COVID-19 Ward-based learning in a pandemic: an approach to ensuring sustainable medical education for healthcare students

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ABSTRACT

The SARS-CoV-2 pandemic has caused significant disruption to medical education, requiring those involved in its delivery to radically revise teaching programmes to ensure continuation of delivery of training to future healthcare professionals.

We describe our experience of implementing an infection teaching programme on a COVID-19 ward at a London teaching hospital affiliated to University College London (UCL) Medical School during the SARS-CoV-2 pandemic. We performed a scoping literature review of all papers published on medical education delivery in the pandemic between January 2020 – May 2021. We used the results from this, along with our pre-existing knowledge of medical education theory, to summarise 10 key learning recommendations for planning medical education in a pandemic.

SARS-CoV-2 is unlikely to be the only significant interruption to medical education we see in our lifetimes. We should develop robust and sustainable teaching programmes with the aim of reducing disruption in the future.

Background

The SARS-CoV-2 pandemic has caused significant global disruption to medical education, with many UK universities initially suspending clinical placements for healthcare students for many months, and subsequently limiting clinical contact with patients, a precaution that remains *in situ* to date and, at the time of writing,

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has lasted 17 months.[1] The pandemic is anticipated to continue to have a profound impact on educating healthcare professionals. It requires those of us involved in their education to adapt and rapidly develop innovative and sustainable methods of teaching and learning to ensure learners can still receive adequate training, pass exams and, most importantly, go on to provide safe and effective care for patients in the future.

Here, we review the literature on novel approaches being implemented in medical education across the world in response to the pandemic and present several recommendations for ensuring its sustainable delivery. These recommendations were implemented at a large London teaching hospital heavily affected by the SARS-CoV-2 pandemic that is affiliated to University College London (UCL) and a major hub for medical education.

Our recommendations are summarised into 10 tips, with the aim of creating a practical guide to enable provision of sustainable medical education during a pandemic.

A practical solution to medical education in a pandemic

In August 2020, in between the UK's first and second waves of the SARS-CoV-2 pandemic when COVID-19 cases were comparatively low in hospitals, we developed a novel teaching programme for medical students. This incorporated pre-existing medical education theory and evidence with government and hospital social distancing guidance. The programme we put together was a blended virtual and face-to-face teaching model to be implemented from September 2020 to July 2021 for small groups of 4th year undergraduate medical students who rotated though a 2-week long 'infection, immunity and microbiology' placement at a major London teaching hospital affiliated with UCL Medical School. The main delivery method for face-to-face teaching was at the patient's bedside, and the students on this programme were to be based on one of the COVID-19 wards in the hospital. They were allocated to 'teaching bubbles' of up to five students to limit mixing of groups, and face-to-face clinical teaching with patients/ clinicians was limited to 2–3 students. Tutors moved between bubbles, however, and this was a model used at many universities both in the UK and globally.[2] All learning in larger groups outside bubbles took place virtually on Blackboard Collaborate (Anthology, Boca Raton, USA), MS Teams (Microsoft, Redmond, USA) and Zoom (Zoom, San Jose, USA). The platform used was dependent on a combination of user preference and functions of the particular platform to suit the teaching type; for example, MS Teams for departmental teaching, Blackboard Collaborate for

small group teaching and Zoom for large group lectures. This is expanded on further in the results section.

After implementing this teaching model, we performed a scoping literature review of articles published between January 2020 and May 2021 containing the MESH terms (medical education [Title] OR student [Title]) AND (pandemic [Title] OR COVID-19 OR SARS-CoV-2 [Title]). There were 369 results. Non-English language articles were excluded (n=5). The remaining 364 abstracts were screened for content and identified for full paper screening if they contained practical approaches to delivery of medical education in the SARS-CoV-2 pandemic. Key themes were extracted from the abstracts on this basis, and nine papers were selected on this basis for full paper review.[2–10] Papers describing the impact of the pandemic on medical education but not offering practical suggestions on how to address this were excluded.

Results

We extracted 10 key themes from the identified literature and used these, with existing medical education theory and evidence, to inform our practice. This included several well-known education theories, including Maslow's theory of human motivation; Lave,

Wenger and Meizrow on transformative learning; Sfard's learning metaphors; and Kolb's experiential learning theory.[11–16] A summary of the key recommendations from the literature review is shown in Table 1 and each is discussed in more detail in the further evaluation section.[2–6,9–12,17]

Further evaluation: The 10 recommendations for medical education in a pandemic

Recommendation 1: Students must feel safe in order to learn

In 1943, Maslow published *A theory of human motivation*.[11] He described how basic human needs must be met for learning to take place. These include 'physiological', 'safety', 'love', 'esteem' and 'self-actualisation', and are often presented as a hierarchy, demonstrated in Fig 1. Since then, his work has been heavily revised, critiqued and analysed.[18,19] We maintain that his work is more relevant in a global pandemic than ever. Many of us feel less safe than we did prior to the pandemic: might we catch SARS-CoV-2 and how will it affect us?[6] It is imperative that students feel physically and psychologically safe when learning in a hospital, in particular when that hospital is filled with patients who are highly infectious with a new and potentially life-threatening disease. How will they learn if they don't feel safe? If students are worrying about the efficacy of their personal protective equipment (PPE), they are unlikely to be able to focus on history-taking skills. Maslow's 'safety' (a key factor in human motivation) is removed. In addition to this, their sense of belonging (Maslow's 'love') will be reduced, as medical teams were busier than normal, as well as physically and emotionally exhausted with little reserve for teaching students.[20] It will be far harder for the students to achieve 'self-actualisation'. Their physiological needs may also not be met; hospitals in the UK adopted the use of PPE consisting of a minimum of a fluid resistant surgical mask (FRSM), gloves and a gown when having contact with any patient. It is far more challenging to concentrate and, therefore, learn when wearing PPE as it can be uncomfortable

Table 1. Ten recommendations for planning medical education during a pandemic		
	Recommendation	Key references
1	Students must feel safe in order to learn	Maslow, 1943;[11] Gordon, 2020[9]
2	Technology should be used to support medical education	Coleman, 2020;[17] Gill, 2020;[2] Sparkes, 2021;[3] Gordon, 2020;[9] Daniel, 2021;[10] Grafton-Clarke, 2021[16]
3	Students must feel like part of the clinical team	Maslow, 1943;[11] Kachra, 2020;[4] Lave, 1991[12]
4	Trainees and trainers should be aware of potential educational opportunities ('stimuli') on the ward and know how to identify these	Lave, 1991[12]
5	Support students to work as volunteers in the global pandemic response	Gill, 2020;[2] Agrawal, 2021[5]
6	Plan for future pandemics and create sustainable and resilient teaching programmes	Agrawal, 2021[5]
7	Increase communications with students	Kachra, 2020;[3] Agrawal, 2021[5]
8	Flexibility of exam schedules and for attendance requirements	Agrawal, 2021[5]
9	Recognise potential health implications (both physical and mental) for students and respond rapidly	Knowles, 2021;[6] Gill, 2020;[2] Katchra, 2020;[3] Gordon, 2020;[9] Daniel, 2021[10]
10	Implement longitudinal clerkships, ie longer placements and less rotation	Gill, 2020[2]
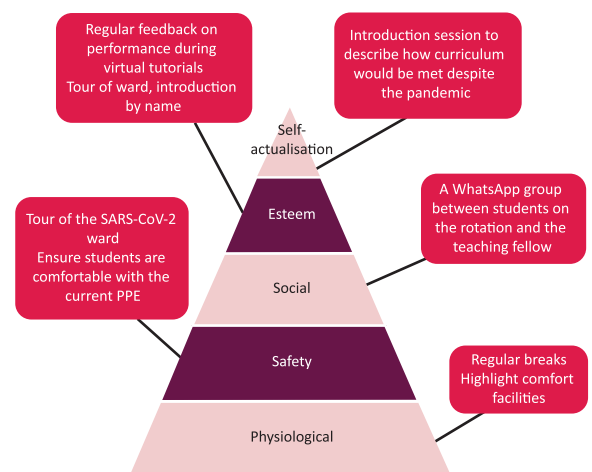
Fig 1. Ensuring that factors influencing human motivation are met during a pandemic and examples of how this can be achieved, based on Maslow's hierarchy of learning needs.[11] PPE = personal protective equipment.

to wear and creates a barrier to communication, translating as a barrier to learning in students' minds; for example, reluctance to go and see patients due to not wanting to wear PPE. Fig 1 presents the approaches we used in our practice to ensure criteria in Maslow's hierarchy were met.

Self-actualisation describes the ability of our students to become the best versions of themselves and fulfil their potential.[11] We aimed to facilitate the students achieving this in two ways. Firstly, by ensuring clear intended learning outcomes (ILOs) were set out at the beginning of their placement. This allowed the students to clearly see how their placement, despite the disruption caused by the pandemic, would help them achieve their learning goals and 'self-actualise'. Secondly, by defining these ILOs in an introductory session and directly relating these to the student curriculum, students felt motivated to self-actualise. Maslow describes how the 'lower needs' needed to be met in order for this self-actualisation to occur. Esteem was addressed by ensuring that students had regular sessions scheduled in with tutors through virtual platforms to optimise feedback. In addition to this, students were taken around the ward and introduced by name to all team members to ensure that they felt recognised and to provide a sense of belonging.[21]

Recommendation 2: The use of technology to support learning in a pandemic

The SARS-CoV-2 pandemic has forced us to embrace technology in learning at an accelerated pace, and it will change the way we work and teach forever. One of the biggest challenges faced by medical educators was facilitating teaching while adopting social distancing in keeping with hospital, medical school and government guidance.[22] Most UK medical schools advised that face-to-face teaching should be held in groups of a maximum of two students at a time, or they suspended in-person teaching altogether.[2] In addition to this, from June 2020, Public Health England (PHE) advised that FRSMs had to be worn in healthcare facilities at all times, including any medical school buildings.[23] As a result, virtual teaching platforms were utilised to deliver medical education. Grafton-Clarke et al describe the approaches used worldwide to deliver medical education virtually in BEME guide no 70.[16]

The technologies we implemented are summarised in Table 2.[24,25] We propose potential advantages and disadvantages associated with each of these methodologies based on our own experience of implementing this teaching programme.

Recommendation 3: Students must be incorporated into the clinical team

In addition to team introductions, social needs in Maslow's hierarchy (Fig 1) were facilitated by a team WhatsApp group to ensure regular communication between students and the clinical team. The students were also encouraged to send direct messages to tutors at any time to ensure that their pastoral needs were met and to rapidly address any concerns. We intended for this to help the students feel safer, as they could easily ask the clinical team questions about any concerns they had and double check understanding. Additional sessions on how to don and doff PPE were organised to ensure students were comfortable and familiar with this process, and students were observed and given feedback on their ability to do this correctly. The students were

also encouraged to participate in a question-and-answer session on anything to do with SARS-CoV-2 and, for many students, this opened up another platform for them to raise personal safety concerns. Finally, their physiological needs (as per Maslow's hierarchy; Fig 1) were addressed by ensuring regular breaks were timetabled, both while on the wards and when in virtual sessions to give them a break from PPE that they were potentially unfamiliar with wearing and to give them a break from screens. This approach is supported by many authors in the literature; for example, Singh et al propose maximum screen time per day to be limited to 4 hours for learners.[26] Comfort facilities, such as toilets and water machines, were highlighted at the start of placements. By ensuring these basic human needs were met, we aimed to set a secure foundation for learning to take place during the SARS-CoV-2 pandemic.

Recommendation 4: Trainees and trainers must be aware of potential educational opportunities ('stimuli') on the ward and know how to identify these

In a workplace environment, students need to identify their own learning opportunities and take a flexible, opportunistic approach to learning.[27] We find Anna Sfard's 'participation metaphor' is particularly relevant here.[14] Sfard describes an 'acquisition metaphor' and a 'participation metaphor', where the former describes learning as the gaining of knowledge and the latter places the learners as 'newcomers and reformers', who become 'participating members of a community'. Sfard's participation metaphor ties in well with socio-cultural learning theory, where learning becomes part of our day-to-day practice.[15]

Learning in a ward-based setting provides unique opportunities, that can only be provided by being emersed this environment. We propose that these should be divided into four broad categories: visual, linguistic, physical and practical stimuli (summarised in Fig 2). In our teaching programme, students were given an introduction lecture to the ward-based learning component of their teaching and the concept of the 'learning stimuli' was introduced to the students to ensure they know how to identify these learning opportunities.

These learning stimuli were specifically designed with the pandemic in mind. The normal learning opportunities available on the ward were significantly reduced, with clinical teams primarily occupied with delivering care and there was minimal time to support students in their learning, therefore, students would need to identify these learning stimuli.

The work of Lave and Wegner around a socio-cultural learning theory can be applied to all four of these stimuli.[12] Learning becomes part of the student's practice by being on the ward and observing the environment and conversations happening (stimuli 1 and 2). Examining a patient (stimulus 3) can happen as part of a 'community of practice'; for example, on a ward round. 'Legitimate peripheral participation' can be achieved by undertaking practical procedures (stimulus 4).

The weaknesses to learning in the workplace environment can be related to the learner and trainer. There are always learning opportunities in a ward environment, but the student has to know what to look for and how to identify them. This may be very learner dependent, and disproportionately affect less confident students who don't ask to be involved in practical procedures or which patients are suitable to clerk.

Table 2. The use of technology to deliver medical education in a pandemic

Technology	Potential use in teaching	Example of implementation	Advantages	Disadvantages
Breakout rooms	Case discussions between small groups of students (2–3); students then meet with the wider group to present and discuss their case	Virtual clerking of patients (one student is the doctor and one student is the patient in a role-play scenario)[24] Small group discussion and working through clinical cases	Allows social distancing, both from other students and from patients Potential to discuss signs (through multimedia) and symptoms that they may not have seen on the ward Learning about a wide range of clinical cases specifically targeted to the curriculum Sessions can be recorded, allowing absent students to catch up	No opportunity to practise examination skills More challenging to practise communication skills with patients Clearly not the same as seeing clinical signs in 'real life'
Team instant messaging group	Communication of venue changes and technology issues Sense of belonging Pastoral support Clarification of technical terms used in clinical meetings	Students are invited to an instant messaging group for their placement facilitated by a member of the medical team, who can rapidly communicate with the students	Rapid and instant communication to the student group Access to support for students if required Opportunity to ask questions Overwhelmingly positive feedback from our group of students; local data gathered unanimously found approval for WhatsApp use in small groups	Inappropriate use; for example, disclosing confidential patient details in error while asking about a clinical case Intrusive: it may blur the line between work and home life if a personal device is being used Access to technology: may disadvantage students without access to smartphones/WhatsApp
Virtual meeting whiteboard and polling	Encourage student participation when asked questions through typing responses on the screen (ie virtual whiteboard such as Blackboard Collaborate (Anthology, Boca Raton, USA))	Asking students open questions eg 'What would you ask this patient?'; multiple students can respond at once Asking students to label photos of clinical signs	Encourages participation from all students, not just the most confident Multiple answers can be typed at once	Requires access to an online learning platform Students may not engage and it is difficult for a facilitator to identify those not engaging
Virtual meeting live chat	Highlight key learning points from clinical cases Clarify any confusions that students might have	Using the chat function on virtual platforms or WhatsApp to answer questions during a virtual clinical meeting, for example MDT discussing patients on a ward (anonymously)	Allows engagement with students during a busy clinical meeting when, historically, clinicians may not have had time to answer questions from students Allows students to clarify any uncertainties that they have Allows a medical educator to question students and check understanding	Access to technology: may disadvantage students without access to smartphones/WhatsApp. Inappropriate use; for example, disclosing confidential patient details in error while asking about a clinical case in breach of GDPR policies[24] Students may not engage and it is difficult for a facilitator to identify those not engaging ('cyber-anonymity')[25] Requires a facilitator The whole group (for example, junior doctors) can't benefit from discussion unless all are in the WhatsApp group Constant messaging may distract from the clinical meeting if only one facilitator is available

Table 2. The use of technology to deliver medical education in a pandemic (Continued)				
Technology	**Potential use in teaching**	**Example of implementation**	**Advantages**	**Disadvantages**
Virtual platforms to deliver seminars and small-group teaching	Traditional lectures and small-group teaching delivered via a virtual platform	Departmental infection teaching on various infection topics Lectures to large groups of students Small case-based discussions with a group of students	Widens access to teaching; for example, those having to shield can still access sessions from home Allows recording of sessions for those with alternative commitments Global participation in meetings Potential cost practicality implications: no need to book expensive venues, provide refreshments or find suitable venues to hold meetings	Some audience and presenters may find engagement challenging in this format Disadvantages those without access to technology Frustration to participants and lecturer, eg due to poor connectivity

GDPR = General Data Protection Regulation; MDT = multidisciplinary team.

Trainers can help address these 'weaknesses' in the learner by 'advanced organising', whereby trainees can learn from their presence, observation and participation, and students are encouraged to reflect on their new experiences.[26,28] Some trainers may not be aware they need to encourage students in this way; they may be busy, not have time to consider students' learning needs and expect them to identify opportunities themselves. Older educators may have learnt acquisition-metaphor-based learning and, therefore, be less familiar with a participation-metaphor-based learning that is arguably more applicable in a ward-based setting.[14]

In conclusion, there are many valuable learning opportunities in the workplace, but educators and learners need to be aware of these and how to identify them. Our 'learning stimuli' model was designed to empower the students to identify opportunities in the context of a pandemic.

Recommendation 5: Support students to work as volunteers as part of the pandemic response

Many universities across the world, including UCL, encouraged medical students to work as volunteers or as paid healthcare assistants during the pandemic and excused them from clinical teaching or placements to do so.[2] Some universities suspended teaching altogether and asked students to help on the wards and in the intensive treatment units as full-time volunteers, which resulted in a mixed response from students and controversy in some settings.[29] One group of medics in Dehli, India, proposed that students are given credit for the time spent volunteering towards their training and argue that, while different from their normal training, the clinical experience of working as part of a team in response to a pandemic will be invaluable preparation for their future careers.[5]

Formally recognising their involvement not only helps students progress in their healthcare training, but also contributes to the students' sense of belonging and feeling part of the team. This may help them build esteem and ultimately achieve self-actualisation.

Recommendation 6: Plan for future pandemics and create sustainable and resilient teaching programmes

The SARS-CoV-2 pandemic has caused significant disruption to medical education since March 2020 and is likely to continue to cause disruption for years to come. Rather than implementing last-minute changes to teaching programmes, and we suggest that all learning facilities implement robust teaching programmes that will allow effective medical education to be delivered regardless of how long the current pandemic lasts. With increasing globalisation, this is unlikely to be the last pandemic we see in our lifetimes. We should plan for future pandemics and create sustainable and resilient teaching programmes.
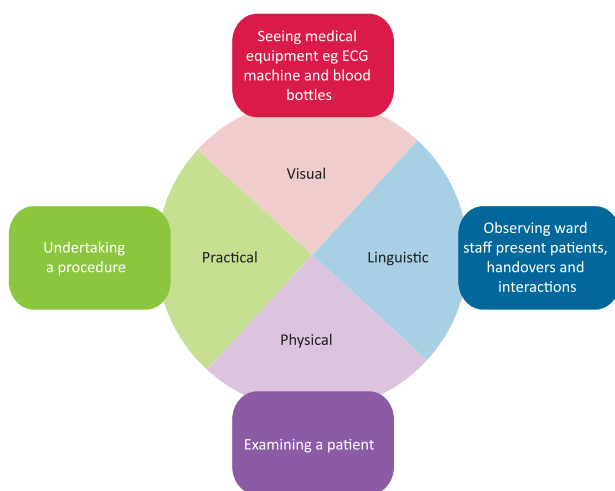
Fig 2. An approach to identifying ward-based learning opportunities: the four learning stimuli. ECG = electrocardiography.

Recommendation 7: Increase communication with students

Increased communication has been highlighted in the worldwide literature to support trainees at a challenging time in their education, ensure they feel supported, and reduce stress and anxiety levels.[2–6,17] This recommendation is based on pre-existing literature from the SARS pandemic of 2003.[4]

Recommendation 8: Flexibility to exam schedules and attendance requirements

Agrawal et al in Delhi recommend that not only should medical schools encourage students to volunteer to help in healthcare facilities as part of the SARS-CoV-2 response but that this should contribute towards their clinical training.[5] As has happened with many secondary schools in the UK, formal exams should be suspended and alternative forms of assessment should be considered, the scope of which is beyond this paper.[30]

Recommendation 9: Recognise potential health implications for students and respond rapidly

The SARS-CoV-2 pandemic has had a significant impact on the mental health of healthcare professionals and the general public alike.[31] Kachra and colleagues highlight that medical learners are at particular risk of burnout and may be at increased risk of issues such as depression and suicidal ideation.[4] Burnout is defined in the 11th revision of the International Classification of Diseases (ICD-11) as 'a syndrome conceptualized as resulting from chronic workplace stress that has not been successfully managed' and can result in feeling exhausted, mentally distanced from one's job and lead to reduced professional efficacy.[32] Burnout is sadly now a well-recognised issue affecting health professionals worsened by the pandemic. Kachra highlights the need to recognise the potential health implications of the pandemic on medical learners and respond proactively; for example, through teaching programmes consistently and persistently reaching out to learners, rather than waiting for learners to ask for help.[4] Mental and physical health may impact both on their learning and, therefore, something tutors can help address. BEME guide no 63 by Gordon et al identify this theme in the global literature and highlight the need to offer additional support to learners.[9]

In our teaching setting, trust-wide initiatives were instigated including seminars on burnout and mental health issues. In addition to this, the medical school offered one-to-one pastoral support meetings with students. In the infection department, regular emails were sent by the teaching fellow encouraging the students to reach out if they were struggling, providing contact details and ensuring students had access to support services.

Recommendation 10: Implement longitudinal integrated clerkships, ie longer placements and less rotation

Gill and colleagues from UCL discuss the potential implications in their Lancet paper on challenges to medical education at a time of physical distancing.[2] They advocate the use of longer attachment to smaller groups of healthcare teams (traditionally known as 'firms' in the UK and longitudinal integrated clerkships (LICs) in the USA) and suggest that LICs may need to replace the constant rotation of healthcare learners that is currently practised in the UK. The major

advantage of shorter placements is to gain maximal exposure to medical specialties. However, the pandemic may force us to revert back to the LIC model that is still widely practised in the USA, largely based on Prof Hirsh's work in 2003 who was instrumental to the model's implementation. Research has demonstrated that this improves the student–patient relationship and a sense of duty of students to patients and draws on Flexner's work dating back to 1910 describing that continuity of service facilitates closeness to patients and, subsequently, improved service.[33,34]

Conclusion and future implications

We propose ten recommendations to delivering a medical education programme during a pandemic, devised from our own experience delivering a blended virtual face-to-face teaching programme to groups of medical students during the SARS-CoV-2 pandemic and from existing literature to date in this area. It is imperative that students feel safe, wanted and welcome in order to learn and that their physiological as well as psychological needs are met, recognising the impact the pandemic may be having on these. Technology should be embraced and has many advantages over the traditional teaching methodology. We propose a novel approach to ensuring students are aware of learning stimuli on the ward to maximise their learning, as well as encouraging student involvement as volunteers in the pandemic response to supplement their clinical training. Finally, we must prepare for future disruption to medical education and implement stable and robust teaching programmes to ensure stability in the education of future healthcare professions. ■

References

1 World Health Organization. *WHO Director-General's opening remarks at the media briefing on COVID19 -11 March 2020*. WHO, 2020. www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19–11-march-2020 [Accessed 28 October 2021].

2 Gill D, Whitehead C, Wondimagegn D. Challenges to medical education at a time of physical distancing. *Lancet* 2020;396:77–9.

3 Sparkes D, Leong C, Sharrocks K, Wilson M, Moore E, Matheson NJ. Rebooting medical education with virtual grand rounds during the COVID-19 pandemic. *FHJ* 2021;8:e11–4.

4 Kachra R, Brown A. The new normal: Medical education during and beyond the COVID-19 pandemic. *Can Med Educ J* 2020;11:e167–9.

5 Agrawal S, Tandon V, Srivastava RM, Kaur A. COVID-19 pandemic-testing times for post graduate medical education. *Indian J Ophthalmol* 2021;69:157–8.

6 Knowles KA, Olatunji Bunmi O. Anxiety and safety behaviour usage during the COVID-19 pandemic: The prospective role of contamination fear. *J Anxiety Disord* 2021;77:102323.

7 Feroz AS, Ali NA, Ali NA *et al*. Impact of the COVID-19 pandemic on mental health and well-being of communities: an exploratory qualitative study protocol. *BMJ Open* 2020;10:e041641.

8 Singh K, Srivastav S, Bhardwaj A, Dixit A, Misra S. Medical Education During the COVID-19 Pandemic: A Single Institution Experience. *Indian Pediatr* 2020;57:678–9.

9 Gordon M, Patricio M, Horne L *et al*. Developments in medical education in response to the COVID-19 pandemic: A rapid BEME systematic review: BEME Guide No 63. *Med Teach* 2020;42:1202–15.

10 Daniel M, Gordon M, Patricio M *et al*. An update on developments in medical education in response to the COVID-19 pandemic: A BEME scoping review: BEME Guide No 64. *Med Teach* 2021;43:253–71.

11 Maslow A. *A theory of human motivation*. Radford: Wilder Publications, 1943.

12 Lave JW, Wenger E. *Situated learning: Legitimate peripheral participation*. Cambridge University Press, 1991.

13 Mezirow J. Perspective transformation. *Adult Education*. 1978; 28:100–10.

14 Sfard A. On two metaphors for learning and the dangers of choosing just one. *Educational Researcher* 1998;27:4–13.

15 Kolb DA. *Experiential learning: experience as the source of learning and development*. Prentice Hall, 1984.

16 Grafton-Clarke C, Uraiby H, Gordon M *et al*. Pivot to online learning for adapting or continuing workplace-based clinical learning in medical education following the COVID-19 pandemic: A BEME systematic review: BEME Guide No 70. *Med Teach* 2021 [Epub ahead of print].

17 Coleman E, O'Connor E. The Role of WhatsApp in medical education; a scoping review and instructional design model. *BMC Medical Education* 2020;19:279.

18 Hofstede G. National cultures in four dimensions: a research-based theory of cultural differences among nations. *International Studies of Management and Organization* 1983;13:46–74.

19 Wahba M, Bridwell L. Maslow reconsidered: review of research on the need hierarchy theory. *Organizational Behaviour and Human Performance* 1976;15:212–40.

20 Shaukat N, Ali DM, Razzak J. Physical and mental health impacts of COVID-19 on healthcare workers: a scoping review. *Int J Emerg Med* 2020;13:40.

21 University College London Arena Centre. *Creating a sense of belonging for your students*. UCL, 2020. www.ucl.ac.uk/teaching-learning/publications/2020/apr/creating-sense-belonging-your-students [Accessed 10 November 2021].

22 Cabinet Office. *Staying alert and safe (social distancing)*. Gov.uk, 2020. www.gov.uk/government/publications/staying-alert-and-safe-social-distancing/staying-alert-and-safesocial-distancing-after-4-july [Accessed 30 August 2020].

23 NHS England. *New government recommendations for England NHS hospital trusts*. NHS, 2021. www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control/new-government-recommendations-for-england-nhs-hospital-trusts-and-private-hospital-providers [Accessed 5 July 2021].

24 Steinert Y: Twelve tips for using role-plays in clinical teaching. *Med Teach* 1993;15:283–91.

25 IGI Global. *Implications of anonymity in cyber education*. IGI Global, 2011. www.igi-global.com/chapter/implications-anonymity-cyber-education/51910 [Accessed 10 November 2021].

26 Singh K, Srivastav S, Bhardwaj A, Dixit A, Misra S. Medical education during the COVID-19 pandemic: a single institution experience. *Indian Pediatr* 2020;57:678–9.

27 Dennick R. Twelve tips for incorporating educational theory into teaching practices. *Med Teach* 2012;34:618–24.

28 Kaufman D. ABC of learning and teaching in medicine Applying educational theory in practice. *BMJ* 2003;326:213–6.

29 Launder M. Medical students apologise for 'menial' tasks complaint. *The Nursing Times* 2021. www.nursinginpractice.com/latest-news/medical-students-on-nursing-shifts-apologise-for-menial-tasks-complaint [Accessed 19 May 2021].

30 Gov.uk. *How GCSEs, AS and A levels will be awarded in summer*. Gov.uk, 2020. www.gov.uk/how-GCSES-and-A-levels-awarded [Accessed 6 July 2021].

31 Phiri P, Ramakrishnan R, Rathod S *et al*. An evaluation of the mental health impact of SARS-CoV-2 on patients, general public and healthcare professionals: A systematic review and meta-analysis. *eClinicalMedicine* 2021;34:100806.

32 World Health Organization. *Burn-out as an 'occupational phenomenon': International Classification of Diseases*. WHO, 2019. www.who.int/news/item/28-05-2019-burn-out-an-occupational-phenomenon-international-classification-of-diseases [Accessed 10 November 2021].

33 Kempson M. *LIC blog*. Hull York Medical School, 2020. https://lichyms.hosted.york.ac.uk

34 Flexner A. Medical *education* in the United States and Canada: *a report to* the Carnegie Foundation for the Advancement of Teaching. New York: The Carnegie Foundation for the Advancement of Teaching, 1910.

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