

**Title:** Benefits and Drawbacks of Online Open-Book Examinations for Medical Students in the COVID-19 Pandemic

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<b>Conceptualization</b>	Ideas; formulation or evolution of overarching research goals and aims.	X	X	X			
<b>Data Curation</b>	Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later reuse.						
<b>Formal Analysis</b>	Application of statistical, mathematical, computational, or other formal techniques to analyze or synthesize study data.						
<b>Funding Acquisition</b>	Acquisition of the financial support for the project leading to this publication.						
<b>Investigation</b>	Conducting a research and investigation process, specifically performing the experiments, or data/evidence collection.	X	X	X			
<b>Methodology</b>	Development or design of methodology; creation of models						
<b>Project Administration</b>	Management and coordination responsibility for the research activity planning and execution.	X	X	X			
<b>Resources</b>	Provision of study materials, reagents, materials, patients, laboratory samples, animals, instrumentation, computing resources, or other analysis tools.						
<b>Software</b>	Programming, software development; designing computer programs; implementation of the computer code and supporting algorithms; testing of existing code components.						
<b>Supervision</b>	Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team.						
<b>Validation</b>	Verification, whether as a part of the activity or separate, of the overall replication/reproducibility of results/experiments and other research outputs.						
<b>Visualization</b>	Preparation, creation and/or presentation of the published work, specifically visualization/data presentation.						
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- 9 1. What are the benefits of Online Open Book Examination?
- 10 2. What are the potential drawbacks of Online Open Book Examination?
- 11 3. Do Online Open Book Exams prepare medical students for graduation in the pandemic?

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**THE LETTER.**

Dear Editor,

The COVID-19 pandemic has disrupted the flow of events, particularly concerning examinations for medical students. One of the adaptations to the disruption caused by the pandemic has been the adoption of online open book examinations (OBEs).<sup>1</sup> As third-year medical students at King's College London, we have encountered similar circumstances with our examinations and hope to highlight the benefits and drawbacks of this format.

It is important to recognize the potential benefits of online open book examinations. For instance, some studies imply that student self-confidence and efficacy improves with this style of examination.<sup>2</sup> Given the current predicament we are in, medical students are under considerable pressure and are still expected to both provide and attain the necessary skill sets that are required for the respective stage. Thus, online OBEs would reduce the psychological burden on students and better prepare them for the challenges associated with the pandemic.

The pandemic has led to deficiencies in the core knowledge base of students. This has manifested in the form of cancellations of OSCEs and electives which correlated with a national survey where 59.3% of final year medical students felt less prepared for FY1.<sup>3</sup> As a consequence of this fast-tracked graduation, students are being pushed early into positions of responsibility, despite the notable lack of training they have received this year. In the midst of this unprecedented crisis, it is imperative that we aim to provide a formal assessment of the curriculum. Online OBE is an appropriate format given the circumstances and acts as a satisfactory conduit for medical schools to meet educational standards set by the General Medical Council (GMC).

On the other hand, cheating is an evident drawback of online OBE.<sup>1</sup> This not only defeats the purpose of the exam to test the competency of students but can add further stress to individuals who are competing against each other. Normally, in person exams are good deterrents against cheating. However, online based examinations are difficult to monitor, therefore cheating can go unchecked. From the perspective of medical ethics, cheating can be viewed as contradictory to the mantra of honesty and integrity. Despite this, we understand that ethics may not deter cheating online where invigilators are not privy to students' actions. Possible solutions to this issue could include a more robust system for online testing such as student authentication, tracking user inputs or an indication of the consequences to cheating.

Another aspect to consider is the style of exam questions utilized in medical school. The multiple-choice question (MCQ) format has been widely adopted by medical schools, and in some cases also applied in an online setting. For instance, the US Medical Licensing Examination (USMLE) and the Medical Colleges Admissions Test (MCAT) both utilize a type of multiple-choice format known as single best answer questions (SBAQs). However, a study has suggested that SBAQs can actually give a false impression of students' competency as compared to very short answer questions.<sup>4</sup> An important question to raise is whether these SBAQs truly prepare students for their role in a clinical setting where multiple options are not always available

1 to them.<sup>5</sup> For this reason, it is worth investigating further whether SBAQs are the best method of examining  
2 medical students, especially in an online open book environment.

3  
4 An alternative format to MCQs are short answer questions (SAQs). When correctly used, this style of  
5 questioning has proven to be popular amongst students and has been considered to be a beneficial  
6 assessment tool. It eliminates the cueing effect, therefore encouraging students to gain a deeper  
7 understanding of their learning material, as well as requiring the use of key skills such as critical thinking.<sup>5,6</sup>  
8 Both students and examiners are able to grasp areas of weaknesses better with this method and can also  
9 provide a useful opportunity for giving and receiving feedback.<sup>5</sup> However, though this format may initially  
10 seem ideal, like the MCQ structure, it too does not come without its own issues. Limitations such as the  
11 complicated production of questions and mark schemes, subjective marking and restriction of materials being  
12 tested via this method, have been highlighted.<sup>5,7</sup> Regardless of whichever format is used in an examination,  
13 implementing robust guidelines related to the construction of questions that effectively assess one's ability can  
14 further engage higher cognitive skills among medical students, thereby improving competency.<sup>8</sup>

15  
16 As with the style of question, it is important to assess the format of examination. The efficacy of open book  
17 examinations in comparison to closed book examinations (CBEs) has been investigated. Studies indicate that  
18 open book exams require higher cognition.<sup>9</sup> Furthermore, open book examinations provide better  
19 reinforcement and recall for students, thus bolstering their learning schemas and memory recall.<sup>10</sup> OBEs have  
20 also displayed potential as formative assessments, acting as sufficient predictors of exam performance in  
21 summative exams.<sup>9</sup> In spite of these benefits, OBEs can potentially mask weaknesses in memory retrieval for  
22 students when feedback is concerned;<sup>10</sup> it is suggested that using OBEs in conjunction with CBEs can  
23 improve memory recall and knowledge retention in students.<sup>9</sup>

24  
25 In summary, one can acknowledge that there are multiple factors to consider in relation to online OBEs for  
26 medical students. We recognize that there are caveats to providing an online open book exam, but realize that  
27 providing an examination as opposed to fast tracking students may prove more beneficial in preparing them  
28 for frontline work in this crisis. We believe that investigation into the efficacy and practicalities of online OBE  
29 will be needed for universities in the coming year.

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