Approaches to integrating online videos into health professions curricula: educators’ perspectives from multiple institutions [version 2; peer review: 2 approved]

Kelly Aluri, Mohamed Sow, Manuel Amieva, Sharon Chen

Stanford University School of Medicine, Stanford, CA, 94304, USA

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Abstract

Background: The COVID-19 pandemic has accelerated a transition from lecture-based classes to blended and online learning, increasing the need to integrate publicly available online educational videos. Although online videos are widely available, it is challenging for educators to effectively integrate them into a curriculum. Years before the pandemic, educators from different institutions integrated videos from a library of microbiology and immunology resources into different curricula. Their experiences may inform current educators on the approach to incorporating external resources into their unique curricula.

Methods: We interviewed US health professions instructors or course directors who had previously requested access to online microbiology and immunology videos. Using thematic analysis, we organized prominent themes into an existing framework for curriculum development. We then reflected on the meaning of the themes using the same conceptual framework.

Results: We found that educators from different schools were able to integrate the same publicly available videos into varying contexts. Most used them as preparation for interactive sessions. For integrating videos, educators felt success when the following actions occurred. 1) Educators integrated videos as a tool to enhance active-learning activities. 2) Educators created activities that focused on clinical applications of knowledge, taught critical thinking, and developed enthusiasm for the subject. 3) They tested students on knowledge application and major concepts rather than solely on content for high-stakes exams. 4) Educators worked with administrators who understood the goals of integrating external videos and supported educators with time and resources to develop effective blended learning.

Conclusion: Our study suggests that educators integrating external resources into their curricula may benefit from first establishing their goals and aspirations for their students. These goals then become the
anchor for other curricular elements, including external videos, in-class activities, and assessments. Our study highlights the need for dedicated time to develop experienced and enthusiastic educators.

**Keywords**

medical education research, microbiology, educational environment, curriculum development, teaching & learning
Introduction

The COVID-19 pandemic has accelerated a global transition from lecture-based classrooms to blended and online learning with a high demand for readily available online educational videos in the public domain (Gordon et al., 2020). Many educators rapidly adopted blended learning, mixing asynchronous online videos with synchronous real-time virtual teaching (Consorti et al., 2021; Dost et al., 2020; Motte-Signoret et al., 2021). Although online medical education videos are widely available, it can be daunting for educators to determine how to best use online videos and when to customize their own (de Jong et al., 2020; Dong & Goh, 2015). During the COVID-19 pandemic, instructors often hastily applied reactionary changes to sustain instruction for their students. The rapid pivot towards blended learning has been associated with student dissatisfaction, reflecting a potential lack of experience for effectively integrating online learning tools (Mohammed, 2020; Mortazavi et al., 2021). Medical school instructors who pivoted teaching methods during the pandemic reported a need for structures that support online learning, as well as best practices underpinned by theories (Daniel et al., 2021; Gordon et al., 2020). With more time for deliberate planning, educators can now reassess and potentially retain learning adjustments they were forced to make.

Years before the COVID-19 pandemic, a group of medical educators from 4 institutions created a comprehensive library of Microbiology and Immunology (M&I) videos (Adam et al., 2017; Chen et al., 2019). Other educators, who were not part of the project, specifically accessed these online videos. They individually planned integration of the online videos into their courses without specific instructions from the video creators. We believed that these engaged educators’ experience of integrating online videos into their courses replicates the situation and challenges of current medical school educators, who have also had to individually plan integration of online videos from external sources.

With this unique scenario, we aimed to capture how 10 programs approached integrating this specific set of online videos into very different courses. While much of the current literature on online educational tools addresses student satisfaction with online learning, this qualitative study addresses an area of limited understanding: instructors’ cognitive processes and behaviors when integrating external learning resources into the curriculum development process (Stojan et al., 2022).

Methods

Design

To extract lessons to inform the post-pandemic medical education environment, we evaluated how educators from different institutions used an identical set of online medical education videos. We conducted a qualitative study to gain a comprehensive view of the educators’ thought-processes, successes, and challenges. We used a theoretical framework for health professions curriculum development as a lens to view the participants’ insights (Lee et al., 2013). Lee et al.’s framework for curriculum development emphasizes the dynamic, integrated nature of curriculum. Curriculum development is not just a linear process but involves many components that support each other, such as identifying healthcare practice needs, defining capabilities providers need, execution of learning, and institutional support (Lee et al., 2013).

Participants and recruitment

We recruited participants from educators who requested access to our open-source M&I videos and formally agreed to be contacted in the future. We emailed all the educators who requested access to the videos directly to ask about participation in our study. Ten educators agreed to participate in the study. These ten participants were instructors or course directors of a microbiology and/or immunology course at an accredited U.S. medical or osteopathic school.

Data collection

We interviewed participants via video conferencing. One investigator (KZA) conducted all interviews, which lasted 30 to 45 minutes each. To promote confidentiality and open reflection, both interviewer and participants were located in private spaces. With the participant’s informed consent, we audio recorded the interviews. Consent was obtained verbally and recorded at the beginning each interview. We removed personal or institutional identifying information from the recordings. We transcribed the recordings using a secure, automated transcription service, and then we reviewed for accuracy. The Institutional Review Board at Stanford University approved our study under protocol number 57567.

The interviews were semi-structured, with open-ended questions in three main domains: 1) how instructors integrated M&I videos into their curriculum, 2) how instructors used videos to achieve their goals, and 3) how instructors assessed student learning. We asked participants to describe elements of their curriculum, the student experience of the course, the benefits and challenges of using online videos for the course, and institutional or instructor factors that contributed to the success of the course. Interview questions were informed by the authors’ research questions on the different experiences with integration of online videos, current literature on integration of external resources into curricula, and Lee et al.’s framework for curriculum development.
for curriculum development in health professional education (Lee et al., 2013). The interview guide was piloted with three instructors at the authors’ home institution. (Appendix 1).

Data analysis
We analyzed the data with NVivo 12.0, using thematic analysis, a methodology that uses a six-step process to generate themes (Kiger & Varpio, 2020). Two investigators (KZA and MS) coded every interview to maximize internal validity and coding consistency. First, analysts gained familiarity with the data by reviewing the transcripts. Initial codes were generated, and then codes were organized into potential overarching themes. Themes that persisted across interviews or seemed impactful to integrating online videos were defined as “key”. The key themes were reviewed and refined until team consensus was reached. Exemplar quotations from the interviews were associated with the key themes. We reflected on the meaning of the key themes based on a conceptual framework for curriculum development (Lee et al., 2013).

Results
The 10 interviewed educators taught at U.S. institutions in nine different states. Their relevant characteristics, including educational background, role in their current institution’s program, and the type of program, are listed in Table 1.

To understand each school’s process of integrating online videos into their curriculum, we first characterized their distinct education environments. While most educators worked for medical schools, one was a course director at an osteopathic medical school and one was a course director in a physician assistant training program. The educators led courses ranging from introductory immunology for first year students to a multidisciplinary microbiology elective for clinical students.

Six educators described integrating M&I videos during a time of school-wide curriculum changes, which compelled them to use external M&I videos. Some of the curriculum changes shortened time for preclinical teaching, leading educators to provide content outside of class. Other schools transitioned from the lecture-based model to flipped classroom style instruction. Eight schools envisioned using the videos to provide context for in-class case studies.

Themes
We organized the key themes discussed in this section around a conceptual framework for curriculum development (Lee et al., 2013). This framework emphasizes the inter-related nature of curricular elements (dimensions), which allows us to explore their connections. In the original framework, the inter-related dimensions are: 1. Identifying future healthcare practice needs, 2. Defining and understanding capabilities (that health professions require), 3. Teaching, learning, and assessment, 4. Supporting institutional delivery. We present our key themes using the framework, adapting the descriptors of each dimension (Figure 1).

Our analysis revealed that educators who had a positive outlook and perceived success about integrating external videos thought about the connections between the curricular elements and viewed external videos as a tool, not a centerpiece. For example, when asked about their course’s goals, educators naturally described the type of healthcare provider they wanted their students to be (Dimension 1). Some educators were able to set learning objectives consistent with their aspirations for students (Dimension 2). Specifically, educators who valued critical thinking prioritized teaching about concepts and applications over rote memorization. However, some educators ran into heavy institutional and student pressure to teach specific content (Dimension 4), resulting in an inconsistency between curriculum dimensions.

Table 1. Characteristics of study cohort.

| Characteristic                  | Number (n =10) |
|--------------------------------|----------------|
| **Academic Training**          |                |
| MD                             | 3              |
| PhD                            | 6              |
| MD, PhD                        | 1              |
| **Length of Employment in Program** |       |
| Mean (SD)                      | 6.2 (3.3)      |
| **Role in Program**            |                |
| Course director                | 5              |
| Professor or lecturer          | 3              |
| Associate dean                 | 2              |
| **Type of Program**            |                |
| MD                             | 8              |
| DO                             | 1              |
| PA                             | 1              |
| **Students in Course**         |                |
| MS1/PA1                        | 4              |
| MS2                            | 3              |
| MS3                            | 1              |
| MS1 and MS2                    | 2              |
| **Gender**                     |                |
| Female                         | 6              |
| Male                           | 4              |
Figure 1. Conceptual framework for curriculum development with publicly available videos and resources.

1. Identifying aspiration for students
   - Clinical application
   - Critical thinking
   - Evidence-based medicine
   - Enthusiasm for subject matter

2. Defining and understanding learning goals
   - Clearly defined learning goals
   - Choosing videos that meet objectives
   - Prioritization of content and concepts

3. Implementation of teaching, learning, and assessments
   - Active Learning
   - Defining success
   - Evaluating success

4. Supporting Institutional delivery
   - Trained and experienced faculty in blended learning
   - Dedicated faculty
   - Dedicated time
   - Supportive administration

Defining learning and understanding learning goals
We described Dimension 2 as “Defining and understanding learning goals”. Educators who expressed a positive outlook on integrating external videos created goals that aligned with the aspirations for students. For example, educators who prioritized critical thinking set their learning goals to achieve this attribute. They focused on curating videos that would allow more class time for clinical application and critical thinking.

“I want people to be able to engage with the next organism and respond the way some of the leaders that we’ve witnessed have responded to this pandemic, to understand the complexity of the biology and come up with strategies to mitigate.” (6)

“You definitely have to curate the ones that are relevant. I made a decision that I was going to watch every single video that would possibly be relevant to my goals.” (1)

“These videos are not your entire curriculum. Just because you have this content doesn’t mean you have a course. The videos are great. That’s the basic knowledge that someone needs to know. [But] you need creativity for the interactive sessions to format it into a way that’s going to work for you and your course. Even if you have all the materials, you still have to put work in there.” (10)

Some educators reported challenges in balancing delivery of detailed content (i.e. lists of facts) versus broader concepts through critical thinking. They felt pressure from students and administrators to prioritize teaching of detailed content for high-stakes exam (i.e. USMLE, US Medical Licensing Examination) preparation. The educators never identified good test-takers or expert memorizers as their aspiration for students, creating an inconsistency between Dimension 1 and 2.

“It makes it very difficult because there’s a lot of material. It’s sometimes difficult to separate in your mind what’s basic and should already be covered in the video. And what do I really need to talk about in this interactive part? And so it’s, it’s actually tough to create.” (10)

“There were many barriers to implementation. There was skepticism about implementing the flipped classroom model and using external videos from the administration. [They] think that teaching is about delivery of content and prize that over [taking] time to help people think.” (4)

Integration of teaching, learning and assessment
We described Dimension 3 as “Integration of teaching, learning, and assessment.” To meet their learning goals in...
Dimension 2, many of the educators used some active learning strategy in their course, including group discussions, polling, and interactive case studies. For assessment of their teaching, some identified exam achievement, but many educators defined student success by referring to their original aspirations for their students (Dimension 1). Success was defined as a positive change in attitude towards the subject, better critical thinking skills, and/or the ability to thrive in a clinical setting.

“[During] those clinical experiences, success is when they feel like the class has made them feel more confident in the clinical setting. The information they’re getting will make them walk into that clinical experience and be like, ‘Oh, I don’t feel totally out of place in a clinical immunology setting.’” (1)

“In the long-term, beyond boards... in the clinical setting, really feel comfortable with the micro. Be able to just answer those questions on the spot at the bedside when their preceptor is asking them something.” (4)

Although many educators identified student success based on original aspirations, their evaluation tools were limited to testing short-term retention of knowledge from external videos and rarely measured their definitions of student success, including attitude changes, critical thinking skills or confidence in a clinical setting. The inconsistency between educators’ goals (Dimension 1) and assessment tools (Dimension 3) created an inconsistency between the elements of the curriculum development framework, which renders it challenging to assess whether the use of external videos helped achieve instructors’ original goals.

Supporting institutional delivery
We described dimension 4 as “Supporting institutional delivery”. Over half of educators described that dedicated faculty, protected time, and a supportive administration were all required to integrate online videos effectively.

Educators who expressed a positive outlook on integrating online videos worked with an administration who supported the consistency between aspirations for students (Dimension 1), course learning goals (Dimension 2), and execution of class time (Dimension 3). Inconsistencies between the dimensions led to both educators and administrators to view online videos unfavorably. For example, while an instructor may aspire to teach students clinically relevant thinking, an institution’s goal may be to transfer facts and utilize the knowledge of their faculty.

“[Some administrators and faculty] were very against the idea that we would use another institution’s learning materials. That was felt to be an embarrassment. They felt... our students are paying for our knowledge, not the knowledge of somebody else in the videos.” (4)

“If we have to edit someone else’s materials, we might as well produce them ourselves... We occasionally have used outside materials for learning, but mostly we’ve generated our own or we’ll [have] live lectures. We actually have our own internal instructional design team. So we are in the process of generating more non-live, asynchronous learning materials.” (8)

Despite administrative support, educators tallied several key “needs” that could be challenging to find. The “right” individuals with experience and enthusiasm was a key need that educators pointed out.

“I think that [faculty] need to experience [flipped classroom] themselves. They have to experience the type of teaching almost as a student before you can really understand what is possible.” (4)

“Not all faculty members had ever experienced anything like that, let alone know how to design a session like that...It’s a huge job to do... Most faculty members still are not familiar with those kinds of teaching techniques.” (5)

“You need people who are going to own this. If you just tell some random person I need you to do X and they’re not really excited about it, it’s not going to happen...Even if there’s content that’s written for you...you still have to have people to implement it.” (10)

“Without having faculty buy-in, it’s not going to happen. And that’s something that we find all medical schools are like this. If you don’t have a champion, it doesn’t really happen or it doesn’t happen well.” (8)

Thoughtful curriculum design also means offering dedicated or protected time to enable success and to engage with a community for learning. Both of these “needs” were hard to find.

“So the challenge is just having the time, you know... how much time do I have to watch 40 hours of material on top of my day job. It’s just time.” (1)

“Time. Honestly, that’s really what it is. You need time to do it.” (10)

“Yes, [knowing what other schools are doing] would be awesome. Because more brains means better integration of these videos.” (9)

Instructors especially need time during the first iteration of the course and its transition from more traditional teaching models to new flipped classroom models.

“The clinicians who are mostly the teachers in the course are so short on time...You can have the best intentions [to improve your course, but] when it gets down to it and you’re supposed to do discussion in two days, you just go back to what you used to do.” (4)

Discussion
We interviewed engaged health professions educators from multiple learning environments who integrated freely available
microbiology & immunology videos into their courses. Their experiences may be helpful to current educators who are optimizing for the post-pandemic learning environment. Grounding our analysis in an existing framework on curriculum development, we found that successful integration of online videos is promoted by certain behaviors of the educator. For example, educators who were mindful of the goals and aspirations for their students viewed integrating online videos more favorably. We focused our study on instructors’ thinking and behaviors as course directors and as a member of a larger organization, because these perspectives are uncommon in current published literature about the use of technology tools (Stojan et al., 2022).

After reflecting on the insights of the educators we interviewed, we generated 2 key takeaways. The first takeaway is for educators to deliberate on curriculum design as interrelated dimensions of a framework that dynamically affect each other, rather than a linear process (Figure 1). Paying attention to the consistency between dimensions leads educators to understand that videos are a tool to achieve their objectives, rather than a centerpiece of the course. Educators perceived success about integrating videos if they set their learning objectives and assessments to be consistent with their aspirations for their students. In contrast, inconsistencies between these dimensions led to educators to have more frustrating experiences with online video integration. For example, when assessments emphasized facts rather than concepts, the content of the videos can become the center of attention, leading administrators to be resistant to using outside resources and to encourage educators to make their own.

Our second takeaway is for administrators to provide time and training to improve blended learning. The process of curriculum development described in the framework requires time for instructor training, curriculum development, and thoughtful reiteration (Motte-Signoret et al., 2021). The educators encountered time and resource constraints, which sometimes prevented integration of the videos and execution of their vision for the course. Without time and skills, instructors are more inclined to revert to traditional passive teaching. Furthermore, instructors’ personal experiences as students heavily influences their teaching approach (Gilakjani, 2012). As one of our educators suggested, instructors may need to first experience well-executed blended learning to draw inspiration to design one themselves. One solution could be remote participation in other instructors’ classes to experience well-executed blended learning to draw inspiration. The existing literature supports our conclusion that institutions must support educators in developing effective skills and curricula during an age of rapid change in educational technology (Daniel et al., 2021; Stojan et al., 2022; Veasuvalingam & Goodson, 2020).

Our multi-institutional study addresses questions educators have posed since the beginning of the COVID-19 pandemic. With the increase in remote learning, instructors have noted a need for best practices based on theory (Daniel et al., 2021; Gordon et al., 2020). This study provides insights into how emerging technology and teaching methods can align with an existing theoretical framework (Daniel et al., 2021; Gordon et al., 2020). Our adaptation of an existing curriculum framework could be used as a foundation for developing such “best practices”. In addition, our study provides perspectives from 10 institutions and highlights the potential for cross-institutional communication and collaboration. Whereas one systematic review on undergraduate medical education’s response to COVID-19 noted that most educators tend “to face inward” and multi-institutional studies are rare, our research focuses on how one set of materials can be adapted to fit the goals of many institutions, if instructors apply the concepts of the curriculum framework (Stojan et al., 2022).

Our study has limitations. First, our study population is limited to educators who inquired about using the M&E videos. We did not systematically find all educators who used the videos after discovering them online in the public domain. Second, we did not collect course evaluation data from our participants. However, our study’s aim was to capture the educators’ experience and not to evaluate course success. To help guide instructors in the post-pandemic environment, we focused solely on the educators creating the teaching, not the recipients of the teaching. It may be valuable in future studies to see if students and instructors perceive the education goal of online videos in the same way.

Conclusion
In our study, we found successful integration of external videos into a health professions course is associated with educators who view curriculum design as inter-related elements. When these elements are consistent, educators perceive that their integration of online videos into their curriculum was successful. Consistency between curricular elements seemed to be occur when institutions enabled instructors to teach concepts instead of pressuring them to teach content. It is important for educators to articulate their aspirations for their students deliberately, so that these goals become the foundation for other curricular elements. Our study also highlights the need for institutions to support curricular development by allowing the use of outside resources and allocating time for training educators who will lead successful blended learning courses with effective online video integration.

Data availability
The data supporting this study is stored on a secure server and only accessible by the research team as described in the data handling requirements approved by the Stanford University Institutional Review Board. The data are not publicly available due to their containing information that could compromise the privacy of research participants. De-identified data are available on request from the corresponding author, KZA, if for the purposes of further research. In the request, please include the reason for requesting data, plans for analysis, and contact information.
Appendix 1: Interview Guide

Introduction: 5 years ago, the Robert Wood Johnson Foundation funded a collaborative project between 5 medical schools to develop a core curriculum for microbiology and immunology with flexible components that could be implemented at each of the schools and freely shared with other schools. The schools involved were Stanford, Duke, UCSF, University of Washington, and University of Michigan, and 4 of these schools implemented this newly developed curriculum at their schools, but each in their own unique way. We also ended up distributing the curriculum content to many schools across the country and world.

Now, we are interested in understanding how different programs (not the original four institutions) implemented this set of videos into their curriculum, and what we can learn from their experiences.

• **Why** were you initially interested in using the RWJF material?
  ◦ Were you actively searching for material, or were you presented with it?
  ◦ Were there any barriers to “buy-in” from the administration or faculty?

• **What:** Which parts of the material did you use?
  ◦ Were there specific modules or topics you use?
  ◦ Did you use only videos?
  ◦ Did you use question banks or in-class interactive discussion templates?

• **How:** Can you walk me through the thought process you used to apply these materials to your curriculum?
  ◦ Did you have a teaching philosophy that led you to use the material?
  ◦ Did you have specific learning goals for the course?
  ◦ Were you designing a new course or integrating into an existing curriculum?
  ◦ Some schools chose to structure the content of their class by introducing basics--such as a unit on bacteria, unit on viruses, fungi--and then delving into units on organ systems. How did you structure the course? Did you use units/modules?
  ◦ Did you use other types of media such as textbooks, online discussions, games?
  ◦ How did you approach providing feedback to students regarding their learning and performance?

• **How:** If everything was implemented perfectly, what would a student’s experience of the class be like?
  ◦ What did they do outside of class?
  ◦ Outside of class, what was important… self-paced learning, a variety of media, online interaction?
  ◦ What was your goal for them to experience in class?
  ◦ Did you emphasize… interactive learning, collaboration, problem solving, real-world scenarios?
  ◦ Was there a way for students to see how far along they were in the context of the entire course?
  ◦ How did the videos help you achieve your goals?

• **How:** Did you feel like your course was successful?
  ◦ What did success mean to you? Did your students learn? Did you feel like you implemented your vision to the students?
  ◦ How did you assess student learning and success of the course?
  ◦ Did you try to specifically measure any changes that resulted from the course or the videos? Examples include… exam scores, class attendance, student feedback, faculty feedback
  ◦ What was your feedback from students?
  ◦ What was your feedback from faculty?

• **Who** was involved in this design and implementation?
  ◦ Did it involve… course directors, instructional designers, education specialists, medical students, educational technical staff?
  ◦ What resources were required to put together this course?
Open Peer Review

Current Peer Review Status: 

Version 2

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Barbara Anne Jennings
Norwich Medical School, University of East Anglia, Norwich, UK

The authors have responded thoroughly to the reviewer comments and documented the amendments in their responses to reviewers. Thank you very much, I enjoyed reading this article again about how and why educators use short open-source animated videos in their lessons. The article (with direct links to the open-source resources) will be of great interest to colleagues who curate and use online learning objects within their curriculum, and to others who are focused on principles of instructional design.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Technology enhanced learning and faculty development.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 04 October 2022

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Ken Masters
Medical Education and Informatics Department, College of Medicine and Health Sciences, Sultan Qaboos University, Muscat, Oman

The authors have addressed all of my concerns, and I am happy to approve this version of the
The authors present an interesting qualitative study about the way educators used short open-source animated videos which had been described in a previous evaluation article (Adam et al., 2017 - cited in the introduction of this manuscript; and the videos can be found here). There were some unique and important aspects to this analysis – for example, the focus was on what the educators' intentions and actions were. In addition, the themes that emerged were analysed with respect to an established framework for an integrated health professions curriculum (Lee et al., 2013 – cited in the article).

The introduction, methods, results, and discussion sections are written clearly and are complemented by a useful table and illustration of the thematic analysis. In the introduction, the authors explore the impact of the pandemic on practice for online learning (with useful citations including a BEME guide) – the focus on video resources that can be used for active learning within the curriculum and (intentional) instructional design principles make this a good read for anyone interested in asynchronous online teaching.

In the methods section, the recruitment and (semi-structured) interviewing of 10 participants (who lead microbiology or immunology curricula in US medical schools) are described along with the thematic analysis. However, more detail in the methods and results sections would allow a more thorough understanding of the study and its findings.

Please could the authors consider the following queries about the Methods section:

1. How did the authors select the ten study participants? Could you elaborate on this in the methods section: “We selected participants from educators who requested access to our open-source M&I videos and formally agreed to be contacted in the future. We emailed the educators...”
directly to ask about participation in our study.”?

2. Could you link the interview documentation to the manuscript? For example, this could be the list of open-ended questions or the interview guide that was piloted and refined. Please could the authors consider the following queries about the Results section:

1. In the data analysis section, the authors state “The key themes were reviewed and refined until team consensus was reached.” Could this have been explained in more detail in the themes section of the Results?

Ideally, the full data set or metadata would be shared, as described in this F1000 guide, but I note (in the data availability section) that this would not fit with the data handling requirements approved by the Institutional Review Board, and that anonymised data is available on request.

Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Not applicable

Have any limitations of the research been acknowledged?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Technology enhanced learning and faculty development.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

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**Author Response 23 Aug 2022**

**Kelly Aluri**, Stanford University School of Medicine, Stanford, USA

Thank you for reviewing our paper and for your detailed, constructive feedback. We clarified the following information in our Methods and Results sections:
We added some clarifying information about our participant recruitment process:

“We recruited participants from educators who requested access to our open-source M&I videos and formally agreed to be contacted in the future. We emailed all educators who requested access to the videos directly to ask about participation in our study. Ten educators agreed to participate in the study. We verified that these ten participants were instructors or course directors of a microbiology and/or immunology course at an accredited U.S. medical or osteopathic school.”

2. We added the interview guide in Appendix 1 to provide more context on our semi-structured interview questions. While not all questions were asked and some new questions arose during each interview, this provided a way for each interview to address our core research questions.

3. To clarify our key themes in the discussion we clarified:

“We organized the key themes discussed in this section around a conceptual framework for curriculum development (Lee et al. 2013).”

**Competing Interests:** No competing interests were disclosed.

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Reviewer Report 20 July 2022

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Ken Masters

Medical Education and Informatics Department, College of Medicine and Health Sciences, Sultan Qaboos University, Muscat, Oman

The paper describes a qualitative study regarding the use of videos in microbiology and immunology classes given during the pandemic.

Overall, the study has been well-conducted and the results well-presented. There are a few issues that do need to be addressed, but I think that these will be done relatively easily.

- “To extract lessons to inform the post-pandemic medical education environment, we evaluated how educators from different institutions used an identical set of online medical education videos.” - This sentence comes too early, as the Introduction is still discussing the background, and this sentence is already describing what the researchers did. In fact, that sentence and quite a bit of the information in the Introduction needs to go into the Methods, especially material from the last paragraph of the Introduction. In addition, if copyright permits, it would be a good idea to replicate the model from Lee et al., otherwise readers have to go to that paper to familiarise themselves with it. (The description of the model given in this
paper is really not enough. I realise that the authors have provided their Figure 1, but because it does not match the original model exactly, a view of the original model will be useful for the reader).

○ A link to the video site would be useful (and also good advertising for the site :-).

○ “The Institutional Review Board at Stanford University approved our study” - It is generally considered standard practice to supply the reference number, so, please do so here.

○ “While Nvivo is a proprietary software, the same analysis can be conducted using open source software such as FreeQDA and QDA Miner Lite.” - I think it would be best to remove this sentence. Firstly, it is not necessary, and, secondly, as much as I like using QDA Miner Lite, there are some things that it cannot do (e.g. add new data iteratively).

○ It would also aid the readers if the authors could have a separate Conclusion (as they have in the Abstract).

○ The final paragraph/Conclusion also ignores an important overall finding. Although time is an issue (as the authors have correctly identified), the problem appears to be broader than that and is related to overall institutional support. The first two quotations given in Dimension 4 are crucial: (1) having institutions/faculty acknowledge that maybe, people in other institutions are better-resourced to create better-quality materials, and (2) balancing editing against original creation. So, the Conclusion does need to identify that overall institution support (including swallowing one’s pride) is required.

Minor:
○ “in 9 different states” - Generally, numbers less than 10, when used in a sentence, are written out in words.

So, overall, a good and useful study and paper, with a small amount of work required. If the issues are addressed, I will happily change my rating to “Approved”.

Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Not applicable

Have any limitations of the research been acknowledged?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
No source data required

Are the conclusions drawn adequately supported by the results?  
Partly

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Online teaching and learning.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 23 Aug 2022  
**Kelly Aluri**, Stanford University School of Medicine, Stanford, USA

Thank you for reviewing our paper and for your detailed, constructive feedback. The following changes were made in response to your comments:

1. We moved some of the information from the introduction to the methods to provide more background in the introduction: “To extract lessons to inform the post-pandemic medical education environment, we evaluated how educators from different institutions used an identical set of online medical education videos.”

2. We added a link to the YouTube channel that currently houses the videos.

3. We agree that seeing Lee et al.’s original figure would provide the most context but we will not directly use the image for copyright reasons. We provided more explanation of their original figure in the Methods.

4. The IRB protocol number was added to the Methods.

5. We removed the statement about NVivo alternative softwares.

6. We made our final paragraph a conclusion section, and emphasized the finding that institutions should support curricular development by supporting the use of outside resources and allocating time for training educators.

**Competing Interests:** No competing interests were disclosed.