Modification of Medical Education due to COVID-19 Pandemic

at Tbilisi State Medical University

1. Introduction

The COVID-19 pandemic has created an unprecedented crisis in the education system throughout the world. Due to the unpredictable dynamics of the virus and strict social distancing, Higher Education Institutions were led to rapidly shift from face-to-face to distance *(online)* learning mode. Medical education appeared to be the most vulnerable, as to develop practical and professional skills, medical students have to interact with patients in order to obtain diagnostic and treatment skills. Higher medical education institutions were forced to find logical and rational ways to move from the current, traditional teaching model *(Plan A)* to specifically designed for force majeure circumstances," but at the same time effective *Plan B* model (fully online learning mode). According to the dynamic of the virus, the combination of both plans and implementation of a *hybrid (blended)* mode of learning can be discussed.

Noteworthy, no medical school had a readymade plan specifically considered for the force majeure circumstances in the world. One of the biggest challenges for academia was ambiguity about shifting from *'what to teach'* to *'how to teach''.* Nowadays, competent international medical education organizations are intensively working on the development of guidelines during the pandemic. Nevertheless, there is no such guideline yet, but based on shared recommendations and experiences Tbilisi State Medical University has elaborated recommendations for online medical education. The recommendation is about modification of teaching, learning and assessment methods during the pandemic period.

General Recommendations for Teaching and Learning Online

1. Study process modification – transfer of clinical and theoretical subjects, including electives (during the fully distance learning mode);
2. Making relevant modified program changes to the syllabus of subjects/modules (replacement of clinical components with theoretical);
3. Conducting virtual lectures and practice sessions in an interactive format;
4. Focusing on the formative component when evaluating. (Optimal distribution of points is possible, e.g. formative - 80%, summative / exam - 20%); Some medical schools have purchased electronic monitoring system - Proctoring (https://www.proctoru.com/), in order to detect and prevent cheating. Despite the cost, it ultimately failed. The system appeared to be blocked easily.

As for now, international medical education organizations do not recommend to use the platform for online examinations.

5. Use of e-learning resources (see appendix)

2. Methods of Online Medical Education

Medical education includes three major components: knowledge, competences and values. Obviously, in the mode of online learning it became impossible to fully equip medical students with all these competences, especially developing diagnostic and practical skills which are essential for future doctors and healthcare professionals. A table below shows how to achieve undergraduate medical education sector standards in case of distance learning and assessment, assigned by the National Center for Educational Quality Enhancement in 2018.

Field standards achieving capacities, teaching and assessment methods during online learning

	Field Competences	Competence Achieving Possibility	Teaching Methods	Assessment Methods
	Field knowledge	Fully possible	Online lectures and practical sessions (interactive, flipped format), case-based learning (CBL), problem-based learning (PBL), role plays, e-learning materials	Formative (ongoing) assessment is preferable, which is reflected in the distribution of points (instead of 60/40 e.g. 80/20). Questions are core (e.g. clinical problem, open-ended answers (books are allowed to be used during limited time) – "open book" exam, oral exam, multiple-choice test (MCQ)
Field -Specific Competences			
1.	Carry out a patient consultation	Fully possible	Online lectures and practical sessions (interactive, flipped format), case-based learning (CBL), problem-based learning (PBL), role plays, virtual consultations, online simulated and/or standardized patients, e-learning materials	Direct observation (assessment report) OSCE/standardized patient, portfolio / log-book, oral exams and tests, simulations, 360-degree assessment, portfolio.
2.	Assess clinical presentations, order investigations, make differential diagnoses, and negotiate a management plan	Fully possible	Online lectures and practical sessions, CBCR sessions, virtual clinical curations, online simulated and/or standardized patients, interactive clinical and multimedia cases.	Formative assessment in clinical disciplines (MCQ tests) virtual OSCE, summative/exam assessment - "open book" exam, oral exam.
3.	Providing first aid in emergency medical	Partially possible	Fully distance learning - training videos, teaching with	virtual OSCE - formative assessment is

	situations (First aid and resuscitation measures)		online simulators, models and interactive multimedia simulators	less valid during the final assessment, portfolio.
4.	Drug prescription	Fully possible	Online lectures and practical sessions, CBCR sessions, virtual clinical curations, telephone or video consultations with patients, online simulated and/or standardized patients, interactive clinical and multimedia cases.	Formative assessment in clinical disciplines (MCQ tests) virtual OSCE, summative/exam assessment - "open book" exam, oral exam.
5.	Conducting Practical Procedures	Partially possible	Fully distance learning - Use of models and interactive multimedia simulators	virtual OSCE - formative assessment is less valid during the final assessment.
6.	Communicate effectively in a medical context	Fully possible	Virtual consultations, online simulated and/or standardized patients, virtual curations.	Formative assessments in clinical disciplines, virtual OSCE
7.	The use of Ethic and Legal Principles in Medical Practice	Fully possible	Online lectures, CBCR sessions, virtual clinical curations, role plays, telephone communications with patients, online simulated and/or standardized patients.	Formative assessments in clinical disciplines, virtual OSCE, portfolio.
8.	Evaluation of psychological and social aspects regarding patients' disease	Fully possible	CBCR sessions, virtual clinical curations, teaching videos, online simulated and/or standardized patients, online consultations with ambulatory and stationary patients, virtual rotations.	Formative assessments in clinical disciplines, virtual OSCE, portfolio.
9.	The use of knowledge, skills and principles based on evidence	Fully possible	Virtual consultations, online simulated and/or standardized patients, virtual curations, clinical cases based on disease management.	Formative assessments in clinical disciplines, virtual OSCE, portfolio. summative/exam assessment - "open book" exam, oral exam.
10.	Use information and information technology effectively in a medical context	Fully possible	Interactive presentations, medical documentation (applying information technologies) during virtual clinical rotations.	Formative assessment, portfolio
11.	Ability to apply scientific principles, method and knowledge to medicalpractice and research	Fully possible	Problem-based learning (PBL), Case-based learning (CBL), Case-based clinical reasoning (CBCR), virtual mini conferences , participation in scientific conferences, online learning of scientific skills, virtual clinical rotations.	MCQ tests, scientific presentations, virtual mini-clinical exam, scientific paper, abstract, portfolio.
12.	mplementation of health promoting events, engage with public healthcare	Partially possible	Lectures; Case-based learning (CBL), seminars, online communications with patients.	Oral/written exam, MCQ test, scientific presentations, portfolio.

	issues,efficient performance within the healthcare system			
13.	Professionalism	Partially possible	Problem-based learning (PBL), Case-based learning (CBL), Case-based clinical reasoning (CBCR), tutorials, teaching videos, seminars, online communication with patients, virtual clinical rotations.	Oral exam, analyze of clinical cases, scientific presentations, portfolio.

The following are methods of distance learning, teaching and assessment at undergraduate preclinical teaching basic, fundamental disciplines) and clinical teaching stages.
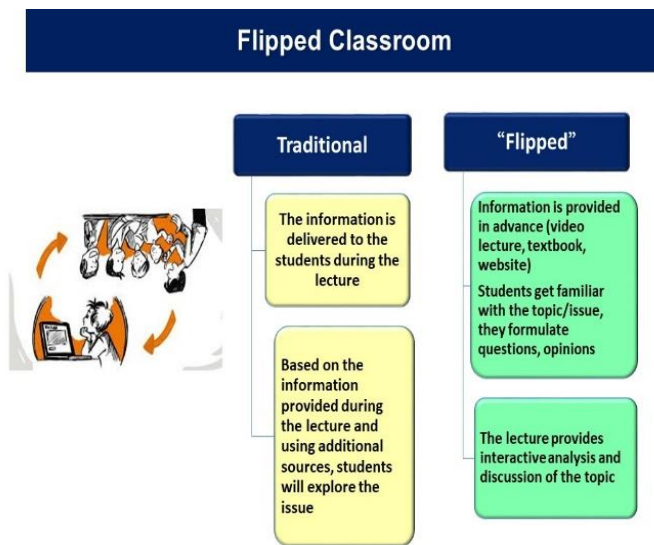
3. Methods of Distance Undergraduate Education at the Basic/Preclinical Stage

There are more basic disciplines during the preclinical than the clinical stage. Therefore, distance learning during the preclinical stage is less difficult. But it should be noted, as a result of curriculum integration, on the very first year of teaching, clinical components are also included in the MD program. Based on the recommendations, due to the pandemic, subjects should be shifted from the clinical to the basic ones (in case of necessity, clinical subjects can be replaced by electives either). The disciplines which incorporate clinical/laboratory works can be transferred later, by the end of the pandemic or when the virus will be diminished. However, if it is possible, separate clinical components may be conducted online (by applying relevant video materials, communication skills, gathering anamnesis from simulated patients). In case of pandemic prolongation, the teaching/learning process will be fully online.

E-learning platforms should be used on both, clinical and preclinical stages (*Google meet, Zoom, Moodle, Google Drive, Microsoft Teams and etc.)* These platforms give students opportunities to conduct webinars, mini conferences or have online individual consultations with their professors. New technologies are used to study fundamental subjects (virtual reality applications and related devices). To exemplify, a special program can be used to study the citation of publications while teaching scientific skills. *Camtasia Studio,* is a platform giving detailed instructions to students how to complete the task. https://www.eventmobi.com/golive-best-virtual-events-platform/ recommended platform for delivering virtual, interactive conferences.

Synchronous learning is recommended over asynchronous during the online learning. As asynchronous includes teaching/learning process via e-mails or social networks, such mode of distance learning evokes students' apartness from their teachers, contributing to decreasing quality of learning process.
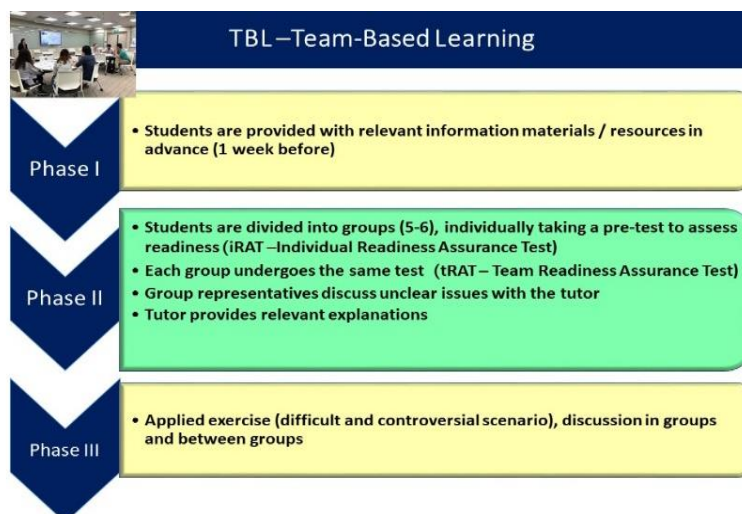
Recommended Tools during Interactive Virtual Learning

Flipped Classroom

Traditional
- The information is delivered to the students during the lecture
- Based on the information provided during the lecture and using additional sources, students will explore the issue

"Flipped"
- Information is provided in advance (video lecture, textbook, website)
- Students get familiar with the topic/issue, they formulate questions, opinions
- The lecture provides interactive analysis and discussion of the topic

1. Flipped classroom – Before lecture students are given thematic materials (video-lecture, books, links of e-sources), students are introduced to the material, they mark interesting / incomprehensible issues and opinions, which are discussed at the lecture later. This method of teaching enhances students' involvement during the lectures, is a student-centered approach and improves quality of the teaching/learning process. Assessment focuses on a student activity during the online lecture/practical sessions. If a student is not ready for the lecture and does not take part in discussions, he/she is awarded points accordingly (only attendance without interaction is not evaluated). Combination of synchronous and asynchronous teaching mode is possible, which allows teachers to assess student's knowledge thoroughly and enhances student motivation for independent learning.

2. Team-based learning TBL –TBL is recommended to be implemented during the distance learning mode if there are more than 20 students in a group. Zoom platform is perfect which gives possibility to divide groups into smaller groups.

TBL –Team-Based Learning

Phase I
- Students are provided with relevant information materials / resources in advance (1 week before)

Phase II
- Students are divided into groups (5-6), individually taking a pre-test to assess readiness (iRAT –Individual Readiness Assurance Test)
- Each group undergoes the same test (tRAT – Team Readiness Assurance Test)
- Group representatives discuss unclear issues with the tutor
- Tutor provides relevant explanations

Phase III
- Applied exercise (difficult and controversial scenario), discussion in groups and between groups

3. Problem-based learning (PBL). PBL is even recommended for basic disciplines and can be implemented in online learning. PBL sessions are conducted once in a week or two weeks introducing group of students (maximum 15 students) an unknown problem to solve. While trying to analyze and solve the problem students are looking for various ways of revealing it. They identify unexplored issues related to the problem, eliminate gaps in their knowledge and study material not familiar to them.

Problem-based learning scheme:

- Presentation of a problem (problem can be presented in the form of a scientific publication, video recording or a presentation)
- Identification of key issues
- Formulation of problems/hypothesis
- Development of action plan
- Identification of study issues
- Revision of the problem
- Integration of a new knowledge into already acquired knowledge.

Assessment Tools during the Preclinical Stage

Different online assessment tools (MCQ with Extended Questions and Answers) minimizing cheating can be used to evaluate students' knowledge on preclinical distance learning mode, when students study theoretical materials (especially during synchronized learning). Virtual Objective Structured Practical Examination (OSPE) is recommended to be conducted (e.g. in histology and pathology, when identification of tissue specimens is possible remotely, without using microscope).

4. **Methods of Distance Undergraduate Education at the Clinical Stage**

One of the biggest challenges during the online learning is the clinical stage, as it is impossible to provide student/patient communication. Thus, a gap becomes visible in the second – skills component of medical education. E-resources and online teaching tools are recommended during the fully distance learning mode. The aim of the multiple recommendations and methodologies is to develop clinical reasoning/thinking skills among students, which is a milestone for healthcare professionals. The content of clinical modules/syllabi is arranged in such a way that first of all theoretical issues and clinical thinking skills are taught. Teaching of practical components is planned later, after transition to blended or traditional, face-to-face teaching mode. In case of pandemic prolongation, practical component is recommended to be conducted online by using virtual simulators (see appendix).

Distance Clinical Learning Methods

Students are provided with lectures in various clinical disciplines during synchronized or asynchronized teaching/learning process. (It was already mentioned that during distance learning it is not a problem).

Obtaining the field –specific skills during the clinical stage:

1. Discussion of virtually interactive clinical situations through various electronic portals (see annex);
2. Virtual case-based clinical reasoning (CBCR). Typically, this method is used at the end of the preclinical stage (on the third course, at TSMU it is implemented since 2012). In case of fully distance learning mode CBCR sessions (once a week, two hours) can be integrated during clerkship for the 4th and 5th course students. CBCR develops students' reasoning skills essential for the health professionals. This tool also allows them to apply acquired knowledge and develops diagnosing skills. Clinical problem is presented as a case from the doctor's practical life and is not just a theoretical issue. Assessment is based on the student's ability to apply theoretical knowledge in solving a clinical problem. Assessment criteria are: reasoning skills; active involvement during the session; leadership and communication skills while working in a group.
3. Applying video recordings of hospitalized, outpatient, standardized and simulated patients;
4. Virtual communication/consultation - Real-time contact with patients using telephone and electronic portals for history taking and consultation purposes. (Based on patient confirmation).
5. Virtual clerkship – Students are given material based on the medical history of anonymous patients (history extract includes anamnesis, diagnose, results of instrumental and laboratory examinations). At the end of the week, students should submit a report on the diagnosis, additional examinations, treatment plan and prognosis. The discussion is online with the participation of the professor / observer.
6. Virtual hospitals which give students opportunities in different clinical departments to acquire those methodologies which are necessary for the examination of a patient (see annex).
7. Doctor/patient role play in order to obtain communication skills (the 3rd and 4th course students)
8. Student/patient online consultation (via telephone or available online platform). A student (5th or 6th course) receives from a patient detailed information about his/her condition after leaving the hospital, listens to possible problems, finds out effectiveness of treatment, monitors the patient. Student activity (in written format) is reflected in his/her portfolio.

Assessment during Online Clinical Stage

Formative assessment is recommended during both, preclinical and clinical stages. As it was already mentioned, optimal distribution of points is 80/20.

1. Hybrid assessment – clinical cases, interactive presentations, MCQ tests – All these assessment tools in combination are recommended to be used for formative (ongoing) assessment which allows efficient and objective overall assessment. Creativity of a student during the presentation will be essential component – how effectively is he/she using leadership and communication skills to make the presentation interactive, Q&A and discussion. When resolving an unknown clinical case, attention should be paid to reasoning, the ability to use pre-given information in terms of diagnosis and disease management. MCQ tests are recommended to be used during formative assessment. Lecture / practical session interactive monitoring and student activity can be checked via Google meet, Chat or Zoom platforms (break out room discussions with separate groups). Usually, during the formative assessment pre- and post-tests are conducted in order to objectively assess the quality of teaching and learning process.

2. In order to be achieved assessment objectivity, oral or "open book" exam is recommended during the summative assessment. Students are given several clinical cases including detailed information about patient, anamnesis and conducted examinations. They should write answers to the open-ended questions requiring expanded and logical answers (about probable diagnose, diagnosis and treatment) in limited time. Clinical scenarios are recommended to be written in such a way that student will not be able to find answer easily in a manual (typically, in each case, the underlying systemic and concomitant disease symptoms are described). In this case, it is very difficult for a student, to give comprehensive answers through the textbooks or with the help of external person. Clinical reasoning and applying acquired theoretical knowledge in a limited time is required to be demonstrated from the students. Combination of all these methods are also advisable. Applying artificial intelligence (via proctoring) does not exclude subjectivity and cheating during the exams.

3. Portfolio and especially e-portfolio is important which reflects performance of each student during the online learning process. (See annex T. Haldane. "Portfolios" as a method of assessment in medical education).

4. As it was already mentioned, assessment of field-specific skills are the most problematic during the online learning. Teaching and evaluating practical diagnostic and treatment procedures are the most vulnerable. Objective Structured Clinical Examination (OSCE) is recognized as the most reliable assessment tool. Virtual evaluation of students' communication, counseling, treatment planning, interpretation of test results and conclusion making skills are fully possible (e.g. via online communication with simulated or standardized patient). As for the performance of practical

procedures, a methodology for conducting virtual OSCE (vOSCE) is being developed. Based on international experiences implementation of virtual OSCE is possible via support of technical facilitator. Students are assessed remotely, beyond computer screen.

Recommendations for vOSCE:

➢ The number of exam stations should be reduced from 12 to 8 and possibly even fewer, considering what the goal is, which course students and what skills are tested.

➢ Each student should be evaluated by two assessors using the same evaluation sheet independently. (If the student is assessed differently, an agreement will be reached between the assessors);

➢ The student is given ten minutes on each station.

Instructions for students:

• Context (e.g. you are a family doctor and a patient having surgery problems has a visit);

• To-do list (list the questions you would ask the patient, describe physical examination process, list the diseases with which you would make a differential diagnosis, present patient examination and treatment management plans)

• Information about the patient (age, gender, major complaints, various clinical and laboratory information)

During the virtual OSCE collecting anamnesis from the standardized/simulated patients is possible in separate break out rooms: via Zoom platform

Publications and Links for Online Learning

1. https://resources-for-online-teaching-and-learning.webnode.com/topics/
2. https://www.simulationiq.com/free-consultation (virtual OSCE – recommendations and free consultations)
3. https://examsoft.com/programs/medical (guidelines about proctoring platforms for distance exams at medical schools).

E-resources for Online Learning

	Link	Description
1.	https://bodyinteract.com/	Interactive simulation of virtual patient. Web-page is chargeable
2.	https://www.medicalexamtutor.com/	Curriculum for developing clinical thinking skills, virtual clinical cases, tutorials. Web-page is chargeable
3.	https://aquifer.org/exams-and-assessment/clinical-decision-making-exam/ https://aquifer.org/courses/aquifer-diagnostic-excellence/	Instructions for conducting examinations in various clinical disciplines and fundamental disciplines. Online clinical simulators, institutional registration. Web-page is partly free of charge
4.	https://www.nejm.org/multimedia	Virtual interactive clinical cases with asssessment system. Free
5.	http://www.inmedea-simulator.net/med/scene/entry?	Virtual hospital with clinical departments, lecture rooms, library – Students can examine various profile patients, make a treatment plan of the disease, prescribe drug and find the necessary information in the library according to the profile. Web-page is chargeable
3	https://www.medicactiv.com/en/create-a-simulator/	Virtual simulators for nurses (performing procedures through a virtual program) Web-page is chargeable
4	https://live.medsims.com/	Patient examination platform (interactive patient simulation) Needs registration
5.	http://www.patientsim.co.uk/	Virtual patient Needs institutional registration
6.	https://medsim.in/	Virtual patient (physical examination, diagnosis, treatment) Needs registration
7.	http://pie.med.utoronto.ca/PIE/PIE_whatWeDo_VPatient.html	Virtual interactive cases Free of charge

8.	https://pages.insimu.com/insimu-for-universities/ https://drive.google.com/file/d/10APAq986yoiC_G6vQof8hHaBgJQFIfBF/view	Virtual simulations for medical schools. Web-page is chargeable
9.	https://www.healthysimulation.com/5689/free-medical-simulation-scenarios/	Clinical cases for nursery schools which may be used at medical schools for students.
10.	https://emergencymedicinecases.com/	Emergency medicine tutorials Free of charge
11.	https://www.openpediatrics.org/	Pediatric interactive cases Free of charge
12.	https://www.visiblebody.com/en-us/anatomy-and-physiology-apps/	Anatomy and physiology virtual resources. Free of charge
13.	https://caehealthcare.com/hololens/ https://interactive-commons.webflow.io/holoanatomy	Applying artificial intelligence in medical education Demo version
14.	https://caehealthcare.com/surgical-simulation/lapvr/	Laparoscopic simulation Demo version
15.	https://accessmedicine.mhmedical.com/multimedia.aspx#21837	Videos for teaching clinical procedures (various disciplines).