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Medical education in Covid-19 pandemic: e-learning based professionalising activities

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Abstract: The Covid-19 pandemic has rapidly given rise to an imperative need for online learning to guarantee a continuity in undergraduate medical education. All students were required to study from home due to the level 4 lockdown. To ensure that our students continue to learn methodological and cognitive skills concerning the activities of: anamnesis, clinical reasoning, procedural skills and clinical deepening supported by case discussion, the Office for Medical Education (OME) developed, on our University online platform (LMS), e-learning practical activities. Also the final evaluation has been converted into a Formative Feedback. We would like to share our experience in the rearrangement of Professionalising Activities in the form of e-learning, presenting also the traditional activities we carry out in Humanitas University. Advantages and limitations of this new project are discussed and, in their light, future perspective with a view to a subsequent improvement are presented.

Keywords: e-learning; undergraduate medical education; medical training; professionalising activities; Covid pandemic; medical education; OSCE examination; formative feedback.

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Biographical notes: Benedetta Agnelli, 6th year Medical Student of Humanitas University, started her journey in Humanitas University in 2016 gaining her position participating in the Italian National Test for Medical Schools. Since her first year of Medical school, she has demonstrated a vivid commitment towards the subject. She rapidly gained a very well structured method for exam preparation which helped her to complete successfully all the exams before the exam's session end. She has demonstrated a strong curiosity and interest that led her to become, at the 2nd year, mentor and tutor for younger students.

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1 Contextual information

At the end of 2019 in the city of Wuhan, Hubei province, China, the isolation of a new variant of beta coronavirus (SARS-CoV-2) marked the beginning of the Covid-19 pandemic. The state of emergency defined in order to contain and overcome the outbreak implied different public health and social measures. The latter have been implemented including nationwide lockdowns, movement restrictions, closure of schools and business and international travel limitations (WHO, 2020).

These rapid and decisive actions to reduce the risk of community transmission and campus cluster infection (Hsieh et al., 2020) represented a big challenge for all sorts of educational programs bringing about an urgent need for online learning. The sudden imposed constrains affected in particular undergraduate medical education, which is characterised by practical training sessions for which the online counterpart efficacy is supported by poor evidence.

In this direction, Humanitas University staff developed as rapid as possible an alternative online program to deliver teaching remotely to students in order to safeguard their safety and moreover avoiding both massive limitations of their progress in terms of professional growth and formally guaranteeing the curricular progression as required.

We propose an innovative way to approach and evaluate practical teaching remotely. The aim of the online training was mainly to make students able to identify and memorise the checklists related to the material uploaded on our platform. The starting point in order to approach an online training consisted in the Objective Structured Video Exam (OSVE) (Humphris and Kaney, 2000; Watson et al., 2016), an alternative method used in different settings to assess the student's recognition and understanding of the different procedural skills. We created a virtual space in order to provide the opportunity to learn and reflect on the checklists linked to the technical skills and also give the basic knowledge to start practice the skills individually. With this paper we would like to add a piece of useful information in this field describing the steps taken and hoping that the outlined mechanisms might be useful (Roskvist et al., 2020) to other educators facing similar challenges, particularly in the light of the current situation we are living. The validation of our project has been assessed by the positive feedbacks received from our students to whom we proposed a satisfaction questionnaire.

2 Institutional background

Humanitas University traditionally places a strong emphasis on practical training which is believed to be a fundamental step since the first years for undergraduate medical students. The set of activities related to practical teaching are defined as “Professionalising Activities” and they are performed within 3 different macro-areas among which students rotate in groups: clerkship in the hospital, simulation activities in the campus and clinical case discussion with the presence of real patients. The latter are organised and supervised by the Office for Medical Education (OME), which is the office that supports teaching in our medical school by: developing and proposing pedagogical methods based on national and international literature on Medical Education, producing the material necessary for teaching, training teachers and physicians to become optimal tutors, cooperating with the ICT service in the organisation and management of the Learning Management System (LMS), etc.

The Educational Model we adopted follows the principles presented by Schön (1987) in “The Reflective Practitioner” where active engagement is at the centre of the learning process. This educational principle is applied in our University and it includes moments of briefing and debriefing with specifically trained tutors. The aim is to train a medical doctor characterised by the propensity for lifelong learning, clinical and decision-making skills and the ability to work in a team and relate to the patient and his family members effectively. Throughout the course years the role of the students develops in the setting of the Professionalising activities following general learning objectives built on the basis of the Framework R.I.M.E. (Pangaro, 1999). Professionalising activities are fundamental to allow students to fulfil the compulsory clinical skills required in their curricula. These competencies are active in the fields of: history taking, physical examination, clinical reasoning and team work.

In the setting of all activities the presence of a tutor is provided; he is not only the referent for the diverse clinical skills but he is also trained to give a proper formative feedback, to assist and facilitate the reflection, empowerment and attitude to self-learning of the student. Each Professionalising Activity has its ad hoc evaluation sheet which provides for the assessment of clinical skills and professional behaviour (professionalism) and which is filled out by the tutors at the end of each activity. The average of these evaluation reports is successively added to the result of the final OSCE examination, performed at the end of each semester. These two scores together contribute to the final evaluation of organ pathology examinations from the 3rd to the 4th year and as a presentation for the final exam of Patient management at the VI year.

3 Methods

Due to practical and organisational concerns arisen in this period together with the need to ensure the achievement of this semester’s objectives, in the light of the prerequisite they represent for a continuous training of students’ skills, we restructured Professionalising Activities in the virtual platform of our University (LMS) for the 3rd and 4th years. In the 3rd year 140 students are present while the 4th one comprises 122 undergraduates.

The schedule remained the one planned for the semester, undoubtedly with practical modifications concerning the contents, and both the intermediate and final evaluation

(OSCE examination) has been replaced by the Formative Feedback. The starting point of this rearrangement was the standard method commonly employed for the OSVE.

The activities have been explained through a video conference on Microsoft Teams[®] (Microsoft 2020) to students in order to facilitate the access and increase the effectiveness of this project. All the material has been uploaded on the online platform and it has been shown to be easy to access and furthermore it guarantees asynchronous learning.

For safety reasons, linked to the particular moment we are facing, only 2 of the macro areas considered in order to achieve the learning outcomes have been proposed, excluding the hospital ward attendance.

Figure 1 Instructions, observational and debriefing grids for history taking activity III year (see online version for colours)

HISTORY TAKING III YEAR	
INSTRUCTIONS	
<ol style="list-style-type: none"> 1. Watch the video recording and observe the history taking following the check list of the second semester 2. At the end of the observation, answer the questions in the debriefing sheet uploaded 3. Join the forum and put your comments on the video recording starting from the observational grid uploaded 	
<p>The forum will be supervised by OME and will be open from 20th April until 14th May. On May 8th a feedback on the patient's diagnosis will be given and a summary on the key points that emerged from the forum will be made.</p>	
OBSERVATIONAL GRID	<i>ANSWER</i>
Have the items on the check list regarding the content been respected?	
Have the conduction items been respected?	
What other questions would you have asked?	
In the light of the data collected, what is the compromised apparatus? Which organ?	
Provide a pathophysiological explanation of the causes of the clinical abnormality	
DEBRIEFING GRID - Considering the key points that emerged from the forum and the diagnosis provided, each person should reflect on their strengths and weaknesses points	<i>ANSWER</i>
What would I ask to the patient?	
Was I able to identify the dysfunctional organ?	
Which are my weak points?	
How will I be able to fill in these weak points?	

In particular the activities has been reconstructed as follows: History taking laboratories – The OME has selected and extrapolated from the CAE (Learning Management System of the simulation centre) 6 video-recordings of anamnesis of the last year for the 3rd year and 6 video-registrations for the 4th year. Video-recordings have been uploaded on the LMS in a specific virtual space. The videos were accompanied by instructions, an observation and a debriefing grid (Figure 1 and 2) and the students were invited to view the history and follow the process of analysis of the video-recording as they did during

the last semester with the tutors. A peer to peer forum for questions and doubts has been opened and at the end of the semester the questions that needed further study were returned by a clinical tutor and an educational expert to discuss the relational aspect. The 3rd year student in this way can observe and learn how to conduct a medical history, while the 4th year undergraduate should be able to provide information on the diagnostic course and formulate a possible diagnosis.

Figure 2 Instructions, observational and debriefing grids for history taking activity IV year (see online version for colours)

HISTORY TAKING IV YEAR

INSTRUCTIONS	
<ol style="list-style-type: none"> 1. Watch the video recording and observe the history taking following the check list of the second semester 2. At the end of the observation, answer the questions in the debriefing sheet uploaded 3. Join the forum and put your comments on the video recording starting from the observational grid uploaded 	
<p>The forum will be supervised by OME and will be open from 20th April until 14th May. On May 8th a feedback on the patient's diagnosis will be given and a summary on the key points that emerged from the forum will be made.</p>	
OBSERVATIONAL GRID	<i>ANSWER</i>
CONTENTS	
Have the checklist points been respected?	
What is the patient's active problem?	
What are the secondary problems?	
On the active problem, please specify whether you need diagnosis, therapy, monitoring	
FOR THE FOLLOWING ACTIONS ON THE ACTIVE PROBLEM:	
If the aim is diagnosis: What are the diagnostic hypotheses? What tests would you require?	
If the aim is monitoring: what vital parameters should you monitor and how soon?	
If the aim is treatment, specify the therapeutic strategies you would implement and the recommendations to give to the patient.	
CONDUCTION	
Have the conduction items been respected?	
Which aspects have not been explored? What questions would you ask the patient?	
You may have noticed that in a couple of video recordings the simulated patient is a foreigner patient. Did you observe any change in the conduction by the student? If so, which one?	
DEBRIEFING GRID - Considering the key points that emerged from the forum and the diagnosis provided, each person should reflect on their strengths and weaknesses points	<i>ANSWER</i>
What other questions would I ask the patient?	
Why was I unable to identify the patient's main problem?	
What strategies/resources could I use to address my weaknesses?	

Clinical case discussion - Clinical cases were recorded and uploaded on the platform. The videos were accompanied by a grid of observation and debriefs with learning points (Figure 3) and a forum was opened, also in this case, for peer discussion. At the end the tutors provided a pathophysiological study of the case, with the possibility for tutors to provide feedback on unresolved questions posed by students at the end of the semester.

Figure 3 Instructions, observational and debriefing grids for clinical case discussion activity III and IV year (see online version for colours)

CLINICAL CASE DISCUSSION III-IV YEAR

INSTRUCTIONS	
<ol style="list-style-type: none"> 1. Watch the video recording and observe the history taking considering the check list about the traditional medical interview and the following explanations about the signs and the symptoms of the pathology and of the dysfunctional organ 2. At the end of the observation, answer the questions in the debriefing sheet uploaded 3. Join the forum and put your comments on the video recording starting from the observational grid uploaded 	
<p>The forum will be supervised by OME and will be open from 20th April until 14th May. On May 8th a feedback on the patient's diagnosis will be given and a summary on the key points that emerged from the forum will be made.</p>	
OBSERVATIONAL GRID	<i>ANSWER</i>
Have the items on the check list regarding the content been respected?	
Which are the questions used for each chapter of the medical interview to focus on the signs and symptoms presented by the patient?	
What other questions would you have asked?	
In the light of the data collected, what is the compromised apparatus? Which organ?	
Provide a pathophysiological explanation of the causes of the clinical abnormality.	
Are you able to describe the signs and the symptoms of the described pathology and to relate them with the physiopathology?	
DEBRIEFING GRID - Considering the key points that emerged from the forum and the diagnosis provided, each person should reflect on their strengths and weaknesses points	<i>ANSWER</i>
Which are the questions in a pneumological/hematological medical interview?	
Was I able to identify the dysfunctional organ?	
Which are the concepts of anatomy and physiology that are modified by the pneumological/ hematological pathology?	
Which are the main signs and symptoms associated with the pathology described?	
Which are my weak points?	
How will I be able to fill in these weak points?	

Physical Examination and procedural skills laboratories – Original videos were produced on the manoeuvres and procedures planned for the semester.

Concerning the III year we included: PE of the chest and BGA execution, PE of the ear, breast and eye. While the procedural skills of the IV year covered: rheumatological

PE, procedural skills of nasogastric tube and bladder catheter placement and treatment of wounds.

The student through provided instructions could follow the explanation and verify consistency with the corresponding check lists. An ad hoc observation grid (Figure 4) allowed them to test their own learning and furthermore students were invited to perform the manoeuvres, when possible, individually.

ECG and radiology labs – They involved only the III year. The radiology lab provides for a video with the explanation of radiological reports with focus on pneumonia in the light of Covid-19. The ECG lab consisted in reports of ECG cases that students had to carry out and on which they successively received a feedback. For both workshops specific observation grids (Figure 4) were provided to facilitate the learning process.

Simulation of full scale scenarios for clinical reasoning – This activity has been reserved to 4th year students. In this case the OME has selected and downloaded 4 scenarios from last year recordings with the same learning objectives and the videos were uploaded on the LMS. The students received the observational checklist and some debriefing questions (Figure 5) to reflect on the actions of their colleagues observed in the recordings.

Figure 4 Instructions, observational and debriefing grids for procedural skills activity III and IV year (see online version for colours)

SKILLS LAB III-IV YEAR

INSTRUCTIONS	
1. Watch the video recording and observe the maneuver by following the check list in the booklet 2. At the end of the observation, answer the questions in the debriefing sheet uploaded 3. Participate in the forum where everyone should put his/her comment on the video recording	
The forum will be supervised by OME and will be open from 20th April until 14th May. On May 8th a summary on the key points emerged from the forum will be made.	
OBSERVATIONAL GRID	
In what clinical context can be applied this maneuver?	<i>ANSWER</i>
For what purpose?	
Which instruments are used in this maneuver?	
Have all items on the check list been respected?	
Can you list them without observing the check list?	
Which are the pathological findings you can obtain with this maneuver?	
DEBRIEFING GRID - Considering the key points that emerged from the forum and the maneuver carried out, each person should reflect on their strengths and weaknesses.	
Did you remember to prepare all the material?	<i>ANSWER</i>
Are you able to remember all the points of the maneuver?	
Which points on the check list do I feel most difficult?	
Which strategies/ resources could I use to fill my weaknesses?	

Figure 5 Instructions, observational and debriefing grids for case scenario activity IV year (see online version for colours)**CASE SCENARIO IV YEAR**

INSTRUCTIONS - The scenario, in high fidelity simulation, aims at accompanying students in the understanding of the patient's pathology starting from the execution of an accurate problem anamnesis and from the head-foot objective examination.	
<ol style="list-style-type: none"> 1. Watch the video recording and observe the anamnestic collection, the head-foot examination following the check list of the second semester 2. At the end of the observation, answer the questions in the debriefing sheet uploaded 3. Join the forum where everyone is invited to put his/her comment on the video recording 	
The forum will be supervised by OME and will be open from 20th April until 14th May. On May 8th a summary on the key points emerged from the forum will be made.	
OBSERVATIONAL GRID	<i>ANSWER</i>
CONTENTS	
Has the check list been respected?	
What is the patient's active problem?	
What are the secondary problems?	
On the active problem, please specify whether you need diagnosis, therapy, monitoring	
FOR THE FOLLOWING ACTIONS ON THE ACTIVE PROBLEM:	
If the aim is diagnosis: What are the diagnostic hypotheses? What tests would you require?	
If the aim is monitoring: what vital parameters should you monitor and how soon?	
If the aim is treatment, specify the therapeutic strategies you would implement and the recommendations to give to the patient.	
CONDUCTION	
The conduction has been respected?	
Which aspects have not been explored? What questions would you ask the patient?	
DEBRIEFING GRID - Considering the key points that emerged from the forum and the diagnosis provided, each person should reflect on their strengths and weaknesses.	<i>ANSWER</i>
I wasn't able to identify the main problem	
I wasn't able to identify the secondary problems	
I wasn't able to identify the actions on the individual active problems	
They are deficient in the management of conduction aspects (identifying specific aspects of the check list)	
What actions could I take to improve my weaknesses?	
What strategies/resources could I use to improve my performance?	

In this setting, considering crucial the need to provide a useful opportunity to enhance appropriate learning, in substitution to the OSCE final examination, we introduced the Formative Feedback, which by definition, informs learners of the gap between where they are and where they need to be; it is 'for' education, it provides an information and not a judgement (Vaporciyan, 2019). Unlike the OSCE it did not provide for the practical execution of the manoeuvres but their recognition, according to the checklists studied during the virtual training, within ad hoc built videos. At the end of the whole test, the system provided each student with final feedback to evaluate their learning. We pointed toward (Hasnain et al., 2004; Sandars, 2011; Junod Perron et al., 2016) the need of correcting deficiencies and monitoring students' self-learning to ensure accurate (Junod Perron et al., 2016; Eva and Regehr, 2005; Ward et al., 2002) identification of areas for improvement and to develop effective learning. In this way we helped students to evaluate their accomplishments and their gaps that still need to be corrected; although we decided not to provide a score, as we traditionally do with OSCE examination.

In the next months, or anyway when travel will be possible, students will be given the opportunity to perform a practical training to conclude the course of the semester and allow us to consider fulfilled their learning goals.

In every training process both activities and tutors are evaluated by the students. The suggestions and indications collected are the subjects for monitoring and continuous improvement of the activities. Especially in this particular period and in the light of this innovative e-learning experience we provided an ad hoc satisfaction questionnaire based on a Likert scale from 1 to 10 (1 = not satisfied at all, 10 = extremely satisfied), including 'not applicable' (N/A) to quantitatively evaluate the impact of this project on students and an empty space where students could leave a comment to perform a qualitative analysis, obtaining further suggestions or criticisms. Different items have been evaluated, applying the aforementioned Likert scale, among which: the provided material (audio, video, slides) for each activity, the instructions, the debriefing cards, the self-evaluation forms, forum activities and the usefulness of the virtual training in understanding and memorising the procedural checklists.

4 Results

The Professionalising Activities satisfaction questionnaire concerning the III year has been completed only by 23 students over 140 (17%), while for the 4th year the questionnaire was answered by 77 students over 122 (64%). The results of both questionnaires are reported in Figures 6 and 7 respectively.

On the other hand the qualitative analysis of data, derived from comments and suggestions proposed by our undergraduates, confirms the advantage of the e-learning activities in helping to fix the procedural check lists, although it highlighted the necessity for an increased tutorial support and a more detailed study of the uploaded material.

5 Discussion

In consideration of the obtained results from our students we believe our innovative approach to Professionalising Activities to be a good model or inspiration for the transformation of practical learning and its evaluation also in other universities.

Figure 6 Results of satisfaction questionnaire for the III year (see online version for colours)

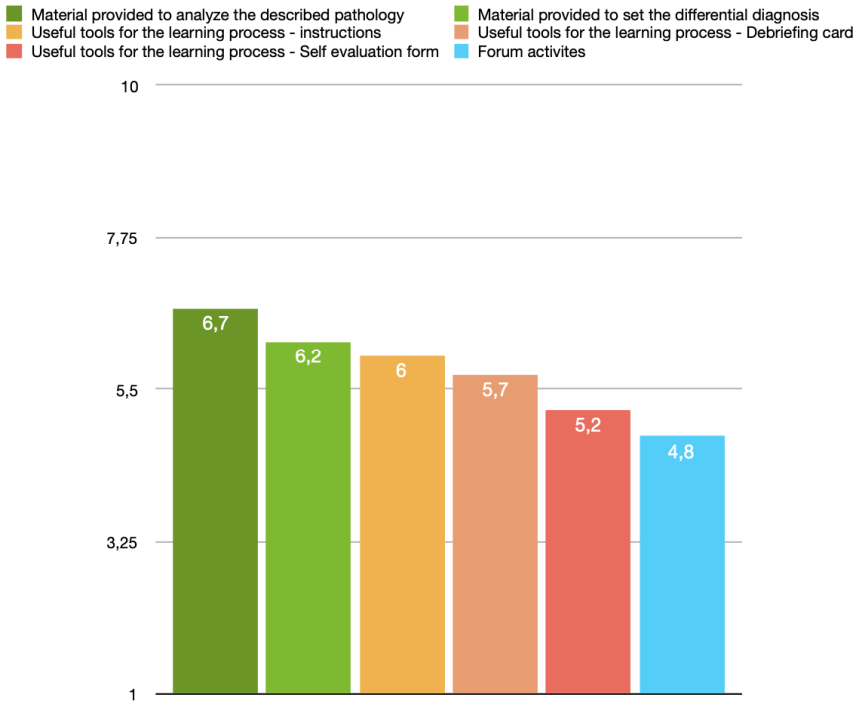
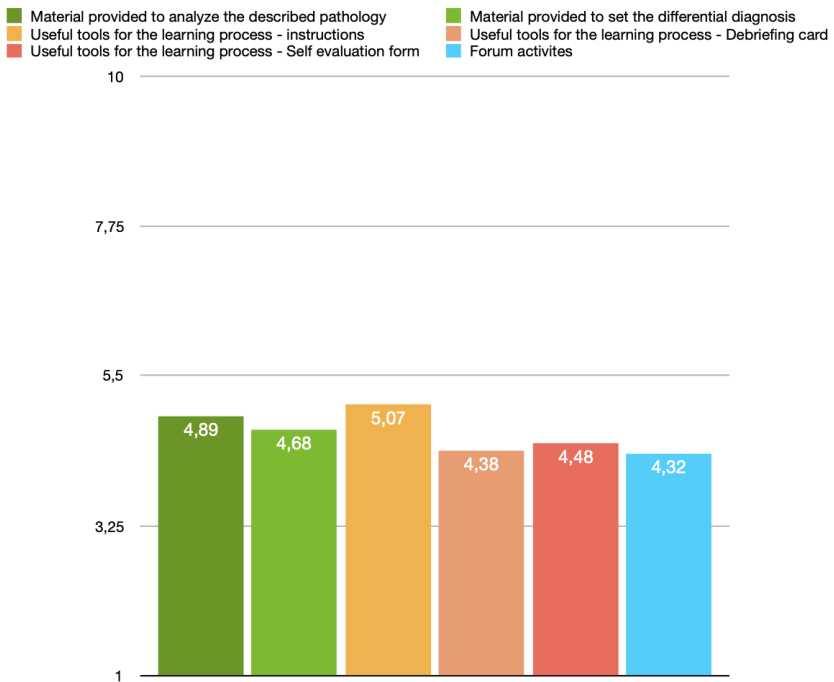


Figure 7 Results of satisfaction questionnaire for the IV year (see online version for colours)



Several papers (Hsieh et al., 2020; Kanneganti et al., 2020; Roskvist et al., 2020; Siddique, 2020; Lim et al., 2009) have been published recently reporting their experience concerning e-learning strategies in Covid-19 pandemic for both undergraduate and post-graduate medical students.

There is the evidence that online learning can be as effective as traditional teaching modes such as lectures (Humphris and Kaney, 2000; Fransen et al., 2018; Pei and Wu, 2019; McCutcheon et al., 2015; Al-Shorbaji et al., 2015), although the mastering of the method is far to be complete (Fasanando-Vela et al., 2017), especially in relation to practical teaching.

For this reason the challenge is defining how much learning can be undertaken online, and how much clinical exposure is still necessary (Roskvist et al., 2020). The difficulty in determining this is mainly linked to the fact that previous experience, documented in similar activities (Fransen et al., 2018; Pei and Wu, 2019; McCutcheon et al., 2015; Al-Shorbaji et al., 2015), was in the form of prospective studies or systematic reviews for the comparison between lectures and blended online teaching methods; they took advantage of e-learning to improve learning processes of students however on the basis of lectures. Indeed they did not convert the entire teaching pathway online, as we inevitably did in this period.

Frederike Fransen et al. (2018) proposed an integration of dermatological course with an online program named Education in Dermatology (ED) which represents an interactive web-based program that can be accessed from any computer or smartphone. It includes clinical cases and multiple choice questions in order to fill a vital gap in the understanding of clinical reasoning in dermatology that is considered having a great importance for the development of a medical doctor, especially for general practice.

Similarly E. Montassier et al. (2016) compare the effectiveness of e-learning and lecture-based courses for learning ECG interpretation skills in a large randomised study. They showed that the e-learning course is an effective tool for the acquisition of ECG interpretation skills by medical students.

In our project the complete teaching pathway has been turned online assuring to our students the continuing medical training, from a cognitive point of view, especially concerning the activities of: history taking, clinical reasoning, procedural skills and development of a wider medical approach toward patients and their concerns.

The peculiarity of this innovation, brought by the current pandemic, is not only the transformation of practical activities in the form of e-learning but mainly the possibility to offer to our students the acquisition of procedural checklists and the basics to practice the skills individually. Furthermore the online evaluation provided the opportunity for undergraduates to learn and reflect on the checklists linked to the technical skills.

We are aware that such training requires a great deal of professional maturity from our students, although we believe that the current situation we are living has already stimulated a huge reflection on the course of study they chose and on the meaning of being doctors today.

As it is easily noticeable, the results concerning the evaluation questionnaire on different items are insufficient, in particular: 3 out of 6 items concerning the 3rd year are considered inadequate and all the items regarding the evaluation from 4th year students received a score below 6. Although, as indicated in the results, the evaluation questionnaire has been completed only partially by students, in particular concerning the 3rd year; for this reason a bias in the evaluation score we received should be taken into account.

With the thorough analysis of the qualitative data it has been demonstrated the need for a more accurate selection concerning the uploaded material and the necessity for a tutor that guides the virtual activities without leaving the learning process to the individual handling providing only briefing and debriefing grids.

For the aforementioned reasons, concerning the next semester, having learned from the pandemic transformation, we planned to maintain the virtual space we have created. In the latter, videos, observational and self-evaluation grids will be uploaded in order to ensure that our students have the possibility to look at the material in advanced allowing for a more in-depth understanding of the topics covered. Successively, providing that we will be allowed, we are planning to organise a practical session in presence, guided by tutors, where students can exploit the theoretical and methodological knowledge of the skills learned online. In the case in which some of our students would not be allowed to come back to Italy we are equally planning a practical training at distance using Microsoft Teams[®].

This is the method we would like to use to improve the reasoning capacity of our students.

Another interesting data derives from the fact that third-year students, entering clinical practice, are more satisfied concerning virtual learning with respect to those in the IV year. This difference can be attributed to the growing interest of 4th year students to measure themselves against reality; it will become essential in the next semester to give more emphasis to method and reflection even for older students. Being 4th year students more “advanced” in their pathway, it is more difficult for them to accept that their clinical practice has become online. On the other hand, a student at his 3rd year, approaching for the first time the real world of clinical practice, even if in a non-traditional, online, scenario, will be more excited.

This period highlighted that reflection on practical activities can be guaranteed by the virtual world and it must be emphasised in the correct way, although it should be associated with the practical part.

A fundamental resource and innovative opportunity is represented by the presence of a peer-to-peer discussion forum which is considered a great advantage in terms of constructive discussion essential in training activities. This learning enhancement allows increased learner interactivity and promotes learners’ efficiency, motivation, cognitive effectiveness, and flexibility of learning style (Ruiz et al., 2006). The importance of the forum has been assessed, however a further improvement should be done firstly providing more detailed information about the use of this platform and secondly implementing the active presence and intervention from tutors.

6 Conclusions

The great advantages offered nowadays by technology allow students to access all kind of courses that traditionally could be offered only by means of lectures in University campus. Innovation can adapt undergraduate medical training programs in pandemics, although with some necessary modification. It is hoped that the learning from our project contributes to increase the mastering concerning the association between the virtual and the traditional training, creating a complementarity between these two methods for the teaching of clinical competences with the aim to improve reflection and self learning.

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