Uncomposed, edited manuscript published online ahead of print.

This published ahead-of-print manuscript is not the final version of this article, but it may be cited and shared publicly.

Author: Frankl Susan E. MD; Joshi Ashwini; Onorato Sarah; Jawahir Gilianne L. MHA; Pelletier Stephen R. PhD; Dalrymple John L. MD; Schwartz Andrea W. MD, MPH

Title: Preparing Future Doctors for Telemedicine: An Asynchronous Curriculum for Medical Students Implemented During the COVID-19 Pandemic

DOI: 10.1097/ACM.0000000000004260
Preparing Future Doctors for Telemedicine: An Asynchronous Curriculum for Medical Students Implemented During the COVID-19 Pandemic

Susan E. Frankl, MD, Ashwini Joshi, Sarah Onorato, Gilianne L. Jawahir, MHA, Stephen R. Pelletier, PhD, John L. Dalrymple, MD, Andrea W. Schwartz, MD, MPH

S.E. Frankl is assistant professor, Department of Medicine, Beth Israel Deaconess Medical Center, and associate director of clinical faculty development, Harvard Medical School, Boston, Massachusetts.

A. Joshi is a fourth-year medical student, Harvard Medical School, Boston, Massachusetts; ORCID: https://orcid.org/0000-0002-5522-9668.

S. Onorato is a fourth-year medical student, Harvard Medical School, Boston, Massachusetts; ORCID: https://orcid.org/0000-0002-3505-2746.

G.L. Jawahir is educational quality improvement coordinator II, Office of Educational Quality Improvement, Harvard Medical School, Boston, Massachusetts.

S.R. Pelletier is senior project manager, Office of Educational Quality Improvement, Harvard Medical School, Boston, Massachusetts.

J.L. Dalrymple is associate dean for medical education quality improvement, and associate professor of obstetrics, gynecology, and reproductive biology, Harvard Medical School, Boston Massachusetts; ORCID: https://orcid.org/0000-0001-5183-1937.

A.W. Schwartz is assistant professor, Department of Medicine, Division of Geriatrics and Palliative Care, VA Boston Healthcare System and New England Geriatrics Research Education and Clinical Center, and Brigham and Women’s Hospital, Harvard Medical School, Boston, Massachusetts.
Correspondence should be addressed to Susan E. Frankl, Beth Israel Deaconess HealthCare: The Street, 25 Boylston Street, Suite 204, Chestnut Hill, MA 02467; telephone: (617) 754-0400; email: sfrankl@bidmc.harvard.edu.

Supplemental digital content for this article is available at http://links.lww.com/ACADMED/B149.

Acknowledgments: The authors wish to thank Drs. Catherine Dawson, William Kettyle, Todd Griswold, Swathi Damodaran, Alexandra Hovaguimian, Arun Ramappa, Elizabeth Pingree, Beth Harper and her daughter Ingrid, and Alexandra Chabrerie for writing and recording the video vignettes to demonstrate specific specialty skills via telemedicine examples; Agnieszka Jackson for expert administrative assistance in bringing together so many moving parts; New England Clinical Skills Consulting for providing the standardized patients in the video vignettes; and the talented individuals of the HMS Media Services, Michael Mascheri and Nestoras Nestoros, for all their support in bringing this course to life.

Funding/Support: Harvard Medical School receives funding from the American Medical Association, which provides support to the Standardized Patient Program. Some of this material is the result of work supported with resources and the use of facilities at the Boston Veteran’s Affairs Healthcare System (VA) and New England Geriatrics Research Education and Clinical Center. The contents do not represent the views of VA or the United States Government.

Other disclosures: None reported.

Ethical approval: The anonymized course evaluation materials were approved by the HMS Program in Medical Education Educational Scholarship Review Team as a quality improvement study and thus exempt from full institutional review board review.
Written work prepared by employees of the Federal Government as part of their official duties is, under the U.S. Copyright Act, a “work of the United States Government” for which copyright protection under Title 17 of the United States Code is not available. As such, copyright does not extend to the contributions of employees of the Federal Government
Abstract

Problem
The COVID-19 pandemic led to changes in both the clinical environment and medical education. The abrupt shift to telemedicine in March 2020, coupled with the recommendation that medical students pause in-person clinical rotations, highlighted the need for student training in telemedicine.

Approach
To maintain students’ ability to participate in clinical encounters and continue learning in the new virtual environment, a telemedicine curriculum for clinical students was rapidly developed at Harvard Medical School (HMS) focusing on the knowledge and skills needed to conduct live video encounters. Curriculum leads created an interactive, flexible curriculum to teach students clinical skills, regulatory issues, professionalism, and innovations in telemedicine. This 5-module curriculum was delivered using various primarily asynchronous modalities including webinar-style presentations, pre-recorded videos of physical exams from different disciplines, shadowing a synchronous telemedicine visit, peer discussions in small groups, and quizzes with both multiple-choice and open-ended questions.

Outcomes
During May 2020, 252 clerkship and post-clerkship medical students at HMS completed the telemedicine curriculum. All students completed a pre-course survey and 216 (85.7%) completed the post-course survey. Students’ self-rated knowledge of telemedicine increased, on average, from 38 (15.1%) reporting being fairly/very knowledgeable over 4 domains before the course to 182 (84.3%) afterward (P < .001). The course was highly rated, with 176/205 (85.9%) students reporting that it met their learning needs and 167/205 (81.5%) finding the delivery methods to be effective. Of 101 (45.3%) students who answered an open-ended post-course survey question, 91
(90.1%) reported asynchronous learning to be a positive experience.

Next Steps

As telemedicine becomes increasingly and likely permanently integrated into the health care system, providing medical students with robust training in conducting care virtually will be essential. This curriculum provides a promising and feasible framework upon which other schools can apply these emerging competencies to design their own telemedicine curricula.
Problem

The COVID-19 pandemic prompted many clinicians to begin conducting synchronous telephone or video visits. Including medical students in synchronous ambulatory telemedicine visits has become an essential modality for their clinical learning. Given the high degree of patient satisfaction and convenience associated with virtual visits, this model of care is likely to become increasingly integrated into the health care delivery system, necessitating teaching telemedicine skills at all levels of medical training.

Despite the 2016 American Medical Association recommendation for telemedicine instruction at all levels of physician education, many U.S. medical schools offer neither preclinical or clinical training in telemedicine. Among the subset of medical schools offering telemedicine training, few have publicly accessible information about their curricula or methodological effectiveness. An urgent need exists to expand telemedicine education, supported by significant medical student interest in formal training to obtain skills necessary to conduct these visits.

On March 17, 2020, the Association of American Medical Colleges released its first set of guidelines strongly supporting a pause on all medical student clinical rotations to ensure the safety of both students and patients. Due to these changes in medical education, as well as the rapid adoption of telemedicine use during the COVID-19 pandemic, including students in synchronous ambulatory telemedicine visits has become an essential modality for students’ clinical learning. This gap, combined with a lack of medical education experience in teaching synchronous video visit skills, necessitated the rapid development of a clinically relevant, timely telemedicine curriculum for students.
Approach

Given the urgent need to train all clerkship and clinical elective students in telemedicine visits, on April 13, 2020, we began developing a curriculum focused on knowledge and skills needed to conduct live video encounters for students in clinical clerkships and clinical electives at Harvard Medical School (HMS). It was deployed on May 4, 2020. Students had 4 weeks to complete the course. The HMS online learning management platform, a customization of Canvas (Instructure, Salt Lake City, UT) was used to rapidly deploy a curriculum that could be implemented asynchronously, thus reaching students at different levels of training who were simultaneously also engaged in coursework and clinical rotations in a wide variety of specialties. The innovative use of embedded reflection questions, quizzes, and novel videos with faculty demonstrating telemedicine skills created active student engagement. Consistent with adult learning theory in medical education, objectives and assignments targeted learning behaviors associated with increasingly higher levels of Bloom’s taxonomy as students progressed through the modules (Table 1).

We consulted with local clinical and academic telemedicine experts as well as HMS curriculum faculty leaders to develop the learning objectives, which were used to create a curricular map (Table 1). In addition, 3 students served as advisors to the faculty course director, providing the student perspective on important learning goals. To our knowledge, prior to COVID-19 the literature on telemedicine teaching strategies reported few details of curricular efforts in this domain, despite a recent increase of relevant work.

The curriculum was presented in 5 separate modules to allow students flexibility to proceed through materials at their own pace, while engaged in other remote coursework. The overarching curricular goal was to provide all medical students engaged in clinical learning with the foundational knowledge required to successfully engage with their faculty and patients, to
continue developing their clinical skills using remote encounters. The first 2 modules introduced telemedicine and its role during the pandemic, as well as best practices for setting up a telemedicine visit with a patient. Module 3 focused on history-taking and physical exam skills through interactive recordings of standardized patient telemedicine visits across different specialties that addressed several key clinical questions (Table 2). Given the wide range of learners from early clerkship to advanced elective levels, links for supplemental clinical resources were provided and questions were presented to challenge the students’ clinical reasoning and documentation skills. Each vignette also included personal reflections from the faculty.

For students to apply concepts covered in the first 3 modules, module 4 required observation and reflection on at least 1 synchronous telemedicine visit, using a framework for recording student observations and a set of reflection questions to consider (see Supplemental Digital Appendix 1, at http://links.lww.com/ACADMED/B149). Most clerkship students observed their longitudinal primary care clerkship preceptor. To expose students to the breadth of clinical skills needed in different virtual patient encounters, additional faculty from a various specialties were recruited to participate as preceptors. For module 5, students were placed in small groups to share their observation experiences with peers who observed different specialties. Each group collectively authored a 3-page paper addressing potential solutions to 1 of 5 current challenges in providing care through synchronous telemedicine visits (Table 1).

At the start of the course, each student was required to complete a pre-course survey, administered online via the course platform immediately before the course. Eight questions in the pre-survey gathered demographic information and evaluated self-assessed baseline knowledge and self-efficacy in telemedicine. The 12 anonymized post-course survey questions were administered immediately at course completion and also accessed through the online course
platform. These questions were designed to align closely with the learning objectives (Table 1) and enable assessment of any change in students’ self-efficacy and knowledge in conducting telemedicine visits as well as engagement in each module (Table 3).

The pre- and post-course surveys were approved by the HMS Program in Medical Education Educational Scholarship Review Team as a quality improvement study and thus exempt from full institutional review board review. Statistical analysis was conducted using SPSS statistical software, version 27 (IBM Corp., Armonk, NY). Z-tests for proportion were run on the aggregate data. In addition, we conducted a qualitative analysis of anonymized free-text responses. One author (S.F.) coded themes in free-text response answers regarding the course’s asynchronous format. Two authors reviewed the final assignment topics (S.F., A.W.S.).

Outcomes

Participants in the new HMS curriculum were 252 students: all 167 students in the clerkship year (66.3% of participants); and 85/178 eligible post-clerkship students (HMS years ≥ 3) (33.7% of participants) who participated electively. All students completed a pre-course survey; the post-course survey was completed by 216 (85.7%). Pre- and post-course survey results are reported in Table 3. The learning objectives of modules 1–3 were assessed by querying student self-rated agreement with several statements (see Table 3). On average, students’ self-assessed knowledge over 4 domains increased: 38 (15.1%) reported being fairly/very knowledgeable before the course and 182 (84.3%) afterward (P < .001). The post-course survey recorded students’ assessment of delivery method effectiveness, whether their learning needs were met, and if the material was engaging (Table 3).

Nearly half of students (101/216, 46.8%) responded to an optional open-ended question about the course’s strengths and weaknesses, and 91 (90.1%) made positive comments; for instance, “The videos of the simulated visits were fantastic. It was great to have faculty in different areas
of medicine run visits for their particular specialty.” Support for the course’s efficacy was further demonstrated in comments such as, “I will definitely be using some of the lessons from these videos moving forward.” Students also indicated enjoying other innovative aspects of the course such as the asynchronous format, which allowed self-paced and self-directed work plus flexible scheduling. Another student wrote, “I think that the most useful things were the observation of a telemedicine visit and then being able to discuss those as we all had different experiences and could learn from each other.” When asked for suggestions about course improvement, one student noted, “It would be helpful to have discussion/examples that show work with interpreters and/or patients who have challenges with technology/access.” Students also mentioned they would have welcomed an opportunity to practice telemedicine visits with peers, faculty, or patients beyond the single observation session.

In module 4, 92.9% of students (234/252) who completed the telemedicine observation submitted information about their observed preceptor’s specialty. These were 119/234 (50.9%) from adult primary care, 26/234 (11.1%) from internal medicine specialties, 23/234 (9.8%) from pediatrics, 23/234 (9.8%) from neurology, 16/234 (6.8%) from surgery, and the remaining 27/234 (11.5%) from other specialties. A total of 209 individual faculty precepted telemedicine visit observations. These data demonstrate that faculty from a wide variety of disciplines volunteered to teach in this online telemedicine curriculum. The high level of student self-reported learning and satisfaction reported above indicates student satisfaction with multidisciplinary faculty participation. These observations support the conclusion that faculty across specialties may serve as effective telemedicine preceptors and that the medium and the content are applicable to the major clinical disciplines.
Students were divided into 64 groups of 3 or 4 for module 5. Each group worked collaboratively to write the final reflection paper on a topic chosen from 5 potential prompts (Table 1). All 64 groups (100%) completed this assignment. Although all topics were chosen, the most popular topic was “health disparities in telemedicine,” selected by 21/64 (32.8%) of the groups. These students applied concepts of geographic and socioeconomic disparities to telemedicine, exploring the potential to address problems or to worsen gaps in care delivery. Groups presented innovative solutions to address the potential impacts of telemedicine in each of the topic domains. (see student responses in Supplemental Digital Appendix 2, at http://links.lww.com/ACADMED/B149).

Next Steps

This innovative course demonstrates that an asynchronous telemedicine curriculum offers a promising and scalable approach to rapidly teach medical students key aspects of telemedicine, a skill now critical for all physicians. Although designed and implemented at a single medical school, it offers a generalizable mechanism for disseminating telemedicine knowledge and skills to medical students learning remotely or for learners pursuing an elective independently. Key lessons include the ability to cover a wide breadth of skills-based material with practical video recordings, as well as the flexibility of an online asynchronous modality conducive for students with competing academic demands. Providing a sequenced and logical approach to telemedicine added to students’ self-reported learning, allowing immediate application of new concepts to an authentic clinical learning environment.

Next steps for this curriculum include potential improvements for future iterations of the course and anticipated applications for future students and faculty. For instance, students could conduct the virtual visit with faculty supervision and feedback and solicit reflections from others involved in the encounter, including patients, caregivers, or other members of the care team. In
addition, the creation of virtual telemedicine objective structured clinical examinations (OSCEs) may serve as a formal assessment tool to objectively evaluate curricular effectiveness and as a means to ensure students are evaluated systematically in developing telemedicine competencies. A pilot of such a virtual OSCE shows promising results in which students could successfully demonstrate telemedicine skills within a simulated setting.

Where telemedicine instruction is best positioned across a 4-year medical school curriculum in relation to a pandemic is a key question. Ideally, students will learn telemedicine skills in step with foundational clinical skills, building proficiency and facility with virtual care delivery as they move through their education. At HMS, our curriculum committee plans to integrate telemedicine instruction across the 4-year course of study. Future courses should build on telemedicine’s advantages for student learning: fostering longitudinal relationships with patients, building skills in motivational interviewing and patient counseling, and close follow-up and in-home care for chronic disease management.

As the popularity and novelty of this course reached the larger HMS education community, faculty requested information on how best to integrate students into their telemedicine visits. We have developed virtual faculty development sessions (e.g., “Making the Most of Telemedicine Visits with Students”) and widely disseminated a teaching tips sheet and checklist. Pairing these faculty development efforts with student education fills critical gaps and provides best practices to enable meaningful student engagement in telemedicine visits and optimize clinical instruction in virtual settings. Ultimately, acquisition of novel telemedicine clinical skills needed to ensure readiness of future physicians to care for patients in evolving clinical environments requires innovative approaches to curriculum, assessment, and faculty development.
References


9. Hovaguimian A, Joshi A, Onorato S, Schwartz A, Frankl S. 12 tips for clinical teaching with telemedicine visits. Med Teach. [Published online February 8, 2021.]

<table>
<thead>
<tr>
<th>Learning objectives: Upon completing this curriculum, medical students will be able to:</th>
<th>Curricular modules</th>
<th>Core curricular content</th>
<th>Pedagogy used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Recognize the ways that the COVID-19 pandemic has accelerated the adoption of telehealth modalities and be able to describe the benefits, challenges, and risks in the care of patients (Bloom’s taxonomy level: Understand)</td>
<td>Module 1: What is telemedicine and how has the landscape changed due to COVID-19?</td>
<td>• General concepts  • Advantages and challenges  • Regulatory issues  • Informed consent and ethical issues</td>
<td>• Pre-recorded webinar presentations  • Interspersed reflection questions  • Brief post-module quiz</td>
</tr>
<tr>
<td>2. Adopt best practices to set up telemedicine visits in which they will be able to participate as members of the care team including adhering to regulatory requirements and ensuring patient safety and excellent communication (Bloom’s taxonomy level: Apply)</td>
<td>Module 2: Setting up the visit</td>
<td>• Technical issues  • “Webside” manner  • Special considerations for patients with hearing, vision, and cognitive impairment</td>
<td>• Pre-recorded webinar presentations  • Interspersed reflection questions  • Brief post-module quiz</td>
</tr>
<tr>
<td>3. Select physical exam maneuvers that can be performed during video telemedicine visits in order to enhance clinical reasoning, and the development of an assessment strategy and plan (Bloom’s taxonomy levels: Apply, analyze, create)</td>
<td>Module 3: Conducting a history and physical over video</td>
<td>• 5 cases demonstrating specialty-specific telemedicine encounters across primary care/internal medicine, pediatrics, neurology, surgery, orthopedics, psychiatry</td>
<td>• Video recordings of standardized patient telemedicine visits  • Guided thought questions  • Interspersed multiple-choice and free response items  • Student review of faculty reflections on virtual visits</td>
</tr>
<tr>
<td>4. Analyze their experience(s) in telemedicine to develop recommendations and novel approaches for the challenges clinical care and educational when using telehealth modalities</td>
<td>Module 4: Observation of a telemedicine visit</td>
<td>• Observation framework  • Reflection questions  • Healthcare disparities  • Clinical best practices for virtual visits</td>
<td>• Observation of one synchronous telemedicine visit  • Use of framework for recording observations</td>
</tr>
</tbody>
</table>
Bloom’s taxonomy levels: Analyze, evaluate, create

Module 5: Small group discussions and final paper
Final paper topics
Telemedicine Impact on:
- Student relationships with preceptors and patients
- Medical education
- Healthcare disparities
- Best clinical practices
- Future trends in care delivery and physician careers

• Reflection questions
  - Group reflection on telemedicine observation with peers
  - Group paper outlining solutions to current telemedicine challenges
Table 2

Module 3 Curricular Content, From a COVID-19 Clinical Curricular Innovation at Harvard Medical School, 2020

<table>
<thead>
<tr>
<th>Video case description</th>
<th>Key clinical questions addressed</th>
</tr>
</thead>
</table>
| Primary care/internal medicine: 50-year-old man with abdominal pain | • How can a patient’s level of acuity be assessed virtually, including determining whether urgent in-person evaluation needed?  
• How can an abdominal exam be performed virtually? How does that compare with an in-person evaluation?  
• How can one effectively convey empathy in a virtual video visit?                                                                                                                                                                                                       |
| Pediatrics: 2-year-old child with a cough and accompanied by mother | • What are the benefits and challenges of video visits from a parent or caregiver perspective?  
• How can one build rapport over video with a parent? With a child?  
• What is the role of observation of the child and history-taking from the child during a pediatrics virtual visit?                                                                                                                                 |
| Orthopedics: 47-year-old man with shoulder pain after a fall | • How can one perform a shoulder examination over video?  
• How might a virtual visit impact the clinician-patient relationship?  
• When is it necessary to send a patient for radiologic imaging following a telemedicine video visit for a trauma-related injury?                                                                                                                                 |
| Neurology: 42-year-old woman with vertigo | • What components of a neurologic examination can be conducted during a virtual video visit? What are the best strategies to instruct patients to perform complex special exam maneuvers virtually?  
• How could evaluation of a patient be impacted by technical difficulty?  
• In what ways might language barriers influence care delivered through telemedicine, particularly for non-English speaking patients?                                                                                                                                 |
| Psychiatry: 32-year-old woman with increasing anxiety | • In what ways does a psychiatry telemedicine visit with an attending clinician, student, and patient differ from an in-person session?  
• How does precepting during a telemedicine visit affect the attending clinician-student relationship?                                                                                                                                 |
| Geriatrics: Video recorded lecture | • What strategies are available to provide care to a patient with hearing or visual impairment during a virtual visit?  
• How can one perform standardized assessments of cognitive function during a virtual video visit?  
• How can one assess a patient’s mood during a virtual visit?                                                                                                                                 |
Table 3
Telemedicine Course Evaluation: Pre- and Post-Course Surveys, From a COVID-19 Clinical Curricular Innovation at Harvard Medical School, 2020

<table>
<thead>
<tr>
<th>Questions</th>
<th>Responses reported</th>
<th>No. (%) pre-course (n = 252)</th>
<th>No. (%) post-course (n = 205–216)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-survey</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How would you rate your knowledge of how telemedicine is used for the delivery of health care?</td>
<td>Very or fairly knowledgeable</td>
<td>52 (20.6)</td>
<td>198/216 (91.7)</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>How would you rate your knowledge of the ethical concerns of telemedicine?</td>
<td>Very or fairly knowledgeable</td>
<td>34 (13.5)</td>
<td>184/216 (85.2)</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>How would you rate your knowledge of the laws that affect the use of telemedicine in Massachusetts since the COVID-19 pandemic?</td>
<td>Very or fairly knowledgeable</td>
<td>20 (7.9)</td>
<td>152/216 (70.4)</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>How would you rate your knowledge of all the steps that go in to conducting and documenting a telemedicine visit?</td>
<td>Very or fairly knowledgeable</td>
<td>46 (18.3)</td>
<td>193/216 (89.4)</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>What is your level of confidence in performing a virtual clinical visit using a telemedicine platform compared to an in-person visit?</td>
<td>Much more confident or more confident</td>
<td>52 (20.6)</td>
<td>190/215 (88.4)</td>
<td>&lt; .001</td>
</tr>
<tr>
<td><strong>Post-survey</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please rate the following statements on learning the telemedicine material: Material covered met my needs in telemedicine.</td>
<td>Strongly agree, agree</td>
<td>n/a</td>
<td>176/205 (85.7)</td>
<td>--</td>
</tr>
<tr>
<td>Please rate the following statements on learning the telemedicine material: This delivery method was an effective way to learn the material.</td>
<td>Strongly agree, agree</td>
<td>n/a</td>
<td>167/205 (81.5)</td>
<td>--</td>
</tr>
<tr>
<td>Did your completion of this curriculum provide you with new information you can use to improve your skills in providing patient care through telemedicine?</td>
<td>A great deal, somewhat</td>
<td>n/a</td>
<td>189/217 (87.1)</td>
<td>--</td>
</tr>
<tr>
<td>Did your completion of this curriculum provide you with new information you can use to engage with</td>
<td>A great deal, somewhat</td>
<td>n/a</td>
<td>167/215 (77.7)</td>
<td>--</td>
</tr>
</tbody>
</table>
How engaging was Module 1: Telemedicine and how COVID-19 has changed the landscape? A great deal, somewhat n/a 188/216 (87.0) --
How engaging was Module 2: Setting up the visit? A great deal, somewhat n/a 196/216 (90.7) --
How engaging was Module 3: The history and physical? A great deal, somewhat n/a 198/216 (91.7) --
Using the framework and guiding questions presented, how much did observation (or participation) in a live telehealth visit add to your learning? A great deal, somewhat n/a 178/212 (83.9) --
How engaging was the small group discussion/reflective final assignment? A great deal, somewhat n/a 144/214 (67.3) --

Abbreviation: n/a, not applicable.

\(^a\)Unless noted otherwise, all survey questions used a 4-point Likert scale and results were calculated collapsing the top 2 response categories into a single point. The complete set of possible responses was: not knowledgeable at all, a little, fairly, or very knowledgeable; strongly disagree, disagree, agree, strongly agree; not at all, a little, somewhat, a great deal.

\(^b\)Post-course survey total respondents varied between 205–216 because not all students completed the survey nor answered every question.

\(^c\)This item was scored on a 5-point Likert scale: less confident, a little less confident, about the same, more confident, much more confident with more confident and much more confident responses collapsed into a single point.