QUESTIONS FOR ESCAPE:

- Does Approach section (including Table 1) adequately communicate what we did?
- Does Theoretical Framework portion seem contrived?
- Suggestions to make more relevant to other institutions and of interest to Academic Medicine?

Specifications:
Word count 2,000
Abstract 300 words
Up to 3 exhibits
Up to 10 references

TITLE: Transforming a Pre-Clerkship Curriculum to the Virtual Learning Environment in the Time of COVID-19

PROBLEM

The COVID-19 pandemic disrupted every facet of life worldwide, including the complex and critical domain of medical education. As the pandemic progressed, medical education leaders rapidly overhauled multi-year curricula to ensure continued learning and milestone achievement while also promoting student, faculty, staff and patient safety. While all aspects of undergraduate medical training were affected, clinical rotations, which generally needed to occur in-person, rebounded most quickly as information about COVID-19 grew and adequate personal protective equipment became available. Classroom learning, however, could feasibly continue virtually, and so, consistent with most other educational institutions, classroom teaching in medical schools was transitioned to a “virtual learning environment” (VLE) nationwide. Students and teachers struggled to adapt to this new learning environment, and it rapidly became clear that simply shifting existing curricular materials and approaches to the VLE would be ineffective. Rather, curricular adaptation and even redesign was needed.

At the University of California, San Francisco - School of Medicine (UCSF-SOM), we followed a theory-informed rigorous process involving multiple stakeholders to adapt our curriculum to meet the challenges of the COVID-19 pandemic. Separate efforts were undertaken for the three primary phases of our curriculum: Foundations 1 (predominantly classroom-based pre-clerkship phase), Foundations 2 (clerkship phase, predominantly workplace learning) and Career Launch (post-clerkship phase, predominantly workplace setting). In this Innovation Report, we present efforts to adapt Foundations 1, a highly condensed 18-month pre-clerkship curriculum that includes 3 longitudinal, integrated elements (foundational sciences, core inquiry curriculum, and clinical microsystems clerkship). While the pandemic is improving throughout much of North American, we seek to share our process to guide
response to future pandemics and to promote scholarly discussion regarding the role of virtual learning in medical education going forward.

**APPROACH**

**Working group formation and membership:** As social distancing and gathering restrictions were rapidly mandated during the first weeks of the pandemic, we abruptly transitioned the curriculum to a VLE. To provide a more orderly approach moving forward, in early April 2020, UCSF-SOM curriculum leadership formed a working group of faculty, staff, students and technology steward stakeholders with a charge to provide recommendations for virtual learning that promoted effective, engaging learning that maintained a positive learner experience, promoted community development and professional identity formation, and maintained respect for personal boundaries.

**Process and principles:** The working group developed and followed a rigorous process (Figure 1A) framed around pedagogy (large group, small group, laboratory, clinical skills), student and faculty development, and social experience and community development. We also developed guiding principles upon which we based recommended best practices and templates for specific learning settings (Figure 1B). The “three E’s” were considered most pressing: equity, engagement, and effectiveness. Stakeholders reported that threats to these principles already existed in the curriculum but were at risk of being amplified by the pandemic and the VLE.
Theoretical frameworks: We discussed theoretical frameworks to inform our work and identified two as most relevant. We considered sociocultural learning theory as important because remote learning could interfere with engagement and building communities of practice and further exacerbate potential inequities in learning, professional identity development and academic progress; this was of particular concern for the incoming MS1 class. We also considered cognitive load theory (CLT) as relevant because the screen-based nature of the VLE contributes extraneous cognitive load (e.g., Zoom fatigue, technology limitations) and places learners at high risk of cognitive overload.

Curricular adaptation: The Foundations 1 phase of our curriculum includes several different elements, each of which required specific adaptations to promote effective teaching and learning within the VLE (Table 1).
<table>
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<th>Table 1. Summary of curricular adaptations.</th>
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<td><strong>Element</strong></td>
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<td><strong>Large group didactics</strong></td>
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<td><strong>Small group discussions</strong></td>
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<td><strong>Anatomy lab</strong></td>
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<td>Clinical skills and quality improvement</td>
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**Technology implementation:** The technology team identified potential solutions to support effective remote learning and that aligned with guiding principles. We utilized Zoom as our primary technology platform, leveraging features to promote active learning, including breakout rooms, polls, annotation, whiteboards, and screen sharing of cloud-based collaborative documents. We established 70 standardized accounts used exclusively for curricular sessions; the standardized settings promoted effectiveness and equity of student experience. An artificial intelligence system (otter.ai) provided real-time transcripts. Lectures were recorded and posted for student viewing within minutes of session completion. Students were provided with personal Zoom accounts which they could use for both school and personal purposes.
Faculty, staff and student development: We communicated formatively with stakeholders primarily during scheduled leadership meetings (which included faculty, staff and student representatives). Summative recommendations were disseminated in a formal report in July 2020. Course leaders were tasked with orienting their respective faculty and staff to VLE principles and recommendations. Students were oriented separately. Students, faculty and staff were offered skill-building sessions focused on Zoom essentials, polling, breakout rooms, engagement, collaboration, and humanizing the remote learning experience (sessions were mandatory for those with high-intensity teaching roles). We trained volunteer student leaders to serve as technology stewards. We linked VLE practices with skill-building for telehealth.

Assessment: Summative assessment data derived from course evaluations. Formative assessments were performed via surveys and focus groups. We also received ad hoc feedback during leadership meetings, via email, and via a student web-portal.

OUTCOMES

Student perspectives: In a formative student survey administered in September 2020, 45% of 124 respondents reported that virtual learning was very or extremely effective, and 49% indicated that it was moderately effective. However, only 52% indicated they enjoyed virtual learning (64% of MS2 class, 44% of MS1 class). 68% of MS2’s reported virtual learning was somewhat or much worse than before COVID. Qualitative themes arising from the survey and from focus groups were both positive and constructive. Benefits included the chat moderator, indicating pronouns on Zoom, use of active learning technology tools, and captioning and transcription. Challenges cited included access to adequate technology and bandwidth, lack of social and community-building activities, and Zoom fatigue.

Course ratings: Average course rating did not differ comparing pre-COVID in-person learning (seven courses, average 4.14, 1-5 scale) and during-COVID virtual learning (seven courses, average 4.12, 1-5 scale).

Examination performance: Examination performance did not differ comparing pre-COVID learning (97.8% pass rate out of 2,177 student examinations) and during during-COVID virtual learning (97.9% pass rate out of 2,426 student examinations).

NEXT STEPS

- Brief summary
- Lessons learned to inform in-person learning and for future pandemics
  - Sociocultural learning theory lens
    - More intentionally promote social formation, especially early in the MS1 year
    - Promoting greater enjoyment of virtual learning (example of anatomy labs)
    - Promoting relationship development with faculty
    - Empowering students to take charge of SG learning
  - Cognitive load theory lens
    - Benefits of technology for reducing intrinsic load, promoting germane load
      - Chat moderator
      - Annotation, polls, other active learning
Impact of Zoom fatigue on extraneous load
Providing tech training to reduce extraneous load

The need to reframe approach to curricular change: be more nimble, more active, more bold to promote positive change even in absence of pandemic – focus on the “3 E’s”