also lead discussions themselves or give presentations to the rest of the class.
- Specific types of activities included in a synchronous course depend on the subject and the program. In clinical subjects, for example, the teachers may pose case studies to students, who then have to negotiate an answer with other classmates (either in smaller groups or together, as a class).
- Similarly to in-present classes, the students may be asked to complete some readings and assignments before the class begins which helps them prepare to participate in the discussion.
- When planning the synchronous online classes, the teachers are recommended to set a dedicated agenda and carefully consider the time-frame and schedule of the lecture. It is also necessary to adjust the learning objectives appropriately to the used teaching method according to the Bloom's taxonomy.
- In contrast to the in-present education, more frequent switch among different activities, frequent breaks and more interactive approach are recommended to attract and keep students' attention.
- The synchronous education provides regular contacts not only with teachers, but also with the classmates and may partly substitute the in-person interactions (mainly if they are prohibited e.g. for the epidemiological reasons). Synchronous classes thus provide the interactive environment which is frequently mentioned among the students' needs regarding online education.
- Less flexibility (inability to reach the content at any time and repeatedly) and set schedule and time frames represent major disadvantages of the synchronous learning. Furthermore, unless the class is recorded, the students have no chance to get back to the previous classes or previous parts of the current lecture, which may also represent a certain disadvantage. All of these disadvantages, however, apply to in-present education as well.
- Another disadvantage of the synchronous learning are its higher technological demands. Especially on real-time video chats, a slow internet can cause lag times where the students (or teachers) might miss the key points or discussions.
- Online lectures and online seminars in real time represent the most frequently used type of online learning and are most preferred by both the teachers and students.
- This type of education is particularly suitable for exercises and practical courses (if they can't be performed in person) and also for seminars where the active students' participation and presentation is required. In the latter case, the synchronous online learning helps the students to improve their presentation and communication skills.

3.2.2 Asynchronous online courses

- Asynchronous learning courses do not take place in real-time.
- Students are provided with content and assignments and are given a time frame to complete course work and/or exams. The assignments usually need to be completed weekly, biweekly or monthly, depending on the type of course.



- Asynchronous online learning allows students to view the content at any time they choose and how many times they wish, and thus they can learn at their own pace. Such flexibility represents the major advantage of this type of course and some students may prefer asynchronous type of education even in the era when the online education is not obligatory.
 - In medical education theory we often use a term directed self-learning, which is one of the aspects of student-centred learning. It means that the teacher provides support and help to the student in the learning process, but the student is responsible for his own learning. In the asynchronous online learning the teacher can use for example an online study guide.
 - The self-learning, however, puts higher demands on self-discipline and time-management of the participating students. Therefore, it is especially important for students attending and asynchronous course to plan their time and effort. It's highly recommended to reserve some time to accomplish the assignments in the daily schedule and not saving all the assignments to be done at the last minute.
- The content provided to the students may include many types of files e.g. PowerPoint presentations, Excel files, text documents, online interactive textbooks, video files including the video-recordings of the real-time or online lectures, the pre-recorded commented presentations, audio recordings and others.
 - Of those, sharing the pre-recorded presentations or video lectures is particularly suitable for asynchronous courses since it provides many advantages of the synchronous type of education. It also represents one of the most preferred types of online learning among both the students and teachers.
- Interaction during the asynchronous online course usually takes place through discussion boards or blogs. Students may also complete the home assignments in the form of tests or quizzes, which may provide them immediate feedback (not provided here directly by the teacher or classmates in contrast to the synchronous teaching forms).
- However, there also exist methods using peer feedback in the asynchronous learning. Students have to complete a home assignment, for example to film a short video or write a case report. They upload their homework on the internet (depending on the platform that is used) and the teacher or automatically the E-learning platform distribute anonymously the files and a feedback questionnaire. Students give feedback on the homework to their peers via the feedback questionnaire. Later the teacher can also comment on the results.
- Lower level of interactivity and inability to interact with other students and/or teacher directly during the lectures represent major disadvantages of this type of education. Students may miss the instant feedback, mainly in the situations when they don't fully understand the topic or its particular aspects, or wonder if they are completing an assignment correctly. The students may also feel even more disconnected or disengaged in an asynchronous, online course.
 - To prevent or get over these students' feelings, the teachers are recommended to respond to all discussion posts from students and support the meaningful interactions among students (e.g. by creating the projects which require cooperation of smaller groups or all the class).
 - It is also recommended to check in the end of the module or before the end of the course how confident the students feel in completing expected learning objectives, in other words to collect feedback. We can use self-evaluation (e.g. Likert scales in combination with open-ended questions). The result can navigate teachers how to evolve the study materials to help the students to reach the learning objectives.
- The asynchronous type of course also usually doesn't have any positive impact on the

students' presentation and communication skills.

- In general, asynchronous online learning environments are effective for students with time constraints or busy schedules, for those who prefer to learn at their own pace.
- This type of course is also suitable for the introverted students, who may feel intimidated by the in-person or synchronous classes.
- It may also be advantageous if the students live in many different time zones, which makes the use of synchronous type of course complicated.
 - o The educators are aware that the time shift may bring some problems, since they mentioned the students with time shift among those being disadvantaged in online education.

3.2.3 Hybrid courses (blended courses)

- Hybrid courses are learning environments that allow for both in-person and online interaction. Typically, hybrid courses meet in person several times during a semester and provide for computer-based communication in between those face-to-face sessions.
- If at least some extent of in-person interaction is allowed, this type of course might be preferred mainly for exercises and seminars. It allows gaining the practical skills in the in-person manner, while the rest of interactions can be performed in the online space.
- This type of education is the most appropriate for clinical subjects, or those which include the training of practical skills (e.g. in labs).
- Another major advantage is keeping at least some in-person social interactions, which may help to decrease the feeling of isolation.
- This type of course may, however, be not available if all the in-person contacts are strictly prohibited (e.g. from the epidemiological reasons)

3.3 Suitable form of teaching for different types of courses

Lecture is a form of teaching in which the teacher teaches students the theory. The lecture is typically held once for all students in the subject. Lectures are generally optional and public (thus accessible to non-students). In the online environment, both the synchronous online lectures and asynchronous type of teaching with sharing the video with pre-recorded lectures or commented presentations are applicable for both pre-clinical and clinical lectures.

- If the synchronous online teaching is used for lectures, students can actively participate on the lectures, ask questions or ask the teacher to re-explain some problems in real-time if needed. It's recommended to record the lecture and share the record with students. This allows them to review the lecture repeatedly, which represents one of the major advantages of this type of teaching.
- In asynchronous online teaching, the presentation, records or other materials are already available online. The students, however, should have the opportunity to ask questions or discuss some aspects of the topic which are not fully understandable from the presentation or which they find of particular interest. The combination of the asynchronous methods with online discussion boards or similar tools is thus highly recommended.

Seminars and practical laboratory or clinical exercises serve to increase student engagement and practice. They are devoted to smaller groups of students. Exercises are generally mandatory and non-public.

- The most suitable approach for seminars and clinical and laboratory exercises are the hybrid (blended) courses, which allow for both in-person and online interaction.



- Hybrid courses allow gaining the practical skills in the in-person manner, while the rest of interactions can be performed in the online space.
- This type of course may, however, be not available if all the in-person contacts are strictly prohibited (e.g. for the epidemiological reasons).
- If the blended type of education is not allowed, synchronous type of course is recommended for exercises which include the training and practical demonstration of certain skills and seminars where the active students' participation and presentation is required. This type of education provides instant feedback and allows for more interactions in real-time.

4 Technical requirements for online education

4.1 Background from survey

When being asked about their needs regarding the technical side of online education, almost half of the educators skipped the question and about 1/3 of those who answered stated they have no needs. Others frequently mentioned that they need equipment or better equipment, training for teachers, reliable and fast internet connection, educational applications or a unified environment for the learning activities. Some mentioned also specific apps and tools that would be useful such as MS Teams, breakout rooms in MS Teams, Zoom, Grammarly etc.

The most dominant platform is MS Teams followed by Zoom. This, however, was influenced by the recommendation and support of particular platforms in the participating universities. MS Teams is the most frequently used platform, 82% of the respondents use it daily. Other platforms such as Zoom, Google Meet or WebEx are used on less regular basis.

Among other applications educators use presentation/screen recording software, software for creating quizzes, tests, interactivity and video recording software.

The problems that occurred during real-time online education and were most frequently mentioned by teachers relate to internet connection (78% of teachers). The other problems were mentioned in this order: problems with screen sharing (52%), microphone problems (41%), problems logging in to the platform (35%), "no students could be heard" (30%), problems using available applications in the platform (25%) and rarely interruption during teaching and video playback (1%), poor technique of students (2%), and camera problems (1%). Most of the educators (65%) who responded to the question focused on the use of the online learning platform, however, evaluated its use as always trouble-free or almost trouble-free.

The students reported that the most often problem that occurred during real-time online education was the internet connection problem (34%), followed by microphone problems (21%) and problems logging in to the platform (18%) and screen sharing (11%). Rarely, problem with the teacher's sound (1%); lack of information on how to participate (1%), and accidental disconnection (1%) were mentioned. Other problems were extremely rare and reported by only 1 out of 306 students (too strict time for tests, some documents load longer and MS Teams global outages). 51% of students had no worries to use the online learning platform as they experience it almost trouble-free or always trouble-free.

The educators also evaluated the students' IT literacy using the platform. The ones who responded evaluated it as excellent and good in 91%. On the other hand, the students evaluated the teachers' IT literacy as good or excellent in 68% of their responses.

4.2 Software used for online education

- Most of the universities provide a list of supported and recommended computing software that is widely compatible and in broad use across the university. Furthermore, they continue updating it according to the needs and requirements from the staff, technical facilities, and the availability of the updates or new software tools or platforms.
 - o This list should contain also the links for safe download of particular products and the links for both the remote support guides and helplines/ helpdesks support available for particular programs/products. Teachers/ students should be aware that the use of recommended products provides them the certainty of relevant technical support available.
- Most of the software products listed here (or even all of them) are paid by the university and thus are available for free for the staff and/or students.

- The departments, centres or individuals who consider use a new software tool should speak to their IT support staff to determine what products are supported for particular purpose before performing any selection. If no suitable products are supported, the IT department should at least check the safety and compatibility of the software product considered. The teacher should always consider the accessibility of the new software tool for the students to prevent disadvantaging some students from the online education.
- This list usually contains also the minimum supported and recommended versions of the operation systems (usual requirements are Windows 10 version 2004 or above, macOS 11.x Big Sur or above), which again is continuously updated.

4.2.1 E-learning platforms

- The online learning using learning management systems, video-communication and collaboration software applications, online learning platforms, or virtual learning environments have become increasingly common, especially due to the sweeping educational changes that became necessary due to the pandemic.
- The term “e-learning platform” is generically used to describe a range of integrated web-based applications that provide teachers, learners, parents and others involved in education with information, tools, and resources to support and enhance educational delivery and management. The applications that form part of these online services can include web pages, email, message boards, and discussion forums, text and video conferencing, shared diaries, online social areas, as well as assessment, management, and tracking tools.
- All the terms mentioned above are often used interchangeably, but their exact meaning is slightly different:
 - A learning management system is a software-based app that facilitates a user making, designing and delivering their own self-created course content.
 - The term online learning platform in the narrow sense is a web-based learning platform for a user to both design the online course, and then deliver this content to the audience of students. With an online learning platform there is the option for the creation of the content by the educator, but it can also incorporate previously created content. The availability of a range of previously created content represents the major difference to the learning management system. In the broader sense, however, the term online learning platform is used as a superordinate interchangeable with e-learning platform.
 - The video-communication and collaboration software applications (Zoom, Google Meet, MS Teams, WebEx) are frequently used as the learning management system or e-learning platforms.
 - A virtual learning environment in educational technology is a web-based platform for the digital aspects of courses of study, usually within educational institutions. They present resources, activities, and interactions within a course structure and provide for the different stages of assessment.
- There are many e-learning platforms currently available with many shared features, but they may differ in many aspects (availability of particular tools or assistive technologies, possibility to use the platform as a mobile app, availability for students/ teachers, technical requirements, specific features provided, costs etc.).
- Tips how to choose the most appropriate online learning platform:
 - In most universities, one online learning platform is supported and the multi-licence is paid by the university. In such situation, teachers are highly recommended to use this platform, since it usually means the same platform is available for free to all

students and teachers, which makes the online education easier and more comfortable.

- If no platform is directly recommended by the university, there are several features to be considered when choosing the most appropriate one:
 - Price: Some online learning platforms are available for free, or have a low cost entry tier. Others offer more features, but at a higher price point. Besides the purchase price, further costs of operation, additional fees required by the platform and possibly also the salaries for experienced administrators and operators to keep it running. A total cost of ownership (TCO), i.e. an estimation of the expenses associated with purchasing, deploying, using and retiring a product, should always be considered. Pricing models are also different with some providers charging only by each student, while others having the price based on the plan, and then a lower additional cost for each additional learner.
 - Many platforms or learning environments are currently available as so called Software as a service (SaaS). This term refers to a software distribution model in which a cloud provider hosts applications and makes them available to end users over the internet. The user thus doesn't need to install, maintain and update the software on his/her own, which makes the use easier and less demanding.
 - Availability in mobile application: Especially younger learners prefer to use these apps. Furthermore, it allows the possibility to join the educational activities from anywhere at any time. It's thus recommended to choose the platforms available for both Android and iOS.
 - Specific tools, assistive technologies and educational aids: Many platforms provide a wide range of tools or services, which allow making the educational process more informative, interactive and attractive for students and may be very helpful for teachers. For effective teaching of the students with visual, hearing or learning disabilities, the availability of the assistive technologies represents an important requirement. Among others, the following tools are available in most platforms:
 - Screen sharing: the tool allows teachers or students to share their desktop or any open application or browser window with others.
 - Whiteboards: this tool represents a digital version of the classroom whiteboard where the teachers and/or students can write or draw and share it with the rest of the class.
 - Asking questions: as in a traditional classroom, students can raise their hand to ask a question and unmute their microphone if they are called upon.
 - Speaker highlighting: this feature makes the current speaker larger and more visible to other participants, so that students can better focus on the educator.
 - Breakout rooms: this tool allows teachers to break up the class into smaller groups, as they would in a physical classroom. Teachers can do this by assigning students to different virtual rooms or "breakout rooms", where they can take advantage of the smaller group size. This tool was also mentioned among teachers needs in the survey and is thus important at least for some of them and may not be widely

available.

- Recording the session for later distribution: this tool allows to record the lecture or meeting and distribute the record to the participants or other students. This provides students the option to review the lecture repeatedly. It's also very important for students with no internet access at home or those who were not able to attend the online course in real-time for any reason.
 - Transcription of the sessions: the tool allows to create a machine-created transcript of any lecture and distribute it to students. This option may partly substitute the session recordings and may be particularly important for students with unreliable internet.
 - Live captions: the tool which supports live captioning during video conference meetings or teaching sessions. This helps student stay focused and is extremely helpful for those with hearing disabilities, dyslexia and autism.
 - Low Vision Support: the accessibility features for users with low-vision, e.g. the high-contrast mode or the resizing and zoom features.
 - Audio descriptions of visuals: this tool allows the transfer of visual content to audio description, which helps students with visual or learning disabilities.
 - Keyboard shortcuts: this feature provides users with limited mobility an alternative to using a mouse for navigation and accessing features. Keyboard shortcuts can also save time and reduce mouse clicks.
 - Subtitles in the videos: it can help the students learning in foreign language to understand better and to learn the vocabulary and it enables students to watch the video without the sound (e.g. when travelling).
- Most frequently used e-learning platforms: according to the survey, common and widely available video-communication and collaboration software applications (MS Teams, Zoom, Google Meet) are the most frequently used platforms for online education by the teachers across all the universities involved in the survey:
- *MS Teams* (<https://www.microsoft.com>): a cloud-based team collaboration software that is part of the Microsoft 365 and Office 365 suite of applications.
 - Basic version is available for free. Several extended paid versions with broader options are also available (providing longer or even unlimited meeting duration, increased or even unlimited number of participants per meeting, expanded cloud storage, attendee registration and reporting tools etc.)
 - The core capabilities in Microsoft Teams include business messaging, calling, video meetings and file sharing.
 - It provides most of the important tools required by teachers and students (screen sharing, asking questions by hand rising, whiteboard, breakout rooms). It also allows to mute channels, manage notifications and set user's status and many other useful features.
 - It's compatible with many assistive technologies, like:
 - Screen readers

- Dictation software
- Eye control (on Windows 10)
- Voice control (on iOS and Android)
- Screen magnifiers
- Switch access (on iOS and Android)
- For video meetings, the recommended download/upload speed in this platform is 4 Mbps/2.5 Mbps.
- *Zoom* (<https://zoom.us/>): a cloud-based video communications app that allows users to set up virtual video and audio conferencing, webinars, live chats, screen-sharing, and other collaborative capabilities.
 - Similarly to the MS Teams, basic version is available for free. Several extended paid versions with broader options are also available (providing longer group meeting duration, increased number of participants per meeting, expanded cloud storage, and many additional tools etc.)
 - The users don't need an account to attend a Zoom meeting.
 - The platform is compatible with Mac, Windows, Linux, iOS, and Android, meaning nearly anyone can access it.
 - Similarly to MS Teams, it provides most of the important features required by teachers and students (screen sharing, asking questions by hand rising, whiteboard, breakout rooms, mute channels, manage notifications etc.).
 - It, again, provides many assistive technologies:
 - Auto-generated captions
 - Manual captions
 - Screen-reader support
 - Voicemail transcription
 - Focus mode and many others
 - For HD group video calls, the recommended download/upload speed is 3 Mbps/ 2.5 Mbps.
- *Google Meet* (<https://meet.google.com/>): a video-communication service developed by Google.
 - Similarly to the previous platforms, basic version is available for free. Several extended paid version with broader options (Google Workspace Individual, Google Workspace Enterprise) are also available (providing increased number of participants per meeting, meeting recording saved to organizers' Google Drive , breakout rooms, hand raise, intelligent noise cancelation and many other additional tools)
 - Provides two-way and multi-way audio and video calls with a resolution up to 720p with an accompanying chat available.
 - Connection with Google Calendar and Google Classroom.
 - Similarly to previous platforms, provides many features required for successful online teaching or learning by both students and teachers (screen sharing, breakout rooms, whiteboards, hosts are able to deny entry and

remove users during a call, ability to raise and lower hand etc.).

- Provides assistive technologies:
 - Live captions
 - Screen readers and magnifiers
 - Keyboard shortcuts
 - Voicemail transcription
- The absence of direct contact to the support might be mentioned among the disadvantages.
- For HD group video meeting, following download/upload speed is recommended:
 - 2 participants: 2.6 Mbps/3.2 Mbps
 - 10 participants: 4 Mbps/3.2 Mbps
- *WebEx* (<https://www.webex.com/>): an application sharing and conferencing service that is widely used for presentations, demos and training.
 - Same as the previous platforms, WebEx provides basic version for free. Several extended paid versions with broader options are also available (providing longer meeting duration, increased number of participants per meeting, expanded cloud storage, attendee registration and reporting tools and many other additional tools)
 - Similarly to previous platforms, provides many features required for successful online teaching or learning by both students and teachers (screen sharing, breakout rooms, whiteboards, ability to raise and lower hand etc.).
 - Provides assistive technologies:
 - Closed Captioning
 - Sign language interpreters
 - Screen Reader Support
 - Low vision support
 - Keyboard shortcuts
 - For HD video chats, recommended download/upload speed is 2.5 Mbps/ 3 Mbps.
- *Other platforms*: there are currently many learning management system or specific online learning or testing platforms available, which can be illustrated by a few examples, as follows:
 - *Docebo* (<https://www.docebo.com/>) (Licensing fee is required. Docebo is mainly aimed at industries: it works best with medium to large enterprises that need to train their customers, partners, and employees)
 - *Adobe Captivate* (<https://www.adobe.com/cz/products/captivate.html>) (Licensing fee is required. Adobe Captivate is available in the form of individual or team subscription or enterprise licenses. Limited free trial is provided for the individual customers).
 - *Blackboard Learn* (<https://www.blackboard.com/teaching->

[learning/learning-management/blackboard-learn](#)) (Licensing fee is required).

- *Acorn LMS* (<https://acornlms.com/>) (Licensing fee is required. Similarly to Docebo, this LMS is mainly aimed at industries).
- *Moodle LMS* (<https://moodle.com/solutions/lms/>) (Moodle is an open source solution, which means organizations are free to download it. Pricing plans are also available for additional services and features, as well as cloud hosting. 45-day free trial is available. Moodle is built for universities and schools, but it's also used by companies for training programs).
- *Thinkific LMS* (<https://lms.thinkific.com/>) (Licensing fee is required, but limited 30-day free trial is offered).
- *Absorb LMS* (<https://www.absorblms.com/>) (Licensing fee is required, but limited free trial is offered. Similarly to Docebo or Acorn LMS, Absorb LMS is mainly aimed at industries)
- *360Learning* (<https://360learning.com/>) (Licensing fee is required, but limited free trial is offered).
- *Canvas LMS* (<https://www.canvas.net/>) (Licensing fee is required, but the individual users can try the free version by signing up for their own account. This LMS has been developed for universities and educational institutions.).
- *Big Blue Button /BBB* (<https://bigbluebutton.org/>) (Licensing fee is required, but limited free trial is offered)
- *MOOC* (<https://www.mooc.org/>) A massive open online course (MOOC) is a model for delivering learning content online to any person who wants to take a course, with no limit on attendance This platform, in fact, is not a LMS, but a tool which brings many courses from many schools to millions of learners around the world.
- *TAO* (<https://www.taotesting.com/solutions/higher-education/>) represents a reliable, secure digital assessment platform, that conforms to most of the secure online assessment environment constraints. It comes in both open source (free of charge) and paid versions. Similarly to the MOOC, TAO is not a LMS platform, but provides several tools shared with the previously mentioned LMSs.
- Most of them share the main features with the commonly used video-conferencing platforms mentioned above. Furthermore, they support several other tools like shared diaries, online social areas, assessment, management, and tracking tools and other.
- Some may provide an extra features e.g.:
 - Virtual reality support (Adobe Captivate)
 - In software image editing (Adobe Captivate)
 - Trackable progress (Blackboard Learn)
 - Fostering student and teacher interaction (Blackboard Learn)
 - Including text editor (Moodle LMS)
 - Integrating website builder (Thinkific LMS)

- Integrate in polls and surveys (Absorb LMS)
- Extensive knowledge base (360Learning)
- Automated grading (Canvas LMS)
- Assistance with learners' enrollment and retention (Blackboard LMS)
- Some of them are mostly aimed at enterprises and industrial companies (Docebo, Acorn LMS, Absorb LMS) And many others... Considering the survey results, the common and most frequently used video-communication platforms are, however, fully sufficient in most cases and unless the teachers need the extra features, there is no need to use learning management system and online specific platforms.
- Problems with using e-learning platforms during the real-time online education:
 - According to the survey, about 90% of the teachers and students didn't face any major problem when using the e-learning platforms.
 - Among teachers, 93% reported the real-time use of these platforms as always trouble-free, almost trouble-free, or had only minor concerns. Only 7% educators reported concerns in each use of the platform.
 - Among students, the experience was quite similar: 86% of students reported the use of platform as always trouble-free, almost trouble-free, or had only minor concerns.
 - If any, the most frequently reported problems in both groups were:
 - Internet connection problems (which points out the importance of stable and fast internet connection as the key pre-condition for online teaching and learning)
 - Problems with screen sharing
 - Microphone problems
 - Problems logging into the platform
 - Problems to hear the teacher or students
 - Problems with the use of applications available in the platform
 - Interruption during teaching and video playback, accidental disconnection
 - Camera problems
 - Lack of information on how to participate
 - The e-learning platform users thus may face several problems mainly at the beginning of the use. Considering the overall positive evaluation of the e-learning platforms by both teachers and students, all these problems were probably only rare and solvable in most the cases.
 - Most of the problems experienced by the teachers and students are related to the hardware and internet issues and lack of experience with the platforms and information how to use them. These problems thus underline the importance of:
 - Stable and secure high-speed internet connection.
 - High-quality hardware equipment (microphones, camera, etc.).
 - Education and training of the students and teachers in the use of the platform

(or availability of the guides on this and/or technical support).

- For details, please see appropriate sections.

Solving all these problems would probably markedly reduce any problems with the e-learning platforms.

4.2.2 Other applications or software tools used for the purpose of online teaching activities

- *Video- and/or audio editing software:* creating the video records of the lectures and/or exercises and providing them to students represents one of the most efficient and highly appreciated approach in online education. Besides simple recording of the commented presentation, further video and/or audio editing may increase the quality and informative value of the presentation.
 - The video- and/or audio editing applications allow manipulation and arrangement of video/audio shots. They allow to cut and/or merge the video recordings, and resize the footage for different platforms. Some of them also allow adding automatic or editable subtitles in many languages, adding soundtrack or visual aids such as gifs, icons and many others. These tools thus help students keep focused and make the material more captivating and instructive.
 - Some video and/or audio editing tools might be recommended and supported by particular universities and listed together with all the other software available. In such case, their use should be sufficient and is highly recommended.
 - If no suitable software is supported and provided by the university, there are plenty commercially available tools (Apple iMovie, Windows Movie Maker, Adobe Premiere Pro, PowerDirector for Windows, iOS and Android, VideoPad, DaVinci Resolve, Lightworks, Pinnacle Studio, and many others).
 - Most of these platforms are paid, but many have basic versions for free or they allow free few-days trials.
 - Many of these apps are available even for smartphones.
 - They mostly allow to export the edited video straight to YouTube, Dropbox, and more.
 - All of the platforms are compatible with a high resolution, most of them offer 360° and 3D video editing.
- *Tools which may help using the already available multimedia resources:* Teachers are also encouraged to integrate the multimedia resources (videos, audios, and podcasts) already available online into their course.
 - The use of the already published materials may be particularly important in case of sudden switch of learning to the online environment. In that situation, teachers may not have enough time to create their own new content and using the pre-existing online materials may help to reduce the burden.
 - The use of university library database for readings, link to websites and existing videos and podcasts is recommended for the search for media to be integrated into the course.
 - Several newly available interactive online tools or platforms which allow creating or sharing materials can be used. Among others:
 - Glogster (<https://edu.glogster.com/>), which is a library of teacher-created “glogs,” multimedia posters that combine images, text, and video. Teachers

- can build their own glogs or access more than 40,000 glogs on a range of subjects. Licensing fee is required. Personal or multilincences are available.
- Wakelet (<https://wakelet.com/>), which is a content curation platform that helps teachers to share resources, build online portfolios, and share digital stories. It allows them embed YouTube videos, podcasts, music, articles, or original content into a collection that students can access across many devices. Wakelet is free to sign up for and use.
 - Flip (formerly Flipgrid) (<https://info.flip.com/>) is a platform, which allows teachers to create a topic for discussion and share it with their class. Students can then record short videos on this topic to share with their teacher and classmates. The platform is completely free.
 - Animoto (<https://animoto.com/k/homepage>) allows both students and teachers to create educational videos. The program lets users add text, create photo slideshows, stitch together several videos, and include images to deliver exciting presentations. Animoto offers 3 different payment plans, including a limited free option.
- *Platforms for creating interactive tests or quizzes:* To keep the students' attention and make the education more interactive, teachers may use the digital platforms which allow for creating the interactive online tests or quizzes.
- Many universities provide their own platforms which provide better safety of the data.
 - The application KvIS (<https://is.muni.cz/napoveda/elearning/kvis>) available in Masaryk University represents typical example.
 - Several free or commercial platforms available for this purpose if no custom-made tool is available:
 - Microsoft Forms (<https://forms.office.com/Pages/DesignPageV2.aspx>) (MS Forms) allow teachers to create a form, such as a survey or quiz, invite others to respond to it using almost any web browser or mobile device, see real-time results as they're submitted, use built-in analytics to evaluate responses, and export results to Excel for additional analysis or grading. Microsoft Forms is free to use for anyone with a Microsoft account
 - Kahoot! (<https://kahoot.com/>) is a game-based learning platform, used as educational technology in schools and other educational institutions. Its learning games, "kahoots", are user-generated multiple-choice quizzes that can be accessed via a web browser or the Kahoot app. Kahoot! can be used to review students' knowledge, for formative assessment, or as a break from traditional classroom activities. Kahoot! is free for teachers and students.
 - Quizizz (<https://quizizz.com/?fromBrowserLoad=true>) is a gamified student engagement platform that offers multiple features to make a classroom fun, interactive and engaging. Teachers may use it to conduct formative assessments, assign homework, and have other interactions with your students (for all grades) in a captivating way. There are many ways how to use the platform: the whole class can go through each question together or each student progresses at their own pace on their own devices. It also provides an access to millions of already available public quizzes (which teachers may use as they are or edit and customize them). It allows to create a detailed class-level and student-level report for any quiz. Teachers may also share the quizzes they've created with others. Basic use is for free, but

paid plan is also available. This gets the teachers the access to the Quizizz Super library of quizzes and the ability to create unlimited quizzes and lessons. There is ad-free use with game themes, answer explanations, interactive videos, and more.

- Slido (<https://www.slido.com/>) is an easy-to-use question and answer and polling platform for live, remote or hybrid meetings, events, classes, and webinars. It allows the teachers to engage participants with live polls and quizzes, collect instant feedback with surveys or brainstorm ideas with upvotes about selected topic. Slido has a free version and offers a free trial. Several paid versions with more advanced options are available.
- Glimkit (<https://www.gimkit.com/>) is a another digital learning tool which, in fact, gamifies learning. Using this platform, students respond to questions at their own pace in a game show fashion, learning new material or reviewing and practicing material they've already learned. Free version called Gimkit Basic is offered. Much more options in the paid version (Glimkit Pro). All free Educator accounts come with a 14-day trial of Gimkit Pro.

4.3 Hardware, internet connection, other equipment needed

4.3.1 Obligatory equipment

- Stable and secure high-speed internet connection:
 - The most important condition for any online education. This statement is strongly supported by the survey: problems with internet connection represent the technical problem by far most frequently mentioned by teachers and students. Furthermore, faster and more reliable internet connection was mentioned among the teachers' needs related to the online education.
 - Broadband/high-speed internet is recommended: The internet speed requirements differ vastly from company to company. For example:
 - Skype group videochat (7+ people): optimal download/upload speed 8 Mbps / 512 kbps.
 - MS teams (video meetings): recommended download/upload speed 4 Mbps/2.5 Mbps.
 - Zoom (HD group video call): recommended download/upload speed 3 Mbps/ 2.5 Mbps.
 - Google meet (HD group video meeting):
 - 2 participants: recommended download/upload speed 2.6 Mbps/3.2 Mbps.
 - 10 participants: recommended download/upload speed 4 Mbps/3.2 Mbps.
 - WebEx (HD video chats): recommended download/upload speed 2.5 Mbps/ 3 Mbps.
 - To sum up, for optimal teaching performance with the most commonly used platforms, the recommended uploading and downloading speed should be up to 10 Mbps. For sharing videos (records, live surgical transmissions etc.) 20-30 Mbps upload is recommended. The more participants are expected to connect, the higher speed is required.

- Standard cable, satellite or DSL connection is mostly faster and more stable than a wireless connection, but both options are acceptable.
- Teachers (and students) are also recommended to have a back-up plan when the internet goes down. Private hotspot using the data on smartphone represents usually the easiest and widely available solution, which allows for keeping the communication with students in such emergency situation.
- Fast and reliable computer:
 - For teachers, desktop or laptops represent optimal solutions. The use of smartphones for teaching process can't be recommended with the exception of emergency situations with no better solution available.
 - Students may use a wider range of devices: desktop computer, laptop, tablet and smartphone. Desktops or laptops, however, provide clear advantage, particularly for long-term education.
 - The video-learning platforms mostly require at least a 1 GHz processor and a minimum of 256 MB of RAM (or more). However, the faster the system is, the more reliable the connection will be and minimum of 8 GB of RAM is highly recommended for an online teaching mainly in case of sharing video records or life-transmissions during the lectures. Computer CPU (central processing unit) is recommended to be minimum Intel i5 or equivalent.
 - Faster and better equipped computers allow many other functions useful for online teaching, e.g. editing videos or audio records, and have also much bigger storage.
- HD webcam:
 - In most of the new laptops or tablets (purchased within the last 5 years), the HD cameras are fully sufficient. External devices, however, frequently provide even better quality.
 - Some computers may not be equipped by camera and external webcam is needed.
 - In older devices, external webcam is recommended and may highly increase the quality of the transmission.
- Microphone:
 - The quality of microphones built in newer laptops or tablets is mostly sufficient. External USB devices may, however, provide better sound quality.
 - Some computers may not be equipped with a microphone and external device is needed.
 - In older computers, external microphone is recommended and may highly increase the quality of sound transmission.
- Speakers:
 - In most devices, built-in speakers are available and mostly sufficient. External speakers or headphones (see below) may, however, provide better sound quality.
 - Some computers may not be equipped by speakers and external device is needed.

4.3.2 Optional equipment

- These devices are not required but are highly recommended and may help enhance the lesson experience for both teachers and students.
 - Scanner and printer:



- Scanners help teachers to convert all the materials to be shared with students from the paper to the digital form.
 - Nowadays, scanners are quite frequently replaced/substituted by smartphones.
- For students, printers provide the option to print the practice sheets or other assignments. Scanner allows them to scan various types of printed, hand-written, drawn or otherwise created non-digital assignment and send it back to teachers in the digital form.
- Headphones:
 - Many teachers use their computer or tablet's built-in speakers, but headphones can enhance the experience and allow them to clearly hear themselves and mainly the students with less interference.
- Multiple cameras (incl. multi-camera software):
 - Multiple cameras might be useful mainly in exercises, demonstrations and practice lessons where teachers demonstrate patients or experiments, show models or use live transmissions of surgical procedures, intervention radiology, physical examination etc.
 - The use of multiple cameras can enhance a lesson by giving the student multiple views such as using an overhead-camera position in addition to a side-view or front-view camera.
- Desk, office chair, laptop stand, adequate lighting and other equipment which allows comfortable sitting and helps organize the desk and workplace.

5 Technical support for online education and availability of the manuals / guidelines/ online trainings on online education

5.1 Background from survey

Based on the results of the questionnaire survey, only 47% of teachers clearly know whom to contact for technical support in online education. On the other hand, there are about 10% of teachers who don't know it at all and/or don't care about it. The situation is even more serious with students: only 27% of students clearly know whom to contact for technical support in online education and about 20% of students don't know it at all. The proportion of students/ teachers with a good knowledge on the technical support varied markedly among the participated universities (in some of them, this proportion was almost twice as high as in the others).

In terms of online trainings on online education, almost half of the teachers did not attend any training and another 12% wanted to attend the training, but the time didn't suit them. In contrast, only 30% of teachers took part in at least one online training. Only few teachers were not aware of such trainings (6%). The proportion of those who don't need such a training or don't care about it extremely low (3%).

Among students, about 1/3 of them attended at least one online training on online education and 1/3 who didn't. About a ¼ of the students didn't know about such trainings and about 5% wanted to, but the date of training didn't suit them. Similarly to the teachers, the proportion of those who don't need such a training or don't care about it low (5%).

About 60% of teachers (and even 72% of students) do not exactly know that there are any online education guides and manuals available for them on the institutional websites or where to find them, despite the fact that those who don't need such guides and manuals or don't care about them is very low in both the groups (4% of educators and 2% of students).

Furthermore, the trainings for teachers were among the most frequently mentioned needs regarding the online education and examinations among the educators. Less frequently, the training manuals, the technical support or IT support were listed in the same topic. Among students, only few of them mentioned more support from the IT department among the needs regarding the online education.

Summary of the survey:

The smaller subset of teachers (and major part of students) don't know which types of technical support they may use and whom to contact for this type of support in case of need. Only 1/3 of students and teachers have ever attended at least one online training on online education despite the fact that only very few teachers (and about 1/4 of students) feel that they don't need similar type of training. Furthermore, such trainings are mentioned among the most important needs regarding the online education among teachers. There is thus still a substantial part of the students/ teachers who didn't use the possibility to attend the online training or don't even know about such an option and may potentially benefit from its attendance. Major part of both teachers and students are also not aware of the availability and localization of the online education guides and manuals, which again is in contrast with the very small proportion of those who don't need such guides or don't care about them among both the students and teachers.

Further increase of the knowledge about the modes and availability of the technical support and online education trainings or guides/manuals on online teaching have thus a potential to make the online education less stressful and more efficient and informative for both students and teachers.

5.2 Practice guidelines for technical support for online education and availability of online trainings/ guides/ manuals on online education

5.2.1 General recommendations for the technical support

- The awareness of technical support has to be increased among the teachers and mainly students (and sometimes other university staff).
 - Students and teachers should be informed about different modes of technical support and their availability including operating hours and whom to address in case of need.
 - The use of more than one channel to provide this information could help to increase this knowledge among those who may need it. Such an information should thus be available at:
 - The institution's website
 - University / faculty online information system (always available to all the staff)
 - Institutional newsletters (sent by e-mails to the teachers/ students)
- The teachers, students and other university staff should be informed about:
 - The computing products (operation systems, online teaching or communication platforms, remote learning tools) currently supported by the university.
 - The list of the computing software which is supported and recommended, is widely compatible and in broad use across the university should be available.
 - Such a list should contain also the links for safe download of particular products and the links for both the remote support guides and helplines / helpdesks support available for particular programs / products. Teachers / students should be aware that the use of recommended products provides them the certainty of relevant technical support available.
 - Types of technical support which might be available:
 - Online help (remote support guides or manuals): technical and computing self-help online section should be available from the institution's website or university/faculty online information system for each of the computing products recommended and supported by the university. It should provide answers to common questions and issues that students / teachers encounter. The availability may reduce the use of the helpdesk.
 - Technical support helpdesk should be available via e-mail, phone (for urgent problems) and / or live chat (use of more options brings more advantages). This remote assistance usually uses the screen-sharing service and gives the community the convenience of receiving technical support from IT support staff across campus networks or across the internet. The helpdesk should be able to deal with a wide variety of IT queries and technology requests, including many specific tasks related to particular information systems used by the universities.
 - The remote technical support provided by the companies outside the university (usually related to particular computing product): mainly for situations with limited availability of the technical support provided by the university. Mostly available only in English, otherwise similar to the previous point.
 - FAQ reflecting technical issues that occur as the most common ones can be answered and complemented with a short video guide how to solve them on

- the university / faculty online information system.
- The availability of the technical support
 - At least some modalities of the technical support have to be available 24 hours a day, and 7 days a week so any issues (including urgent ones) students / teachers may encounter while studying, teaching or preparing for lectures can be resolved quickly and efficiently.
 - The helpdesk availability should cover at least the common working / teaching hours. The longer time frame is more advantageous.
 - For urgent problems which occur after the helpdesk operating hours and require immediate attention, the IT After Hours operations number should be available on the university / faculty website.
 - Clear information about the availability of particular types of technical support should be easily accessible on the university / faculty website.
 - Besides the operating hours, students and teachers should be also clearly informed how to contact particular types of support and whom to address in case of need including the urgent situations during the online teaching

5.2.2 General recommendations on the online trainings / guides / manuals on online education

- The teachers and students participating on the online education should be encouraged to use the online trainings or guides and manuals on online education to increase the quality of the teaching process and extend the knowledge about the appropriate tools and methods available.
- The online trainings / guides / manuals should address following topics:
 - Overview of the teaching methods available and related technical requirements.
 - Forms of online education - synchronous and asynchronous learning and particular tools used in each of them (live chat – real time online lectures, online seminars / exercises in real time, audio and video conferencing, data joint viewing of multimedia presentations and online slide show, files sharing, sharing pre-recorded presentations or video lectures).
 - Advantages and disadvantages of particular methods.
 - Suitable forms of teaching for different types of courses - for lectures (preclinical, clinical), seminars and practical laboratory or clinical exercises.
 - Technical requirements for online education (hardware, software, internet connection).
 - Online learning platforms and other applications used in the online education.
 - Platforms available, used and preferred by students / teachers for real-time online education.
 - Other applications used for the purpose of online teaching activities (For creating videos, audio recording, quizzes, tests etc.).
 - Problems with using particular platforms (mainly during the real-time online education).
 - Practice guidelines for effective and attractive online teaching including following specific topics:

- preparation of study materials for online teaching - interactive textbooks, instructional videos, virtual patients, practice tests and others
- tips on how to conduct live online teaching so that it is effective and attractive enough for students to keep their attention
- ways to activate and motivate students during online teaching
- time-requirements for online teaching
- access to online material: who should the teachers share the materials with
- recording the real-time online learning activities
- specific needs of teachers / students in online education
 - how to handle the specific needs of disadvantaged students during the online education (students with limited internet access, lack of concentration, students with specific learning disabilities)
- Practice guidelines for evaluation, examination and continuous assessment of student knowledge during online education.
 - General recommendations on the online assessment
 - Online assessment recordings
 - Preparation for examinations
 - Recommendations on continuous assessment
 - Recommendations on oral exams
 - Recommendation on written exams
- Technical support for online education
 - Particular types of support available
 - The list of supported and recommended computing products (including but not limited to the online teaching or communication platforms, the programs for creating videos or audio recordings) – see above
 - How to inform the students / teachers about the support available and how to get to the contact with particular modes of support
 - The availability of the online education guides and manuals or online trainings on online education
- Students and teachers should be informed about the availability of online trainings or practical guides and manuals on online education and should be supported to use these tools.
 - The use of more than one channel providing the information about their availability could help to increase this knowledge among those who may need it. Such an information should thus be available at:
 - The institution's website
 - University / faculty online information system (always available to all the staff)
 - Institutional newsletters (sent by e-mails to the teachers / students)
- Considering the needs and requirements of various groups of teachers and students, it is highly beneficial to provide the online trainings in more different modes. Following options

are available:

- Online lectures in real time
 - Strengths – Instant availability of the teacher and related possibility to ask any question in real time. For many teachers / students more understandable and illustrative and easy-to-use in comparison with written manual.
 - Weaknesses – exact time-slot, not suitable for everyone who considers the participation. Due to usually limited time-slot, some topics or questions may not be addressed.
- Videos with pre-recorded lectures
 - Strengths – Excellent availability at any time, nicely understandable, illustrative and easy to use for major part of the students / teachers.
 - Weaknesses – limited availability of the teacher in real-time and thus limited possibility to directly ask any questions. Due to usually limited extent, some topics or questions may not be addressed.
- Written education guides and manuals (available online), online interactive textbooks
 - Strengths – Usually comprehensive and containing full extent of information. Available at any time.
 - Weaknesses – Less easy to use, no possibility to ask the teacher if needed.
- Combining more methods may emphasize the benefits of particular methods and reduce or minimize their disadvantages. Possible combinations may include among others:
 - videos with pre-recorded lectures with real-time interactive video consultations
 - written education guides and manuals or online interactive textbooks with real-time interactive video consultations

6 Practice guidelines for effective and attractive online teaching (considering students' and teachers' requirements, experiences and expectations from the survey)

6.1 Background from the survey

6.1.1 Educators' and students' needs regarding the online education

The educators identified in the survey their needs regarding online education, half of them chose to skip the question. Almost 30% of teachers who responded to the question about their current needs stated they have no other needs. Another most frequent teachers' needs in online education include training for teachers, better equipment, interactive teaching elements, alternative systems, reliable and fast internet connection and full-time clinical teaching.

Students were also asked about their needs regarding online education. We can group the students' answers in those categories:

- *none or I don't know*
- *teachers' action and behaviour (more interactivity, good communication with the teacher, good explanation, explanation on whiteboard, teachers' help when the students have difficulties to understand the lesson, possibility to ask questions during classes, teachers should show the face, visual contact etc.)*
- *study materials and forms of online education (recording all lectures, study materials, PowerPoint presentations, more educational videos, individual online consultations)*
- *technical aspects of the online education (good internet connection, computer, more support from IT department, WiFi etc.)*
- *examination and assessment (minimizing the amount of tests, no test during lectures etc.)*
- *logistics (free time between classes, shorter lessons etc.)*

6.1.2 Needs and tips regarding the way to activate and/or motivate the students

72% of educators feel the students' activity is worse or much worse in online education comparing full-time form of education. Concerning the change of the student' activity from educators' point of view, most of the teachers thus reported less activity and less communication with the teacher or even no activity. Teachers also found students more passive, and complaint about no feedback, excuses and cheating opportunities. They also mentioned that everything takes longer.

Only few teachers (about 10%) reported no change or even found students more active or keeping more attention.

Regarding the ways to activate and/or motivate the students, the educators ordered their needs of the most preferred:

- *Interactive elements of teaching*
- *Strengthening communication*
- *Online lectures and seminars*
- *Seminar nature of exercises*
- *Individual online consultation*
- *Communication via email*
- *Others – the six most often mentioned comments: none or I do not know, feedback from*

students, full-time teaching, reliable and fast internet connection, breakout rooms, regular tests

However more than half of the educators skipped this question.

On the other hand, students had a little bit different point of view. They prioritised their needs in the following order:

- *Online lectures and seminars*
- *Communication via email*
- *Strengthening communication*
- *Interactive elements of teaching*
- *Individual online consultation*
- *Seminar nature of exercises*
- *Other*

The educators commented the ways used to activate and motivate their student during online education, we collected 41 answers to this question. They most often used: small tests during and after the lecture; discussions; interesting facts from practice; case reports; asking questions during lectures and exercises; current information; videos; breakout rooms; games; solving logical tasks; and way of presenting the topic.

6.1.3 Concentration and attention during the online educational activities

Students pointed out the problems with concentration or even lack of attention among frequent negatives of online teaching. On the other hand, a few students pointed out better concentration among the positives. This question is thus inter-individually variable and students apparently differ in this point. Similarly, a few teachers mentioned more students' attention in online learning. Most teachers, however, commented on decreased students' attention during e-learning. The decreased concentration and attention thus seem to be much more frequent. Educators also mentioned the need to attract students' attention among the changes which occurred during the online education era.

6.1.4 Communication settings

Strengthening communication, communication via e-mail and communication with each student were frequently mentioned among teachers' needs regarding ways to activate and/or motivate students. Furthermore, many teachers complained about less students' communication in the era of online education (in fact, this was the most frequently mentioned change in the students' activity).

Similarly, bad communication with the teacher; late replies of teachers; ignored emails as well as problems to find basic information for new students were mentioned among negative students' experiences with online education. Vice versa, good communication was frequently pointed out among positive experiences: the most often repeated positive experience were the fast answers, followed by e.g. teacher explain everything thoroughly with understandable words; good email communication; teacher helped me when I need it; politeness and kindness of teachers; trying to help me; and really helpful instructions.

Furthermore, more interactivity and good communication with the teacher were among 5 most frequently mentioned students' needs regarding online education.

To sum up, effective, fast and responsive communication thus represents one of the key steps for efficient e-learning.

6.1.5 Time-constraints of online teaching and learning

77% of educators consider the preparation and implementation of online education is more time



consuming (significantly more or a little more) than the in-person forms of teaching.

6.1.6 Creating study materials and other activities used for online classes

File sharing was the third most frequently used approach according to the teachers' responses (after the real-time online lectures and exercises). For about 1/3 of students, file sharing was the second most preferred approach in online education.

Considering other applications used in the online education, following apps were reported by teachers to be used at least several times a month: the video recording software (31% of teachers who answered this question); audio recording software (21%); presentation/screen recording software (45%); software for creating quizzes, tests, interactivity (46%); and other applications (6%).

6.1.7 Recording the online teaching activities

Most of the educators do not make video recordings of their teaching related activities. The recordings are mainly made from lectures (41%), but in any other activities the educators are not willing to record them. If they make the recordings, the majority of the educators (55%) prefer to publish their education activities video recordings to students registered in their subject. Only 2% of respondents are willing to share such education outputs to anyone.

Recording all lectures was, however, mentioned among the students' needs regarding online education.

6.2 Practice guidelines for effective and attractive online teaching

6.2.1 Choice of synchronous, asynchronous or blended type of course

At the beginning of the course, the teachers need to choose the optimal form of online education (synchronous, asynchronous or blended).

- When being selected the appropriate type of online teaching for their course, teachers should keep on their minds that the forms of online education preferred by most of the students (and educators) are the synchronous online teaching or the asynchronous teaching with the pre-recorded commented presentations or video lectures.
 - o Video lessons are presented in a very instructive manner, which makes it easier for the viewer to absorb the content. By uniting images and sounds, it is possible to approach students and make them more interested in what is being taught. Video lecture is thus one of the most effective ways to teach and engage students.
- The preferences regarding the type of the online course may, however, be inter-individually different. Introverted students, for example, usually strongly prefer asynchronous courses. If possible, the students may thus potentially benefit from the possibility to choose from more different types of courses.
- Each of the methods has certain pros and cons to be considered (mentioned above in the section focused on the types of courses).
- The synchronous courses should be preferred in following situations:
 - o The course requires more interaction (student-teacher or among students), active students' participation and instant feedback.
 - Among others, this applies to most clinical subjects where the case reports are presented and discussed online.
 - Another example may represent the practical exercises which include the training and practical demonstration of certain skills and instant feedback is required.

- Similarly, if the extensive discussion among students is expected to be an important part of education process, the synchronous course represents much better solution.
 - For seminars based on students' presentations on particular topics, again, the asynchronous form of education can't be used.
- Most of the students are living in the same or close time-zones.
- The quality of the technological equipment and internet connection is high both in teacher and students, since the real-time video-chats may present additional technological challenges and a slow internet can cause lag times where students (or teacher) might miss key points or discussions.
- Synchronous courses are particularly suitable for students deeply suffering from the lack of direct social interactions.
- The asynchronous form of education is preferable in following cases:
 - Most of the students are very busy and prefer more flexible schedule and the possibility to accomplish the assignments in any time according to their preferences.
 - The course does not require direct interaction (student-teacher or among students) and instant feedback.
 - The possibility to view the content several times is required for better understanding and deeper knowledge of the topic.
 - The students live in very different time zones (which may limit their ability to participate in synchronous online classes).
 - The quality of technological equipment and internet connection may limit the speed of real-time video-chats.
 - This type of course is also strongly preferred by introverted students.

6.2.2 Tips for selection of the computing programs / platforms for education purpose

- Consider the list of computing programs supported by the university and provided by the IT department. The programs and platforms listed here should be strongly preferred, since they are available to all teachers and students.
- The choice of the appropriate program or platform for particular course should consider:
 - The suitability of the program for the purpose of particular course and required activity.
 - The practical usability of the program: the student's ability to achieve the appropriate level of competence to use the tool effectively and participate meaningfully in the education should be always considered.
 - The accessibility of the program: only tools accessible to all students can be used for education process. Specific accessibility needs of learners with disabilities should always be met.
 - The equipment required: The student's access to technology (e.g. webcams, microphones, Internet access, drawing programmes) should be kept in mind when selecting tools.
- In general, technology skills of the students should be considered in selection of the tools and applications recommended for any type of the course. It is highly important to choose

the tools with low barriers to use so that students do not come to feel that their inability to master a chosen tool will negatively impact their learning.

- Considering the results from the survey, most of the students (and teachers), however, have no major problems when using the most common online learning platforms and other software tools routinely used in real-time online education in their universities within the pandemic era. The students' IT literacy was generally evaluated as excellent or good and the only problems with online education via the e-learning platforms reported by both groups were related to the hardware equipment (problems with internet connection, speakers, microphones or camera) and problems caused by low level of experience with online learning (problems with logging into the platform or using particular features or tools provided by the platform, lack of information on how to participate). The incidence of the latter problems will thus decrease in time.
- For more details how to choose particular e-learning platforms and other software tools used to prepare the online classes, please see above in the appropriate section focused on the technical requirements for online education.

6.2.3 Communication setting

The teachers should always keep in touch with their students in all types of course. The communication is particularly important in case of the sudden shift to remote learning, which can bring students a high level of uncertainty regarding the future structure of the course. It's thus important to let students know about changes in schedules, assignments, procedures, requirements and broader course expectations. Early and frequent communication can ease student anxiety, allow the student successfully continue on the education process and save the teachers from becoming overwhelmed with individual questions. The level of anxiety and uncertainty is only elevated for students with physical disabilities, learning disabilities, and/or mental illnesses and communication with these types of students is particularly important.

For every type of course, the teachers are recommended to develop a communication plan and share it with the students. Such a communication plan should contain:

- How the teacher will communicate with students:
 - In general, the asynchronous communication represents the most frequently recommended type of teacher-student communication on the organisation of the education. Synchronous communication is mostly used for teaching, but rarely for course organisation details.
 - All important information should be available in the university information system including those related to the urgent situations.
 - In urgent or critical situations which require major changes in the schedules and type of education (switch to the different type of course or even timely course disruption) it's recommended to create a group email and send it to the students. University information systems should allow to create a group e-mails and may even provide the possibility to send an email in real time or with a delay depending on the teacher's needs. Flexibility and accessibility should be part of any solution in such an urgent situation.
 - Some university information systems may allow to create a kind of discussion board which might also be used for communication purpose.
 - Alternatively, social networks may be used for this purpose, if they are officially used for communication in the institution.
 - Online synchronous communications can be managed through various web conferencing applications. The list of computing programs and platforms supported

by the university should be considered in the choice of platform used for this purpose.

- To participate successfully in an online synchronous session, students will need Internet access available at the expected meeting time, and the requisite technical ability.
 - The teachers should also take into account that some students may live in different time zones when planning the synchronous communication. For students living in different time zones, asynchronous communication might be more advantageous.
- How the students can communicate with the teacher:
 - The most common type of communication is via e-mail.
 - Alternatively, social networks may be used for this purpose, if they are officially used for communication in the institution.
 - The teacher may also recommend the students to use the discussion board on the university information system for their questions (if the system allows such an option).
 - For frequently asked questions (FAQs), the teacher may create a kind of FAQs forum in the university information system which should reduce the need to respond to similar questions repeatedly.
 - The last two options (together with the active teacher-to-students communication) may help to reduce the mass of emails in case of critical or urgent situations.
 - Frequency of student-to-teacher communication: mainly in critical situations, the students may begin reaching out the teacher individually.
 - Fast responses to their e-mails were the most frequently mentioned positive of online learning mentioned by students in the survey. This point thus seems to be of particular importance.
 - Teachers should let the students know how quickly they can expect a response in the outset communication setting.
 - Alternatively, the teacher may set an automatic reply that reassures the students that their message have been received and the teacher will get back to them in a span of time that the teacher finds realistic and appropriate for his/her capacity and the student's needs.
 - The regular communication is particularly important in the asynchronous type of course, where the students may feel disconnected or disengaged due to the lack or regular social interaction. To prevent or get over these students' feelings, the teachers are recommended to regularly respond to all discussion posts from students and support the meaningful interactions among students (by creating the projects which require cooperation of smaller groups or all the class).
- How the students will communicate and collaborate with each other (if needed for the course):
 - In general, the asynchronous tools are recommended to be preferred for the communication among students.
 - The students should be informed why they are being asked to collaborate, how to do it, how their collaboration will be measured and what the learning goals are for any

required collaborations.

- The discussion board, emails, blogs or social networks enable students to communicate asynchronously by posting messages to each other and thus allow for the asynchronous interactions between the students.
 - In case of need of broader and more complex interactions among student, advanced online applications are currently available (e.g. VoiceThread, Confluence, Notion). These apps represent is interactive collaboration and sharing tools that enable students to build online presentations by adding images, documents, and videos, and other media to which other users can add comments for discussion.
- Teachers are recommended to check the list of computing products supported by their university to find the most appropriate tool for this purpose. Technology skills of the students should, however, be considered in recommendation of similar platforms.
- Again, the communication is particularly important in the asynchronous type of course, where the students may feel disconnected or disengaged due to the lack or regular social interaction. Teachers are thus recommended to support the students' activities which require the communication and interaction among students. They should try to make the education more personable, make students feel included and bring them together as one community.
- How the students are expected to send their assignments (e.g. Word or other text format documents, PowerPoint presentations, videos) to the teacher:
 - It is advisable to avoid sending the assignments as the email attachments, since it can make the tracking of student submissions difficult and increase the teacher's burden.
 - It's possible to use the university information system for uploading the assignments. In some universities, however, this option may be restricted for certain types of documents (e.g. bachelor's or master's thesis, dissertation, habilitation thesis).
 - Most frequently, uploading the documents to the learning or communication platforms (e.g. Microsoft Teams, Google Classroom etc.) is used.
 - Alternatively, uploading the documents to the cloud-based storage and file-sharing services (e.g. GoogleDrive, OneDrive, Dropbox etc.) can be recommended.
 - There are also many new innovative digital tools available (for example Floop, ExplainEverything etc.). They allow teachers to build and receive assessments, provide feedback, and create interactive virtual activities. Many of these platforms allow teachers and students interact in real-time. For example, Floop allows students to upload images of their assignments, and teachers or peer editors to point directly to where they want to comment and offer feedback. Students can respond to these comments and ask questions.
 - In all the file-sharing or communication platforms, the course folder should be created. To preserve anonymity, it's recommended to create sub-folders for each individual students. If anonymity is not important, one joint account for uploading the files can be used.
 - In any case, the students should be informed about the preferred format of the documents including the preferred format for the names of the assignments.
 - In case of sudden transition to the online education, it may take some time for students to become acclimated to the new learning style. When setting the deadlines,

it's thus recommended to be more flexible than usual.

- When giving an assignment, the teacher should inform the students when they can expect feedback and what kind of feedback they can expect.
- Small tests and quizzes may represent an alternative assessment method which can substitute the written assignments (for more details, see the appropriate paragraph).

6.2.4 Creating and curating the content

Availability of study materials was frequently mentioned among students' needs regarding online education. Synchronous online education is the most preferred form of e-learning in both students and teachers. In this type of course, teachers are recommended to consider performing a video-records of their lectures and provide them to students. Alternatively, the pre-recorded video lectures represent the second most preferred type of education, followed by sharing materials. For any type of presentation, clear information with maximum informative value a re-considering of the necessity of particular information can be recommended particularly in case of sudden full transition to online education to reduce the students' overload.

When creating the video lectures, following points should be considered:

- The video lecture is one of the most effective ways to teach and engage students since the uniting of images and sounds makes it easier for the viewer to absorb the content.
- Besides simple recording of the commented presentation, further video and/or audio editing may increase the quality and informative value of the presentation, helps students keep focused and makes the material more captivating and instructive.
- The video- and/or audio editing applications allow manipulation and arrangement of video/audio shots. They allow to cut and/or merge the video recordings, and resize the footage for different platforms. Some of them also allow adding automatic or editable subtitles in many languages, adding soundtrack or visual aids such as gifs, icons and many others.
 - Some video and/or audio editing tools might be recommended and supported by particular universities and listed together with all the other software available. In such case, their use should be sufficient and is highly recommended.
 - If no suitable software is supported and provided by the university, there are plenty commercially available tools (Apple iMovie, Windows Movie Maker, Adobe Premiere Pro, PowerDirector for Windows, iOS and Android, VideoPad, DaVinci Resolve, Lightworks, and many others).
 - Most of these platforms are paid, but many have basic versions for free or they allow free few-day trials.
 - Many of these apps are available even for smartphones.
 - They mostly allow to export the edited video straight to YouTube, Dropbox, and more.
 - All of the platforms are compatible with a high resolution, most of them offer 360° and 3D video editing.
- To create a video-lecture for online teaching, following steps are recommended:
 - Plan the content and format of the course and particular lectures:
 - If possible, the course plan should be subdivided into topics for each video lecture or even each part of the lesson.



- This plan helps teacher maintain a coherent line of thought when creating videos so that there is an understandable continuity between your classes.
- Consider optimal duration of each video-lecture (to prevent making the presentation too long or tiring).
- The presentation of the content should be modified according to the subject and audience the teachers want to reach.
- Make the best in speech and presentation.
- Arrange the scene in which the presentation is recorded so that it looks professional, organized and neutral.
 - The fewer objects in the scene and the brighter the environment, the better.
 - Sitting or standing, you should be as comfortable as possible.
 - Choose a noise-free environment as possible.
- Prepare the necessary equipment (microphone, camera, good lighting).
- Record the video.
- Edit the video (for details see above).

Teachers are also encouraged to integrate the multimedia resources (videos, audios, and podcasts) already available online into their course. According to the survey, videos are mostly preferred to audios or podcasts, which is recommended to consider when searching for multimedia resources.

- The use of the already published materials may be particularly important in case of sudden switch of learning to the online environment. In that situation, teachers may not have enough time to create their own new content and using the pre-existing online materials may help to reduce the burden.
- The use of university library database for readings, link to websites and existing videos and podcasts is recommended for the search for media to be integrated into the course.
- Among others, several newly available interactive online tools or platforms which allow creating or sharing materials can be used as a source of multimedia resources for online education (for more details see section 4.2.2.):
 - Glogster (<https://edu.glogster.com/>), which is a library of teacher-created “glogs,” multimedia posters that combine images, text, and video. Teachers can build their own glogs or access more than 40,000 glogs on a range of subjects.
 - Wakelet (<https://wakelet.com/>), which is a content curation platform that helps teachers to share resources, build online portfolios, and share digital stories. It allows them embed YouTube videos, podcasts, music, articles, or original content into a collection that students can access across many devices.
 - Flip (formerly Flipgrid) (<https://info.flip.com/>) is a platform, which allows teachers to create a topic for discussion and share it with their class. Students can then record short videos on this topic to share with their teacher and classmates. The platform is completely free.
 - Animoto (<https://animoto.com/k/homepage>) allows both students and teachers to create educational videos. The program lets users add text, create photo slideshows, stitch together several videos, and include images to deliver exciting presentations.
- The use of multimedia materials (both integrated from pre-existing sources and newly created) may later be transferred from the era of fully online education to the future learning

setting, which is expected to combine both online and in present types of teaching.

To keep the students' attention and make the education more interactive, teachers may use the digital platforms which allow for creating the interactive online tests or quizzes.

- Many universities provide their own platforms which provide better safety of the data (the application KvIS available in Masaryk University represents typical example).
- If no custom made platforms are available, free or commercial platforms can be used for this purpose (e.g. MS Forms, Quizizz, Kahoot!, Slido et al.).
- Another option are the digital learning tools which, in fact, gamifies learning. Glimkit represents a typical example. Using this platform, students respond to questions at their own pace in a game show fashion, learning new material or reviewing and practicing material they've already learned.
- For further details regarding the quizzes or online tests, please see appropriate section above focused on software tools available for online education.

6.2.5 The use of images, photographs, pictures, charts, animations, videos or audio recordings in presentations or publications

The use of images, photographs, pictures, charts, animations, videos or audio recordings, in general, makes any presentation/poster/publication more illustrative, understandable and attractive for the audience.

- In general, the use of photos/images/videos in the highest possible quality and appropriate size is recommended.
- Few clear and highly informative images are usually better than many less illustrative ones.
- When using the images, photos, pictures or charts in the textual documents, they should always be accompanied by the image/ figure legend. Its purpose is to explain the image clearly and thoroughly, providing readers with all the information necessary to understand it without returning to the main text. All images, pictures and charts need to be referenced in the main text.
- In many cases the images, videos or audio recordings may be copyrighted, i.e. their free and/or commercial use may be prohibited.
- Several items can be used by teachers, presenters or authors without any limitation. However, the element of possible co-authorship needs to be considered. This mainly applies to:
 - o The images, diagrams, charts, photos, videos or audio recordings they have created themselves of uncopyrightable subjects such as views, or nature.
 - This, however, doesn't apply to several public sites or places: some countries may impose legal restrictions on the reproduction of copyright material sited in public (e.g. France, Italy or Greece).
 - o Own photos, audio recordings or videos of the people who have given the author their consent to photograph, record or video record them and publish the photograph, audio recording or video.
 - o Their photos or scans or photocopies of objects or designs whose copyright has expired (for Europe usually 70 years after the death of the author or the last co-author).

- The use of other photos or images including those available on the websites may be protected by copyright law. The teachers should take into consideration that free-to-view images are not necessarily free to reuse. Even uncredited photos on transient websites may be protected by copyright.
- The law regarding the use of images, photographs or videos may be partly different among the countries and appropriate rules should always be followed. In many countries, the approval of the author of the original image or picture may be required for any type of publication including scientific ones. In such cases, appropriate requirements are usually mentioned in the author's guidelines.
- In some countries, however, using copyrighted images, photographs, or pictures for teaching or scientific research can be acceptable within the scope of quotation rules given by the relevant law. For example, in Czech law the use of a copyrighted work for teaching for illustrative purposes or scientific research is not considered infringement when abiding by the following rules:
 - The images should always be used without any changes or modifications. All the parts of the original photograph, image or picture should remain unchanged when being reproduced (including the description or legend). The author reusing and citing the original work can, however, use additional legend or provide the comment or explanation of the cited image or picture in the text part of his work (which refers to the picture/image).
 - The use must not exceed the extent adequate to the given purpose.
 - The use of image must not be used to gain any direct or indirect economic or commercial advantage.
 - The re-users must fully acknowledge the rights-holder (the image caption or credits should reiterate any copyright statement or licence terms indicated at the source)(the name of the copyrighted work and its source (see below the paragraph dealing with the CC licences)
- In audio-visual works, the copyright owner is not only the author (e.g. original composer or writer) but also the recording company and based on the licencing contract sometimes also the performers and/or the person by whom the arrangements necessary for the making of the audio recording or film are made.
- Teachers should be particularly careful when posting the presentation, poster or text document containing the copyrighted images to a website or when physically sharing the document outside the classroom. That could be considered a publication and therefore copyright infringement. In that case, the use of images released with an appropriate Creative Commons licence (see below) is highly recommended and the source should be properly cited. The citing information should always include:
 - Title
 - Author, artist, photographer, or creator
 - Source (i.e., information about the book, journal, database, or web address where the image was found, including page numbers and publication information)
 - Licence (type of the CC licence if applicable)
 - The abbreviation TASL is used as a mnemonic (Title, Author, Source, Licence)

- As an example, the following picture (<http://imgs.xkcd.com/comics/copyright.jpg>) should thus be cited as:
 - Title: Copyright. Xkcd
 - Author: Randall Munroe
 - Source: <http://imgs.xkcd.com/comics/copyright.jpg>
 - Licence: <http://creativecommons.org/licenses/by-nc/2.5/>
- In general, the safest way is to use the pictures, images and photographs released with a Creative Commons licence, which provides a simple, standardized way to grant copyright permissions to the work. The most common licence status of the photos, pictures or images available for use for presentations is the following:
 - CC0 (CC0): in the public domain, no attribution is required
 - CC BY: free to re-use with attribution and indication if changes were made
 - CC BY-NC: free to re-use in a non-commercial context, with attribution and indication if changes were made
- Although the teachers don't have to credit the creators of CC0 works it's still courteous to do so, as is crediting the site where they found the image.
- Many image libraries allow the users to filter search results by the above-mentioned licence status.
- The picture/ image/ photograph/ video users should keep in their minds that any changes or modifications of the public material under any licence status other than CC0 are not allowed or should be indicated.
- Many websites may serve as an open source of free photographs and images. Some of them provide also paintings, drawings, videos and/or PowerPoint presentations. Some are completely free while others provide also the 'premium' paid version with more options and more extensive content. Most of the pages, however, [don't accept responsibility for their content, since they mostly can't prevent the situation when someone uploads content to which he/she is not the copyright holder. Checking the terms of use at the source where possible is thus highly recommended.](#) The following websites represent examples of the free sources of photos and pictures (mostly CC0):
 - Unsplash: <https://unsplash.com/>
 - Stocksnap: <https://stocksnap.io/>
 - Gratisography: <https://gratisography.com/>
 - Pexels: <https://www.pexels.com>
 - Finda.photo: <https://www.chamberofcommerce.org/findaphoto/>
 - Freerange: <https://freerangestock.com>
 - Creative Commons: <https://creativecommons.org>
 - Pixabay: <https://pixabay.com>
 - PikWizzard: <https://pikwizzard.com>
 - Wikimedia Commons: https://commons.wikimedia.org/wiki/Main_Page
 - Morgue File: <https://morguefile.com/>

- Google images: <https://images.google.com/>: Advanced Search enables filtering results by Usage Rights, similar to Creative Commons categories.
- There are also many paid websites providing photos and pictures. They usually provide more extensive content and mostly offer one week or one month free trial (for about 7-10 pictures). As an example, the following websites may be recommended:
 - Shutterstock: <https://www.shutterstock.com/>
 - Depositphotos: <https://depositphotos.com/>
 - Megapixl: <https://www.megapixl.com/>
 - Flickr: <https://www.flickr.com/>
- For further details, please look at Wikimedia Commons, which brings together a variety of subjects and aims to answer the question "Do copyright laws allow the upload of pictures of [...]?"
(https://commons.wikimedia.org/wiki/Commons:Copyright_rules_by_subject_matter)

6.2.6 Copyright issues related to the teacher's work

The teachers should be aware of the fact that their work is also a subject of copyright.

- In most universities, the university holds the copyright to works created by its employees within the scope of their employment, as these are works produced for hire.
- Among others, this mostly applies to the presentations, video recordings of presentations and other educational works of the teachers. They are the subjects of copyright and can't be distributed or reproduced without the permission of the university except for the learning process of the students of a particular course/subject/faculty/university which holds the economic rights, depending on the decision of the author. For this reason, most universities recommend using the copyright notice as an integral part of any presentation. An example of such a notice is the following:
 - This presentation is copyrighted work created by employees of the University XY.
 - Students are allowed to make copies for learning purposes only.
 - Any unauthorised reproduction or distribution of the presentation or individual slides is against the law.
- Different copyright rules, on the other hand, mostly apply to scientific papers published in journals or abstract books. In these cases, the copyright holder of the work is the author, who is usually asked to transfer all or part of the copyright in this particular publication to the publisher.

6.2.7 Distributing Materials

In any type of course, the students should be provided with the study materials. The availability of the materials and their timely distribution were among the frequently mentioned students' needs regarding the online education in the survey. File sharing represents one of the most frequently used forms of online education. It is essential for asynchronous courses and is frequently used also in the synchronous ones (where is combined with online lectures or exercises). Timely distribution of materials is even more important in crisis situations (e.g. sudden and full switch from in-person to online teaching). Mainly in such situations, the teacher may need to provide an updated syllabus that modifies the planned course activities, assignments, content and due dates since some parts of the course (e.g. practical or laboratory exercises) may become less manageable or even inaccessible for a certain period.

For creating the study materials, teachers should be provided with the list of the recommended

computing products supported by the university (e.g. tools for creating video or audio lectures, quizzes or interactive platforms) which they can use for the preparation the study materials (see appropriate sections focused on creating and curating the content and preparing captivating lecture above and below for further details).

Several ways how to distribute materials for online education can be considered:

- Most frequently, the course materials are uploaded in the university information system.
- Alternatively, the storage clouds (e.g. Google Drive, One Drive) can be used for sharing the materials depending on the university regulations and supported systems. When using this way of sharing, the it's, however, particularly important to make sure that all students have an access to these platforms (which is unquestionable in university information system).
- Currently, there are also many new interactive online tools or platforms which allow creating or sharing materials. For example:
 - o Glogster and Wakelet were mentioned in the previous paragraph.
 - o Flipgrid is a platform, which allows teachers to create a topic for discussion and share it with their class. Students can then record short videos on this topic to share with their teacher and classmates.
- If needed, it's also possible to send the materials as group email attachments. Hosting materials in a centralized location (university information system, storage clouds) is, however, more manageable than emailing them and provides higher level of certainty that all students have an access to all materials required.
- All options (university information system, storage clouds and group emails) can also be used for sharing the links to online multimedia resources like videos, websites or podcasts.
- In critical situations with sudden switch of learning to the online environment, teachers should consider converting the Word, PowerPoint and Excel materials in pdf format, which can be read on a mobile device, since some students may only have access to a phone available.
- In any case, the students should be informed where to find the study materials via university information system, email, discussion boards or social networks (depending on the communication plan mentioned above) and the teacher should make sure students know where to find them.
- Teachers should also set, who can access their materials. Most teachers are willing to share materials (including the recorded lectures) only with students signed in their course or (less frequently) with other students/ teachers in their university. Only minimum teachers are opened to sharing the materials for anyone outside their university.

6.2.8 Tips for preparing attractive and captivating online lectures and getting and keeping the students' attention

- Teachers should count with the fact that they don't reach 100% attention even in the in-person education. In the distant mode, the students are even more distracted by many interfering stimuli from the surroundings and/or many other online activities and their attention is only partial. Teachers thus should be aware of the fact that students' ability to keep the attention in the home environment is definitely lowered comparing to the in person education in school. Realizing such situation may help to set the online classes in the most appropriate way to preserve as many attention, as possible. Teachers thus should put particular effort to make the online lecture more interactive, think twice about the content and make the students more involved in.
- It's recommended to focus on important points and cut back on the content to only what is

crucial. The teachers thus should try to get rid the things which are not critical and unnecessary. Focusing on limited extent of highly important information increases the students' ability to follow-up all the subject matter and may help to retain the students' attention.

- In contrast to the in-person education, most of the students are not able to focus for a long time in the online environment. Teachers should thus consider preparing lessons that are a little bit shorter than in-person ones or breaking up the lesson into smaller segments. Free time between classes and shorter lessons were repeatedly mentioned among the students' needs regarding the online education.
- It's important to stay focused and be clear and straight forward while teaching, mainly in the online environment. Teacher's focus helps the students to stay focused as well.
- Clear organisation of the lecture helps students focus and get back to the lecture in case they wandered off for a while.
 - o Teachers are recommended to write a concise lesson plan and goals for each session and stick to it.
 - o They should also provide the plan and goals for their students. It helps break up the lesson for students and give them goals of learning to reach each lesson.
- Opening lecture with the interesting facts or throwing a challenge may help students focus on the topic. It's thus recommended to present attention-grabbing facts or to incorporate a challenge that stimulates the students' thinking at the onset.
- The transitions between topics or important parts of the lecture should be very clear. The best way is to delineate different parts of the lecture by clear statement summarizing the content which is going to follow or which just have been finished. This approach may help the students who have wandered off digitally or physically focus on the presentation and realize that something is changing at this moment and/or what they missed and must get.
- During the synchronous lecture, teachers should individually check in with their students if they can, make sure that they are all on task and understand the content. If not, they are recommended to repeat the parts of the lecture which are still not fully understood.
 - o In asynchronous type of education, such check in could be done through discussion boards or blogs.
- Holding students accountable for learning clearly increases their attention. Students more likely stay engaged if they know their teachers have specific expectations regarding their participation and engagement.
 - o Educators need to clearly communicate what participation looks like in a virtual classroom by laying out clear and measurable goals (e.g. they require students to make a certain number of written or oral contributions each class).
 - o When assigning work or activities teachers should communicate:
 - The time frame students have to complete the work or activity.
 - What the students should produce, explained in specific terms (for example, each group should produce a list of five examples of the diseases which may present with headache).
 - The method by which students will be held accountable (for example, each student must share their work on the platform for all to see).
- In the synchronous online education, interacting with different types of content helps students stay focused. Teachers may use full-of-text presentations, engaging videos, images,

quizzes or tests. It's also recommended to pause the presentation to ask a question and invite students to answer or comment.

- Teachers may also find it useful to split up their online classrooms into breakout rooms for discussions (see below for further details).
- All materials showed to the students during the online classes should be converted to the digital form (e.g. scanned and provided in the shared screen and not just shared from camera).
- More attention is kept mainly by including pictures or very short videos. The number of the non-textual elements should be increased in the presentations intended for online education.
- Telling the real-life examples or case reports helps students understand why they should learn this particular topic. By telling stories that are relevant to real-life problems not only gives student clearer learning objectives and expectation but also emphasizes the importance of learning in their lives.
- More interactive education helps students to retain attention, mainly in synchronous type of teaching.
 - Teachers are thus recommended to incorporate different interactions: teacher-students interaction, students-content interactions, students-students interactions etc.
 - Besides sharing the presentation, they should engage directly with the students, use the whiteboard tool in the communication platforms and switch between these within the same lesson.
 - Students should have the opportunity to engage with a teacher, ask questions and having a teacher answer a specific question.
 - The other way around, just like a classroom, teachers should call on students and ask questions or get their opinions on the topic.
 - It's also possible to let students vote on the correct answer or use interactive tests or quizzes.
 - Students may be encouraged to work in groups, to generate questions, to explain to each other, and discuss using breakout rooms.
 - Breakout rooms are essentially mini virtual conference rooms where smaller groups of students can collaborate in a discussion or on a group assignment. The teacher can enter these rooms to observe or support students through their work.
 - Teachers may ask students to go to breakout rooms for a designated amount of time before returning to a whole class discussion.
 - Smaller groups can make it easier for every student to participate.
 - Some video conferencing platforms offer shared documents that students can create together, and teachers can access when the session ends.
- Use of a certain type of play also increases interactivity and may improve the students' attention.
 - The most natural way is to split the class into smaller teams and incorporate game mechanics (leaderboards, points, badges, levels, etc.) to create a competitive environment. Quizzes or short tests may be used for this type of competition.

- Students may even be awarded by badges or points for starting the online learning unit on time, progressing successfully through an important part of the lecture or finishing the lecture and understanding basic principles of the topic.
- A timed crossword or jigsaw puzzle is a good example of a game format that employs challenge as a game mechanic.
- A game like 'spin the wheel' where players spin a digital wheel and are posed questions based on where the needle rests, is a great way to leverage the emotion of excitement in a player.
- 'Treasure hunt' is another game format that builds on the emotion of 'surprise'.
- Interruptions with an unexpected stimulus may also help students refocus and restore their attention.
 - As an example, teacher may suddenly turn off his/her camera when providing instructions and pretend something wrong is going on. After few seconds, he/she may turn it on and ask the students to remind him/her what he/she have said or explained so far.
- In synchronous lectures, teachers are recommended to make everyone show their faces on screen (including the teacher himself). They should make sure every student has their monitor and camera turned on, which allows teachers to monitor their students and eliminate at least some of the distractions that might take away from their lectures.
- It's highly important to make and keep the eye contact during the online presentations. To make the camera eye contact, it's necessary to talk to the camera and look at it (and not to the screen). Teachers should always notice where they eyes are and where they're focusing their gaze. Adding place marker(s) near the camera may help.
- Educators should also think about their communication style and skills. The styles which are acceptable or tolerable in person may not be acceptable online. Small speakers make voices less impressive and normal inflection when recorded sounds monotonous. The online education where only face and shoulders are seen decreases the teacher's impact. It's thus recommended to change both the tone and inflection of to voice and add "much more life" in it. This helps them to become more captivating.
- The teacher's movements during the online lecture may also help students staying focused. Teachers can move a few feet away from the camera while they're providing instructions to grab more your students' attention. By contrast, they can get closer to the camera to listen to or read students' questions, answers or comments. From time to time, educators may even stand up and keep the interaction with students standing. In such situation, they should stand back in order to move from one side to the other and students can see their body language and hand gestures.
- The use of non-verbal communication (thumbs up, high fives or even a fist bump with the student in camera) makes students feel more connected, seen and heard from a distance. These gestural praises produce positive motivational effects and help teachers build more connection with their students virtually.
- Changing speakers during the lecture may also have positive effect on students' attention.
- Teachers are also recommended to make more frequent short breaks that allow their students to re-energize, drink water, stretch their legs and take some time to breathe outside that learning environment.
- Besides common breaks, teachers may use also so called brain breaks in their online classes when they feel their students' energy and attention are waning. Such brain breaks may

include practising yoga or making some movements, sharing jokes or funny anecdotes, playing games, making guesses, watching funny videos or many other similar refreshing activities for 3 to 5 minutes. Jokes or anecdotes are particularly important: Humour is known to get people comfortable and build a positive learning environment. Pausing for a moment to relax is essential for resetting students' energy level, retaining and staying on task.

- It's also recommended to provide students the opportunity to watch the lecture or other type of content repeatedly. In fact, this option represents one of the major strengths of the online education which helps students retain the subject matter. For this reason, the pre-recorded commented presentations or video lectures are among the most preferred types of online classes and recording all lectures is frequently mentioned among the students' needs regarding online education. In synchronous online learning, teachers thus should consider recording the lecture and making them available online for review.
 - Based on the review, only part of the teachers is opened to record their lectures, and most of them don't record any other teaching activities. If they record any type of activity, they are mostly willing to share the records only with the students signed in their subject or course. Only minimum educators are opened to sharing the materials to anyone. Based on the survey, recording of all teaching activities is highly appreciated by students and should be considered in all the cases.
- Teachers should count with the fact that the preparation and implementation of online education might be (and mostly is) more time consuming than the in-person forms of teaching.
- Teachers should keep in their minds that students may feel disconnected or disengaged during the online education.
 - To prevent or get over these feelings, teachers are recommended to support the discussion and online social interactions among students and bring them together as one community.
 - Furthermore, making the education more personable, answering individual questions, and making students feel included may also help to reduce their isolation feeling.

6.2.9 Recommendation for students attending online courses focused on solving the most frequent problems related to the online education

Mainly for students starting with the online education for the first time, teachers may provide some basic information about potential problems which they may face during the online courses and tips, how to handle it. The most frequent problems are the following:

- The online education itself is considered to be time-consuming and requires a lot of self-discipline. Following steps may help to handle in this point:
 - The students thus should be particularly respectful of themselves and plan their time and efforts.
 - They should also consider their management of a work-school-life balance.
 - Regardless the type of programme (synchronous, asynchronous or hybrid), they are recommended to block off the time to accomplish the assignments in the daily schedule and not saving all the assignments to be done at the last minute.
- Students may experience the problems to keep attention during the online lectures and stay focused when studying at home. To improve their focus and concentration skills, students are recommended:
 - Maintain the consistent schedule and set aside time every day to accomplish the

assignments (to prevent working on them at the last time). The consistency is highly important.

- Make a daily checklist containing all the assignments including their due dates and times. It allows the students to sort the assignments according to their priorities and get the idea about the time required to accomplish those which are due soon. It also helps them to allocate their energy and to plan undertaking the more arduous tasks to the parts of the day when they feel more active.
- Set up a comfortable workspace: the desk or table with a chair should allow to be comfortable sitting for a long time. Adding a lamp may help to make the learning less strenuous on eyes. It's also important to keep the desk or table (or even the room) tidy. Students are also recommended to find out what else they need to make their environment the most conducive to concentration (music, aroma, availability of snacks or drinks) and to set their learning environment accordingly.
- Minimize distractions:
 - Keep the room and desk tidy.
 - The mobile phones should be switched to the non-disturbing mode.
 - Try to mitigate the use of social media, video-sharing websites (e.g. YouTube), television networks or video streaming services (e.g. Netflix, HBO and others) as much as possible.
- Remember to take breaks: the breaks help students relax and return with renewed energy and sometimes a new and additive perspective on their assignment.
- Mainly in case of sudden and/or full switch to the online environment, the students may suffer from the lack of social interactions. This feeling may be even more severe in the asynchronous type of course.
 - To prevent or get over the feeling of isolation, students are recommended:
 - Communicate with educators and schoolmates.
 - Actively participate on the online discussion and assignments requiring collaboration, respond to particular discussion points and try to make meaningful social interactions with the classmates via social networks, video chats, discussion forum or other communication platforms. Such approach may help them keep in touch with the teachers and classmates.
 - If needed, find online tutors or assistance: this may help if the student doesn't fully understand the topic from the lectures and other content provided. In such a situation, different way how to explain things may help and allows the student continue with the course without missing any information potentially important for understanding next lectures or topics.

7 Practice guidelines for evaluation, examination and continuous assessment of student knowledge during online education

7.1 Background from the survey

7.1.1 Background from teachers

The questions related to the examinations and continuous assessment of the students were frequently skipped by the teachers. Even some of those who answered the questions expressed the approach that “this doesn’t apply to them” or had no specific needs. Many of the teachers thus seem to have only limited experience with the online assessment.

The needs regarding online examination and continuous assessment of students’ knowledge in the survey frequently pointed out the preference of the personal contact during the exam (about 1/3 of the teachers who answered this topic) and the concern about the limited objectivity of the online form of examination.

The most focused needs regarding online examination and continuous assessment of students’ knowledge in the online space were following:

- uniform rules of examination at the faculty
- training for teachers
- to prevent opening webpages and study materials
- eliminate unauthorized tools by students
- the ability to see students’ activities during the exam
- better equipment, better internet connection
- mandatory use of the camera
- unified assessment platform
- list of available platforms for creating test materials or quizzes (MS Forms, LMS Moodle, Kahoot etc.)
 - *A software for creating quizzes, tests, interactivity have been used at least once a month (or more frequently, even “on daily basis”) by 54 % of responding teachers (and this particular question was answered only by slightly more than a half of the teachers). Seven percent of them used such a software utility only once a semester. On the other hand, it has never been used by 33% of the teachers and the use of similar software tools was evaluated as “not suitable for their teaching” by 6% of them.*
- larger base of questions
- central database of questions
- display only one question without returning to the previous question
- possibility to set custom test conditions

Most of the recommendations provided by the teachers who answered the questions related to the examinations and continuous assessment of the students was focused on the prevention of cheating and ensuring the objectivity, since the teachers are mostly afraid of cheating and some of them point out the low objectivity of online exams.

The most focused recommendations from the teachers included:

- *verify student identity*
- *see not only the student but also his screen*
- *elimination of the use of unauthorized means*
- *immediate answers to questions, exam in the form of a dialogue on a given topic*
- *do not allow getting back to previous questions*
- *share problems with each other and solve them together*
- *uniform rules of examination at the faculty*
- *small tests or quizzes during and after the lectures are also mentioned as one of the tools for the motivation of students during the online education*

Problems with tests and shortcomings in creating tests are also pointed out among the experiences with online education.

Quite an interesting point mentioned in the topic of students possibly disadvantaged in the online education era: “cheating on online testing puts decent and fair students at a disadvantage”.

7.1.2 Background from students

There were no questions focused on the online testing and examinations in the student version of the survey. In some opened questions, however, some students commented on the online testing or exams. The relevant comments were the following:

- *in the sections focused on bad experiences with online education and negatives of this form of education, the students mentioned:*
 - *no technical support during online exams*
 - *time to wait for the test*
 - *more cheating*
 - *unfair exams*
 - *stress during tests*
 - *unaccepted test results in case of late submission*
- *in the section focused on good experiences with online education, the students mentioned:*
 - *tests in MS Forms*
 - *organisation of exams*
- *in the section summarizing the student’s needs regarding the online education, they pointed out:*
 - *minimizing the amount of tests or even no tests during lectures but on the other hand also continuous revision of knowledge*
 - *possibility of going to previous questions during online tests*
 - *more time for the tests*
 - *easier exams*
 - *exam system based on oral communication*
- *in the section focused on the preferred forms of online education (“others”):*
 - *online quizzes each week*

○ exams

7.1.3 Summary of the background information

To sum it up, the teachers point out the importance of unified examination rules in the faculty and teacher's training in the online examination and testing. Sharing the problems with other teachers and solving them together may also help on this point. They put the major stress on the prevention of cheating: the verification of student's identity, the elimination of the use of unauthorized tools by students (opening webpages or study materials during the oral or written exam) by monitoring the student by mandatory use of camera and sharing the students screen. In oral exams, they recommend the form of immediate answers to questions, i.e. exam in the form of a dialogue on a given topic. In written tests, they recommend the existence of unified testing platform and the use of larger and possibly unified test database. They further emphasize the possibility to set custom test conditions, e.g. the possibility to display only one question without returning to the previous question. It's important to set the conditions in the way that doesn't disadvantages the decent and fair students not trying to cheat.

The students seem to be opened to the online testing and exams and some of them consider such a type of knowledge of their control as an advantage of the online education. Some of them might, however, be stressed by the online tests. Similarly to the situation in the contact education, some students prefer the oral exams in the while the others find the written tests to be more suitable. Fully in this line, some of them recommend the reduction or cessation of the online testing, while the others prefer regular revision of the knowledge by the online tests or quizzes for keeping attention and for the motivation of the students. They appreciate easier exams and more time for the tests in the online setting. From the student's perspective, it's also important to set the exam or test rules to be fair and clearly pre-defined. In contrast to the teacher's recommendations, they appreciate the possibility to go back to the previous questions during online tests.

For both sides (students and teachers), the use of online testing platforms seem to bring positive experience.

Both sides emphasize also the technical requirements for efficient online testing and examinations: the sufficient internet connection and equipment, availability of technical support during online testing. The later submission of the tests due to the technical problems may represent a complication of student's site and should be solved technically.

Neither the teachers not the students addressed the topic of recording the online exams or tests in their survey.

7.2 Practice guidelines for evaluation, examination and continuous assessment of student knowledge during online education

7.2.1 General recommendations on the online assessment

- The testing and examination of students has to be performed with the respect to the requirements of the law, relevant government measures and internal regulations of the university/ faculty. Furthermore, it's necessary to respect the specifics of faculties and individual programmes which must have the possibility to define their needs in terms of requirements for the level of knowledge and form of testing or examinations.
- The conditions of continuous assessment and written or oral exams should always be set in the way that provides equal conditions for all students across course and doesn't put non-cheating students at a disadvantage.
- Limited access to some parts of the education process (e.g. practice) in the era of full transition to online education should be considered by teachers during the setting of assessment/ exam requirements in particular course. These requirements should thus be modified accordingly in relevant cases.

- It should always be verified whether the conditions of written and oral examination of students with special needs comply with such needs, and the adequate technical and organizational adaptations need to be performed, if necessary.
- Before the beginning of the testing, the technical means used during the exam/ test should be checked.
- The teachers and students are encouraged to use the assistance of technicians and user support teams.
- The teachers are encouraged to share their experiences with the online assessment with the others for further improvement of the online testing/examination methods.

7.2.2 Online assessment recordings

- In general, it's recommended to make an official recording of oral and written examinations. Furthermore, there might be specific rules for recording the examinations /tests in particular universities/ faculties based on the decisions of their rectors/deans. The university/ faculty rules should contain among others:
 - o the manner or instrument for making the recordings
 - o the group of persons entitled to handle them
 - o the storage place for keeping the recordings
 - o the storage period. In Czech conditions, it is recommended that the recordings should be kept for the minimum period of 30 days of the date of the oral examination assessment, during which the student may lodge a request for the assessment review. This period may, however, differ in different countries and should be adapted according to the local rules. For example, audio recordings of state exams at UPJS (Slovakia) organised online during pandemic have to be archived three months since the end of the crisis situation.
- The purpose of such recordings is an unbiased processing of:
 - o a request for the review of the assessment or
 - o a dispute connected with the use of unauthorized recordings
- The consent of the student or the examiner to making the recording is not required; however, the student must be informed that the recording is to be made.
- The students must be informed that their own recording the exam is not acceptable.

7.2.3 Preparation for examinations

- The adequate form (e.g. written testing or an oral exam or their combination) and the environment must be selected first.
 - o The choice of the adequate form (e.g. written testing or an oral exam or their combination) depends mainly on the type of the course:
 - Oral examinations may be more suitable for courses focused on knowledge acquisition; an interview with a specific topic and targeted questions may significantly reduce the chances of cheating. Some teachers examine two students at a time and let them interact.
 - Among written exam forms, the „open-book exams“ represent the most relevant and highly recommended option for online assessment. This type of exam doesn't test only the knowledge acquired, but also the student's ability to find and apply information. For the purpose of this exam, students are

allowed to use their written notes, or even other texts or books according to the rules set by the teacher.

- The simple written testing of knowledge is less suitable for the final exams performed in the online mode (but might be appropriate for continuous assessment).
- The choice of the appropriate environment:
 - For oral examining, the use of online communication platforms allowing secure online meetings with a high-quality video and audio connection and instant screen sharing is recommended. The most frequently used platforms for this purpose are currently MS Teams and Zoom, but there are many others available and the teachers should follow the recommendation of their university/faculty concerning the preferred platform to be used (since the preferred platform is usually available for the employees and the technical support is provided).
 - For written tests (including those performed during continuous assessment of the students), the teachers may use:
 - Specific platforms for online testing provided by particular universities/faculties (an available technical support and relevant protection from cheating represent major advantage of such a type of platforms) (KvIS in Masaryk University may represent a good example).
 - Public platforms for creating test materials (MS Forms, LMS Moodle, Kahoot, Quizizz) mainly if no specific platform is available in particular university/ faculty.
- Students must be informed properly and provably of changes in the requirements for the completion of a course (methods and manner of evaluation) and manner and procedure of online testing at least few weeks before the start of the exam according to the specific rules in particular university/ faculty (e.g. at least 3 weeks before the first date of the examination).
- For other oral examinations held online with the use of video conferencing technologies, a longer time may be necessary (the teachers should count with at least 5 minutes before for the potential solution of minor technical issues and sufficient time for the exam itself).
- The teachers should determine in advance the method of resolving potential technical difficulties that will lead to the interruption of the exam (loss of connection etc.) and should inform the students of the method.

7.2.4 Recommendations on continuous assessment

- Continuous assessment, i.e. the evaluation of a student's progress throughout a course of study, as distinct from by examination, represents an important part of online education. Among others, the small tests or quizzes during and after the lectures may serve and an important tool for keeping the attention and motivation of students during the online education.
- If the open book type exam is planned, the students should become familiar with this type of testing already during the course and should be aware of the type of the questions they may face in the exam.
- For written tests or quizzes used for continuous assessment, the teachers may use:
 - Specific platforms for online testing provided by particular universities/faculties (an

available technical support and relevant protection from cheating represent major advantage of such a type of platforms) (KvIS in Masaryk university may represent a good example).

- Public platforms for creating test materials (MS Forms, LMS Moodle, Kahoot, Quizizz) mainly if no specific platform is available in particular university/ faculty.
- Larger database of questions is highly recommended since it is technically impossible to prevent the disclosure of the test questions to students who will pass the assessment in later days (and the test in later days should thus change at least partly).
- The recommended setting is to display only one question without returning to the previous one.
- The time for taking the test and the total number of resits should be limited.
- Another solution is to determine a very large number of questions (that will disable answering them all) and make the evaluation according to the results. Such an approach limits the undesired cooperation among students due to the lack of time, and natural competitiveness.

7.2.5 Recommendations on oral exams

- Examined students must prove their identity (e.g. by showing their ISIC or identity card to the camera)
- The students must be notified that their recording the exam is not acceptable and told what the procedure will be in case the connection is lost (see above).
- The most relevant form of online exam is the dialogue on a given topic, i.e. the form of immediate answers to questions which may prevent cheating.
- Inspecting the student's environment or fairness of conditions of the oral examination are not supported in terms of technology, ethics or law. Teachers are recommended to modify the questions and process of the exam so that it is not essential for the evaluation whether the student might find facts on the internet or in his/her own notes.
- Video conferencing software enables sharing the student's desktop and his/her procedure of searching the relevant information; the teacher may then evaluate for instance such aspects as the correct choice of electronic sources, their relevance and trustworthiness, and discuss the choices with the student.
- Some universities may use the proctoring systems for the direct monitoring of the online examination (software for monitoring the student's eye movements, his/her typing on the keyboard, noises in the microphone, blocking the student's computer and mobile phone). For many universities, however, this approach is not a path that they might want to take.

7.2.6 Recommendation on written exams

- Examined students must prove their identity (e.g. by showing their ISIC or identity card to the camera). The identification of students should, however, be made individually (e.g. in "Breakout Rooms") to prevent compromising personal data.
- It's recommended to prefer the "Open Book" form of final exam if possible.
 - For the purpose of this exam, students are allowed to use their written notes, or even other texts or books according to the rules set by the teacher.
 - Open book exams tend to ask students to apply, analyse, synthesize, compare/contrast or evaluate information. They test whether the student understands whole the course and/or how course concepts work together. It's thus

the exam form which allows to test the way the student thinks about the topic, how he/she can connect it into broader units within the subject, and where he/she sees overlaps with other subjects.

- The student is able to find the relevant information in the open source only if he/she previously studied the book in detail.
- The students should be trained for this type of testing during the course.
- There are, however, fields of study where this type of exam is more natural to apply (fields of social sciences).
- The simple written testing might be less suitable for online form of written exams:
 - The teachers should be aware that it is technically impossible to prevent the disclosure of the test questions to students who will pass the exam in later days. It's thus recommended to change the set of questions among the examination terms, i.e, to have larger database of questions.
 - It's recommended to limit the time for taking the test and the total number of resits.
 - Another solution is to determine a very large number of questions (that will disable answering them all) and make the evaluation according to the results, in line with the European Credit Transfer and Accumulation System (ECTS). Such an approach limits the undesired cooperation among students due to the lack of time, and natural competitiveness.
- Inspecting the student's environment or fairness of conditions of the written examination are not supported due to technological, ethical and legal reasons. Preventing the examined student's use of the internet is not feasible.
- It is advisable to maintain online connection with students also during a written test. Their questions and problems can be discussed in the chat of the meeting (so as not to disturb the other students); the teacher can also have a private chat with the student by means of "Breakout Rooms".

8 Students with learning, mental and physical disabilities and online education

8.1 Background from survey

One quarter of the teachers thinks that the online education disadvantaged some students (from the connection, lack of concentration, disability point of view etc.), about one third thinks that no students were disadvantaged and almost half of educators don't know. Besides technical problems (internet connection, technical equipment, missing trainings etc.) as the major cause of disadvantage of certain part of students mentioned by educators, following students were also found to be disadvantaged by some teachers:

- *Students with concentration difficulties*
- *Students missing personal contact or suffering from the lack of interaction*
- *Those who suffer from psychological pressure*
- *Introverted students (since they did not show up)*
- *Students who don't sufficiently understand the explanation, have poor expression skills, require private space at home*
- *Those with the time shift*
- *Decent and fair students (since cheating on online tests puts them in disadvantages)*
- *And people with disabilities (mentioned just by one educator)*

To sum up, the students found to be disadvantaged in online education in our survey are those with psychological or attention problems and social or emotional needs and those with disabilities (without further specification). The most frequent causes of disadvantage are, however, the technical problems and the time shift (solved in other parts of this manual).

8.2 Students with disabilities and online education

For students with disabilities, online education may be even more challenging in many aspects including but not limited to attention problems, lack of social contacts, higher demands on self-discipline and self-motivation. On the other hand, with the assistive technology devices and services currently available, it also brings many advantages and some students (mainly those with physical disabilities) may even prefer remote forms of education to in-person learning.

- Assistive technology is any item, piece of equipment, software program, or product system that is used to increase, maintain, or improve the functional capabilities of persons with disabilities.

8.2.1 Students with learning disabilities, attention problems, mental illnesses and/or even social-emotional needs

Students with learning disabilities, attention problems, mental illnesses and/or even social-emotional needs might face several challenges in the era of transition to online education:

- Many students may experience increased feelings of anxiety, nervousness, isolation, fatigue, headaches, and a lack of motivation. Mainly in the era of long-term remote learning, the overall negative impact on all students' mental health had consistently been proven. The students show highly increased level of stress due to the fears regarding their own health, loved one's health, financial issues, and increased feelings of isolation. Such an impact may be even more serious in the students with learning disabilities, social-emotional problems

or mental illnesses.

- In contrast, for some anxious and shy students, going online may be easier and can help remove their discouragement. These students are frequently able to focus more on the lectures at home and may even prefer the online type of education over the in-person one.
- Students with learning disabilities typically have trouble understanding what they are studying; they usually need to read and analyse over and over again to get a good grasp of the lesson.
- Most of the students with learning disabilities and Attention Deficit Hyperactivity Disorder (ADHD) may experience problems with their ability to focus on the education process. Some of these students have particular problem to focus in spaces that are not specified for schoolwork. They may find the home environment to have too many distractions and feel an incongruence between being at home and completing schoolwork. Furthermore, they may feel the days to become monotonous and lacking the variety, which may have a severe negative impact on their ability to stay focused.
- Besides the interference with student's ability to learn basic reading, writing, or math, the learning disabilities and/or ADHD can also interfere with higher-level organizational and time management skills.
- Following approaches may help students with learning disabilities, attention problems and mental illnesses (and their teachers) cope with these problems and boost the engagement and connection:
 - Teachers are recommended to consult with their school psychologist, special education team, and counselling support staff in case of need any help with education and support of the students with various types of disabilities.
 - The students with special needs frequently require personalized attention and step-by-step individual support.
 - In fact, the individualized education programs often represent an optimal approach to these students, who often need:
 - More extensive explanation of the education goals, expectations and objectives.
 - Set up an optimal home-based learning environment.
 - More structured support:
 - Specialized and more detailed instructions (written directions or instructional videos).
 - Having tasks broken down for them into more manageable parts.
 - Frequent check-ins to ensure they are on the right track.
 - Use of the visual aids (coloured pictures, images, charts, and diagrams, that help people understand and remember information shared in an oral presentation).
 - Use of assistive technologies may also help to the students with learning disabilities (mainly dyslexia), attention disorders and autism:
 - Captioning and transcription services allow everything being said during a lesson to be seen in the bottom of the window, which helps to decrease or overcome the attention problems.

- The same applies to the possibility to record the lectures and share the recording or the automated (machine generated) written transcript of the lecture.
 - If the students with special needs are included the common classes and mixed-up with students without disabilities, personal instructions and support can be provided to the disabled students using individual or small-group breakout rooms during the online education. This solution allows giving students with special needs extra instruction, encouragement, and support during tasks that they may not be able to do in the large group or independently.
- The teachers should also focus on building positive relationship with the students with attention problems, learning disabilities, emotional-social needs, and/or mental illnesses. So called social-emotional learning represents a recommended approach. One of the key factors for academic success of the students with disabilities is having support systems, like caring adults who help them navigate the challenges they face. This approach helps students feel safe, seen and supported, decreases the amount of stress and disengagement and makes the student more connected.
- General strategies which help overcome and/or solve the problems with keeping attention are mentioned above and apply to students with disabilities as well. Several strategies, however, seem to be particularly important for students with disabilities and help them stay focused. Such strategies should thus be actively supported by their teachers:
 - the opportunity to engage with a teacher and having a teacher answer a specific question
 - changing the speakers during the lecture
 - more frequent breaks
 - blocking specific time for studying
 - avoiding television, cell phones, social networks or streaming platforms during the time blocked for education.

8.2.2 Students with physical disabilities and online education

Physically-disabled students may also face some challenges in the online education era. The accessibility and performance of online teaching and learning in this group of students is highly dependent on the quality of technical equipment and the availability of assistive technological devices or services. Every computer provided to these students should be already equipped with disability accessibility software, and having multiples ways to enter answers. The same applied to the software tools. From this point of view, the situation had been markedly improved in last few years. Many students with physical disabilities thus may find the online learning to be more advantageous comparing to the in-person education for following reasons:

- Students who are physically challenged no longer have to travel long distances and don't face any barriers to get in their classes. Their access to many educational activities is much easier. Online classes thus completely eliminate any physical barriers that previously existed and help decrease or even eliminate the physical exhaustion for mobile-impaired students. The same applies to their caretakers and families: the online educations reduces their burden.
 - The students with very serious mobility disabilities affecting hand control and coordination require specific assistive technologies like mouth sticks, eye tracking, or pointing devices to navigate websites. Similar technologies, however, would probably be necessary for using any online study materials even in the in-person education era.

- In visually-impaired or hearing-impaired students, appropriate support to cope with the challenges associated with distance learning should be provided. Currently, there are many innovative tools and assistive technology devices or services available and their use may again represent an advantage for students with both visual and hearing impairment when compared with in-person forms of education. Every computer provided to these students should thus be already equipped with disability accessibility software, so the software tools including the e-learning platforms do:
 - Many communication platforms (e.g. Zoom, Brightspace, and TopHat) include accessibility features for the disabled user such as accessibility checkers, external text-to-speech software compatibility, screen reader support, and closed captioning.
 - Accessibility Checker is a free tool available in many programmes and applications (e.g. Word, Excel, Outlook, OneNote, and PowerPoint on Windows, Adobe Reader, Office for the web, or Mac, and Visio on Windows). It serves to find most accessibility issues and explain why each might be a potential problem for someone with a disability. It also offers suggestions on how to resolve each issue.
 - A screen reader is a software application that enables people with severe visual impairments to use a computer. It uses a Text-To-Speech engine to translate on-screen information into speech, which can be heard through earphones or speakers. This tool provides the visually-impaired students the possibility to explore any written resources online. When teaching a visually-impaired student, teachers should always check the support of text-to-speech functionality in course materials or web content recommended.
 - Furthermore, screen readers are also capable of providing information in Braille if needed. An external hardware device, known as a refreshable Braille display is needed for this.
 - Closed captions are a text version of the spoken part of a television, movie, or computer presentation. Closed captioning was developed to aid hearing-impaired or deaf people. Here, again, the teachers should always check the support of closed captioning functionality in course materials or web content recommended, when teaching students with hearing impairment.
 - Braille keyboards are also available for visually-impaired or even blinded students.
- All the above mentioned options allow the physically disabled students to study in a much freer environment, removing the discouragement of learning and enticing them to participate more actively instead.
- They usually also prefer the option to study at their own pace, which represents another advantage of the online form of studying.
- The online form of studies also helps these students reduce their costs, which many of the physically disabled students may find highly important.
- For some of the students with physical disabilities, the availability of the online education programs may thus even represent the most important factor when choosing the university.

9 Advantages and challenges of online education – what can we bring for future?

9.1 Background from the survey

The questions asking about the positives and the negatives of the distance form of the education were frequently skipped by the teachers, but not by the students. Some of the respondents in both groups expressed in these questions that they do not see any positives or that they prefer contact teaching/learning. In fact, the in-person form of education is preferred by major part of both students and teachers. However, due to the pandemic there is often no other way than the online substitution and it should be done as best as possible. The responses of students showed that 52% of them rate the online education worse or much worse than in the full-time form of education. This number is quite high and there definitely is a potential to decrease it by better organisation of online education.

The list of advantages of the distance form of the education collected from the answers of the teachers and of the students included number of identical points. Putting the answers of both groups together we get the following:

- *possibility to continue on teaching*
- *health risk reduction*
- *no need to travel, better time management, more time to study, autonomy and flexibility*
- *teaching/learning from anywhere*
- *higher student participation, more concentration*
- *comfortable, less stressful, more effective*
- *more self-study*
- *pre-recorded lectures, recordings of the lectures, online lectures, re-viewing options*
- *new experience, using technologies*
- *possibilities to present a greater amount of knowledge, speed of information dissemination*
- *forces the teacher to prepare more precisely*
- *improving teaching materials, creating new study materials*
- *greater responsibility of students for what they learn*
- *consultation on problematic topics, contact with the teachers*
- *involvement of external teachers*

The answers about the negatives of the distance form of the education also more or less responded in both surveyed groups. Main challenges of online education mentioned in the survey were the following:

- *loss of personal contact, social isolation, loneliness*
- *health problems, mental health issues*
- *less movement, time spent by the computer*
- *lower student involvement, lack of concentration, passivity of the students*
- *no practical training*
- *lack of direct feedback from the students and vice versa*

- *more cheating, unfair examination, non-objectivity of the assessment*
- *inability to evaluate the real work of students*
- *very tiring, time consuming, difficult time management*
- *higher demands on preparation, more projects*
- *worsening of communication and expression skills of students*
- *loss of privacy*
- *more boring lessons*
- *technical issues, connection problems, need of technical equipment*
- *unsuitable for all forms of education*
- *recording and sharing lectures without consent*
- *presence control*
- *worsened motivation*
- *problem to contact teachers with questions*
- *lack of information about the education*
- *need of training the teacher on how to use the software*
- *lack of study materials*

Some of the topics are mentioned in both categories, the advantages and the disadvantages, mostly in the exact opposite (more concentration vs. lack of concentration; better time management and more time to study vs. very tiring, time consuming, difficult time management; comfortable, less stressful, more effective vs. unsuitable for all forms of education; consultation on problematic topics, contact with the teachers vs. problem to contact teachers with questions).

This documents that the experiences of the respondents from both groups may be various and heterogeneous and that perceiving of the online education is highly subjective and varies among the individuals. However, most of the items in the negatives' list are solvable and have the potential to improve.

To sum up, most of the problems were related to the social isolation (which is not the direct consequence of the online education but the result of the pandemic era), technical issues including the need of more training in use of the software tools used in the remote teaching, teachers concerns about cheating and decreased amount of control over the students, exams and testing issues, communication problems, and the need for optimization and rationalization of the information and assignment load.

9.2 Advantages of online education

Major advantages of online classes are the following:

- E-learning activities allow to continue on the education process even if the in-person forms of teaching/learning are not available (e.g. if the in-person contacts are prohibited in pandemic era, in war zones etc.).
- In specific situations, e-learning may reduce some dangers related to the in-person contacts or transport (health issues in the pandemic era, safety issues in the armed conflicts or wars etc.).
- Students (and teachers) may attend the class from anywhere (if the technical requirements, e.g. internet connection, are fulfilled).
- The transition to online teaching and learning represents a new experience and an



interesting field for the use of technologies, which most of the young people are very familiar with and thus find the online learning environment as a natural space for their interactions and other activities.

- The quality online education with appropriate demands on students offers them better time management, higher autonomy and flexibility, and more time to study, since there is no need to travel to the school and back and the students may plan their learning activities according their needs and requirements.
- For many students (e.g. more introverted or shy ones, some physically disabled or ill students, those with time constraints or busy schedules, those who prefer to learn at their own pace etc.), online learning may represent more comfortable, less stressful and more effective form of education which allows them higher participation and/or more concentration.
 - Teachers should, however, keep on their minds that this is highly inter-individually variable and there are students with the exact opposite perception of the e-learning activities.
- The online courses provide the option to communicate regularly with the educators and get the feedback.
- They also allow the interactions and connections with classmates and making the network.
- Online education allows more frequent and efficient engagement of external teachers, which has a potential to increase the quality and attractiveness of particular courses.
- Online learning mostly offers easily accessible learning materials.
 - Many settings of the online education (pre-recorded commented presentations or video lectures, recorded synchronous online lectures) provide students opportunity to watch the lecture or other type of content repeatedly. This approach helps students better retain the subject matter.
 - The online availability of the learning materials forces the teachers to improve their study materials or create the new once and prepare all the materials more precisely.
 - The speed of information dissemination and their availability markedly increases in most type of online courses when compared with most of the in-person ones, which provides students more space for self-studying and allows them to access and repeat the knowledge.
 - The responsibility of students for what they learn is markedly increased in the online form of education which provides students an option to improve their skills in finding the information sources, evaluating the quality of these sources and working with those they find most relevant.
 - For motivated students, the teachers have the possibilities to present or provide greater amount of materials.
- Online learning setup may also bring advantages for many specific groups of students, mainly:
 - Students with physical disabilities: online education provides them easier access to most educational activities.
 - Immunocompromised students who are not yet comfortable in large gatherings, and students who frequently miss classes due to medical attention.
 - Very shy and bashful students: online learning may help remove discouragement from the minds and participate actively in the virtual space with no crowds seen

around, decreased pressure from classmates, less competition and safe environment at home.

9.3 Challenges in online education

The online education has, however, also several challenges, mainly:

- Any type of online education provides only limited social interactions comparing to in-person classes. Mainly in case of full and sudden switch to the online learning environment, many students experience the social isolation and loneliness which may even result to their mental health problems.
- During the e-learning, students/ teachers spend much more time online, sitting at home. Full online education thus may result in reduced amount of daily physical activity and exercise and decrease of overall physical condition and worsening of the health status of both teachers and students. Both the groups are thus recommended to increase their physical activity in the rest of the days during the online education era.
- Access to online learning may represent a technological challenge: students need dependable internet, reliable computer or other device with the e-learning platform in any type of online classes. Both teachers and students may experience connection problems or other technical issues during the online classes, which need to be solved directly. This underlines the importance of appropriate technical equipment and the need of technical support for all participants (please see appropriate sections above).
- Many students may feel disconnected or disengaged during the online education which may lead to lower student engagement, worsened motivation and passive approach in some of them. They frequently experience the problems to keep attention during the online lectures and stay focused when studying at home, since they may find both the home and online environment to have too many distractions and disruptions that affect their attention levels. Some students may also complain about more boring lessons. In general, teachers need to make more efforts to gain their students' attention in remote teaching. Tips for making the online lectures attractive and engaging are mentioned in the practical manual.
- Some students may find the online classes very tiring or time consuming. Others complaint about the increase amount of assignments and projects. E-learning in general puts higher demands on the self-discipline, motivation, and time-management of students. To prepare the high-quality online education keeping the students attention and not overloading them with the increase amount of work and assignments also thus puts higher demands on teachers both from time and content point of view (please see appropriate sections in the practice guideline above).
- Mainly in case of unplanned sudden transition to online education, many educators find themselves in unfamiliar territory as they try to navigate new ways to meet their students' needs. The training of the teachers (and students) on how to set the course, use the software and prepare the lectures might be very helpful (please see the practical guideline above). In the same situation, lack of information about education and assessment might be reported by some students. Appropriate communication setting is thus highly important (please see the practice guideline above).
- One of the major issues is the lack of practice or clinical training in case of full online transition of all learning activities. From this point of view, hybrid (blended) courses are highly recommended for clinical subject or those requiring laboratory practice. If no personal contacts are allowed for certain time, immediate return to laboratory or clinical practice after the restrictions removal is extremely important and highly recommended.
- Another major issue is availability of the study materials: creating and distributing the



material early in the online course is particularly important (please see above).

- For some participants (both teachers and students), the lack of direct feedback and problems to contact teachers with questions may represent an important disadvantage. Synchronous courses and appropriate communication setting help solve the problem (please look at the appropriate sections in the practice guideline).
- Attendance control in the e-learning environment may also represent a problem for some teachers. Many of the e-learning platforms are equipped with attendance tracking functionality which helps to solve this problem. The attendance doesn't automatically mean that students keep their attention on the educational activities. However, the same applies to the in-person forms of education.
- Recording and sharing lectures without consent of the participants (mainly teachers) may represent an important issue (recommended approach is mentioned in the practice guideline).
- Transition to online education activities may also complicate the examinations, testing and assessment of students. Both teachers and students raised many concerns about this topic (more cheating, unfair examination, non-objectivity of the assessment, inability to evaluate the real work of students). Suggested solutions of particular problems are provided above in the Practice guidelines for evaluation, examination and continuous assessment of student knowledge during online education.
- Mainly the asynchronous forms of online education may lead to the worsening of communication and expression skills of students. Synchronous or blended courses represent better solution from this point of view.
- Some participants (both educators and students) may feel the loss of privacy during the online lectures.

9.4 What can we bring for future?

E-learning has the potential to provide fully comparable or even better experience than classroom learning at least for certain segment of students. From the long-term point of view, teachers should consider to apply these positive aspects of online education in the in-person one and try to avoid or solve the negative aspects. Key recommendations should be the following:

- It's recommended to keep the better availability of study materials including sharing the pre-recorded presentations or video records of the lectures even during the in-person education, since it allows students to re-view the materials and better retain the subjects matter. It also makes the study materials available also for those who were not able to attend particular class (for health issues or any other reason).
- More frequent use of multimedia materials (both integrated from pre-existing sources and newly created) may be transferred from the era of fully online education to the future learning setting, which is expected to combine both online and in present types of teaching.
- Most of the students, as well as the teachers prefer in-person form of education. Full or major switch to online form of the courses is thus improbable in medical education. However, considering many advantages that the online learning brings as well as its' preference by a certain segment of students, the teachers may consider opening both in-person and remote form of their course and let students allow to choose the most appropriate form according to their needs. This option was provided by many universities even in the pre-pandemic era and major progress and experience in e-learning methods during pandemics made this parallel education even more realistic, available and advantageous.
 - o Among others, the online form of (at least some) lectures allows more frequent and

efficient engagement of external teachers.

- This basically applies mainly to the subjects which don't include any exercises or laboratory/ clinical practice. If the practical or laboratory part of education is essential, it's possible to move the theoretical part of the education (mainly lectures) to the online learning environment to reduce the need of travel and related time burden of both teachers/ students or to use the option to combine the in-person lecture with its live broadcasting or sharing the record online.
- Many challenges and concerns related to the e-learning (the choice of appropriate type of course and platform; technical issues including the need of technical support; problems with communication with other participants; availability of study materials; keeping attention; making the online classes less tedious and exhaustive; online assessment, exams, and testing; recording the online classes etc.) are solvable and have the potential to improve. Among others, this manual provides a wide range of tips and recommendations on how to solve many issues and improve the quality of online education.



10 Summary

This methodological manual contains information focused both on course guarantors and teachers participating in the preparation of online teaching. It provides an overview of the different types of online courses, i.e. synchronous, asynchronous, and hybrid (blended) courses, points out their advantages and disadvantages, and also gives tips on how to select the most suitable form of teaching for lectures (preclinical, clinical), seminars and practical laboratory or clinical exercises.

For pre-clinical and clinical lectures, both synchronous and asynchronous courses can be used. If synchronous online teaching is performed, students can actively participate in the lectures, ask questions or ask the teacher to re-explain some problems in real-time if needed. It's recommended to record the lecture and share the record with students. This allows them to review the lecture repeatedly, which represents one of the major advantages of remote education. In asynchronous online teaching, the presentation, video or audio records of the lecture, or other materials are available online at any time. It should, however, be combined with online discussion boards or similar tools providing students the opportunity to ask questions or discuss the topic with teachers or schoolmates.

For seminars and practical laboratory or clinical exercises, the most suitable form are the hybrid (blended) courses, which allow for both in-person and online interaction. The students thus have a chance to gain practical skills in an in-person manner, while the rest of the interactions can be performed in the online space. If the blended type of education is not allowed, synchronous courses are recommended for exercises that include the training and practical demonstration of certain skills and seminars where active students' participation, interaction, and/or presentation are required. This type of education provides instant feedback and allows for more interactions in real time.

A key prerequisite for online education represents appropriate technical equipment. Most universities provide a list of supported and recommended computing software, which should be preferably used. Such a list mostly provides also links for safe download of particular products, related hardware requirements, and contact to remote support guides or helplines. Probably the most important software tool for remote teaching and learning is the e-learning platform. For this purpose, specific learning management systems are available (Docebo, Adobe Captivate, Blackboard Learn, Acorn LMS, Moodle LMS, Thinkific LMS, Absorb LMS, 360Learning, Canvas LMS, Big Blue Button, etc.) These systems provide many specific tools for the organization of the course, assigning the homework and evaluation and testing. In most cases, however, common video-communication and collaboration software applications (Zoom, Google Meet, MS Teams, WebEx, etc.) are used as e-learning platforms. The choice of the most appropriate learning platform should follow the university's recommendation. If no platform is recommended, price, availability in mobile application, and availability of specific tools and assistive technologies and educational aids should be taken into consideration. The use of e-learning platforms may bring several challenges. Most of the problems experienced both by teachers and students are related to hardware and internet issues and lack of experience with the platforms and information on how to use them. These problems thus underline the importance of stable and secure high-speed internet connection, high-quality hardware equipment, and the education and training of the students and teachers in the use of the platform.

Besides the e-learning platforms, several other applications or software tools can be used for online teaching activities, mainly the video and/or audio editing software, tools that may help use the already available multimedia resources (Glogster, Wakelet, Flip, Animoto, etc.), and the platforms for creating interactive tests or quizzes (Kahoot!, MS Forms, Quizizz, Slido, Glimkit. etc.). Particularly the latter may help teachers to keep the student's attention and make the education more interactive and attractive for students.

From the hardware point of view, a stable and secure high-speed internet connection represents

the most important condition for any online teaching and learning process. Furthermore, fast and reliable computers (desktop computers, laptops, and for students even tablets or smartphones), HD webcams, microphones, and speakers are also highly important. Other equipment is not strictly required, but its availability is highly recommended, since it may help enhance the lesson experience for both teachers and students, e.g. scanner and printer, headphones, multiple cameras (incl. multi-camera software), desk, office chair, laptop stand, adequate lighting, and other equipment that allows comfortable sitting and helps organize the desk and workplace.

Another important prerequisite for successful online teaching and learning represents technical support for online education. Students and teachers should be informed about different modes of technical support and their availability including operating hours and whom to address in case of need. The manuals/guidelines or online training on online education should be available online at any time, which may help teachers and students resolve a lot of problems they may face during the education process. The availability of the training both in the form of synchronous and asynchronous courses represents a reasonable and optimal approach.

Online education puts higher demands on both students (mainly on their attention) and teachers (who are expected to prepare effective and attractive online courses). When planning the online course, teachers are recommended to set communication rules. All important information from teachers related to the course organization and requirements should be available in the university information system. In urgent or critical situations, group e-mails might be sent to students by teachers or the university staff. Alternatively, social networks or discussion boards on university websites may be used for communication between teachers and students. When students need to communicate with teachers, e-mails, social networks, or online discussion boards are mostly used. The discussion board, emails, blogs, or social networks also represent recommended tools for students' communication and collaboration with other students. Last but not least, students should be informed how they are expected to send their assignments. Most frequently, uploading the documents to the learning or communication platforms, cloud-based storage, or file-sharing services is used, while sending the assignments as e-mail attachments is not recommended. Students should always be informed about the preferred format of their assignments including their names and due dates.

A key step in successful online teaching represents creating and curating the content. It's recommended to start with the course plan subdivided into topics for each video lecture or even each part of the lesson, consider the optimal duration of each lecture, and modify the content and presentation form according to the subject and audience the teachers want to reach. Teachers should focus on important points and cut back on the content to only what is crucial. Further video and/or audio editing may increase the quality and informative value of the presentation. Teachers are also encouraged to integrate multimedia resources. To keep the student's attention and make education more interactive, teachers may use interactive online tests or quizzes.

The availability of the materials and their timely distribution are of particular importance in online courses. Most frequently, the course materials including links to online multimedia resources are uploaded to the university information system. Alternatively, the storage clouds (e.g. Google Drive, One Drive) can be used. If needed, it's also possible to send the materials as group email attachments. Hosting materials in a centralized location (university information system, storage clouds) is, however, more manageable than emailing them and provides a higher level of certainty that all students have an access to all materials required. The students should always be informed where to find the study materials via the university information system, email, discussion boards, or social networks. Teachers should also set, who can access their materials. Most teachers are willing to share materials only with students signed in their course, while they're not open to sharing it outside the university.

When preparing study materials, several rules already mentioned above should be followed to attract and hold students' attention. Opening lectures with interesting facts or throwing a challenge



may help students focus on the topic. Teachers are recommended to hold their students accountable for learning and expect their participation and engagement and stay as interactive as possible. Splitting the class into the breakout rooms may also help. Telling real-life examples or case reports helps students understand why they should learn this particular topic. The transitions between topics or important parts of the lecture should be very clear. Interruptions with an unexpected stimulus may also help students refocus and restore their attention. In synchronous online lectures, teachers are recommended to make everyone show their faces on screen (including the teacher himself) and keep eye contact. Teachers should also think about the tone and inflection of their voice, and try to add “much more life” to it. More frequent short breaks allow the students to re-energize, drink or eat and take some time to breathe outside that learning environment.

Including pictures, videos or audio recordings also helps increase students’ attention. Teachers should, however, always consider copyright issues. In general, teachers are free to use the images, diagrams, charts, photos, videos, or sound recordings they have created themselves of uncopyrightable subjects such as views, or nature, or people who have given the author their consent to photograph, record or video record them and publish the photograph, audio recording or video. The use of other photos or images including those available on the websites may be protected by copyright law. In that case, the use of images released with an appropriate Creative Commons license is highly recommended and the source should be properly cited. The citing information should always include the title, author, source, and type of license.

Teachers should be aware of the fact that their work is also a subject of copyright. In most universities, the university holds copyright in works created by its employees. This mostly applies to the presentations, video recordings of presentations, and other educational works of the teachers. They are the subjects of copyright and can’t be distributed or reproduced without the permission of the university except for the learning process of the students of a particular course/subject/faculty/university which holds the economic rights, depending on the decision of the author. For this reason, most universities recommend using the copyright notice as an integral part of any presentation, and students are allowed to make copies for learning purposes only.

The assessment of student’s knowledge and skills has to be performed with the respect to the requirements of the law, relevant government measures, and internal regulations of the university/faculty. The conditions of continuous assessment and written or oral exams should always be set in a way that provides equal conditions for all students across courses and doesn’t put non-cheating students at a disadvantage. Before the beginning of the testing, the technical means used during the exam/test should be checked. In general, it’s recommended to make an official recording of oral and written examinations and to keep the recording for a legally defined period. The consent of the student or the examiner to make the recording is not required; however, the student must be informed that the recording is to be made. The students must also be informed that their recording of the exam is not acceptable. The adequate form (e.g. written testing or an oral exam or their combination) and the environment must be selected first. Oral examinations may be more suitable for courses focused on knowledge acquisition; an interview with a specific topic and targeted questions may significantly reduce the chances of cheating. Among written exam forms, the „open-book exams“ represent the most relevant and highly recommended option for online assessment. The simple written testing of knowledge is less suitable for the final exams performed in the online mode.

Students must be informed properly and provably of changes in the requirements for the completion of a course (methods and manner of evaluation) and the procedure of online testing at least a few weeks before the start of the exam. Examined students must prove their identity. Inspecting the student’s environment or fairness of conditions of the examination are not supported in terms of technology, ethics, or the law. Teachers are recommended to modify the questions and process of the exam so that it is not essential for the evaluation of whether the student might find facts on the internet or in his/her own notes.

For students with disabilities, online education may be even more challenging in many aspects including but not limited to attention problems, lack of social contacts, and higher demands on self-discipline and self-motivation. On the other hand, mainly the students with physical disabilities may even prefer remote forms of education, since they may be easily accessible for students who are physically challenged (and thus don't face any barriers to getting into their classes). Using the assistive technology devices and services currently available (accessibility checkers, screen readers, closed captioning, or Braille keyboards), remote education may bring many advantages also to visually impaired or hearing impaired students.

Students with learning disabilities, attention problems, mental illnesses, and/or even social-emotional needs may experience increased feelings of anxiety, nervousness, isolation, fatigue, headaches, and a lack of motivation. Teachers are recommended to consult with their school psychologist, special education team, and counseling support staff in case of need of any help with education and support of the students with various types of disabilities. Students with special needs frequently require personalized attention and step-by-step individual support. The teachers may also help these students by building a positive relationship with them. A more extensive explanation of the education goal and expectations, breaking the tasks into more manageable parts, and more frequent breaks may be helpful. Furthermore, the use of assistive technologies (captioning, transcription services) may also help.

To sum up, despite many problems with the transition to the online learning environment, online education also brings many advantages, many of which we can use in the future planning of the optimal learning approach. The major advantage is the broad availability of the course content, which can be assessed from anywhere and (mainly in asynchronous courses) anytime. At least basic information thus should be provided the same way in the future, even during in-person teaching. Furthermore, asynchronous online education offers students better time management, higher autonomy and flexibility, and more time to study, since there is no need to travel to school and back.

Online education has, of course, also several challenges. It provides only limited social interactions compared to in-person classes, any students may feel disconnected or disengaged and may experience problems with keeping attention. More time spent online, sitting at home, decreases the overall physical condition of both teachers and students. Access to online learning may sometimes represent a technological challenge, mainly in case of a sudden and full switch to the online learning environment. It puts higher demands on teachers in terms of preparation of study material and the organization of the course. The transition to online education activities may also complicate the examinations, testing, and assessment of students.

Main sources used

<https://www.national.edu/2021/05/12/synchronous-vs-asynchronous-learning/?msclkid=2d1f2546b10311ecbd1ed4cf593b7920>

<https://www.goabroad.com/articles/study-abroad/how-to-stay-focused-on-online-classes>

<https://www.hmhco.com/blog/7-ways-to-keep-students-attention-in-an-online-class>

<https://edulearn2change.com/article-4-tips-to-get-students-attention-in-online-learning/>

<https://knowledgebase.raptivity.com/an-educators-guide-to-using-game-mechanics-for-the-win/>

<https://elearningindustry.com/online-learners-attention-5-ideas-getting>

<https://soeonline.american.edu/blog/how-to-get-students-attention>

<https://files.eric.ed.gov/fulltext/EJ1018283.pdf>

<https://www.lexology.com/library/detail.aspx?g=a61bcc63-11fa-4ac0-a1b5-b46ca803627f>

[https://greatergood.berkeley.edu/article/item/how teachers can help students with special needs navigate distance learning](https://greatergood.berkeley.edu/article/item/how_teachers_can_help_students_with_special_needs_navigate_distance_learning)

<https://www.fi.muni.cz/students/lectures.html.en>

<https://www.techradar.com/best/best-online-learning-platforms>

[https://www.umass.edu/oapa/sites/default/files/pdf/handbooks/teaching and learning online handbook.pdf](https://www.umass.edu/oapa/sites/default/files/pdf/handbooks/teaching_and_learning_online_handbook.pdf)

[https://www.fordham.edu/info/24884/online learning/7897/types of online learning](https://www.fordham.edu/info/24884/online_learning/7897/types_of_online_learning)

<https://www.rev.com/blog/instructional-teaching-strategies-for-online-special-education>

<https://online.osu.edu/resources/learn/whats-difference-between-asynchronous-and-synchronous-learning>

<https://docs.microsoft.com/en-us/takelessons/teacher-support/becoming-a-takelessons-teacher/what-are-the-technical-requirements-to-teach-online-lessons>

<https://oxfordtefl.com/blog/teaching-online-what-hardware-and-software-do-you-need/>

<https://www.tprteaching.com/technical-requirements-for-teaching-online/>

<https://www.tprteaching.com/online-teaching-equipment/>

<https://blog.coursify.me/en/how-to-create-videos-for-online-courses/>

<https://www.copyrightlaws.com/legally-using-images-presentation-slides/>

<https://webcentrum.muni.cz/aktualne/blog/desatero-pro-pouziti-obrazku-a-fotek-na-webech-mu>

<https://blog.thenounproject.com/a-guide-to-using-images-and-photos-for-powerpoint/>

<https://www.slidegeeks.com/blog/8-key-dos-and-donts-of-using-images-in-presentations-for-2019-and-beyond/>

<https://commons.wikimedia.org/wiki/ Commons: Copyright rules by subject matter>

<https://welch.jhmi.edu/get-help/can-i-use-images-i-find-my-presentationclass-without-having-get-permission>

<https://subjectguides.york.ac.uk/copyright/images>

INVOLVED INSTITUTIONS

MUNI
MED



Co-funded by the
Erasmus+ Programme
of the European Union

This project has been funded with support from the European Commission.
This publication [communication] reflects the views only of the authors. The national agency
and the European Commission cannot be held responsible for any use which may be made
of the information contained therein.

NEWMED
New Era in Medical Education

Reg. no.: 2020-1-CZ01-KA226-HE-094424

Funded by the European Commission ERASMUS+ program