










Best practices in online/distance pharmacy practice course didactic instruction

Dawn E. Havrda Pharm.D., FCCP | Andrew J. Crannage Pharm.D., FCCP  |
Angela L. Bingham Pharm.D., FCCP  | Kristen M. Cook Pharm.D.  |
Susan E. Hamblin Pharm.D.  | Andie E. Lloyd Pharm.D.  |
J. Russell May Pharm.D.  | Jessica R. Merlo Pharm.D.  |
Kaely G. Miller Pharm.D., MBA  | Christina A. Spivey Ph.D. 

American College of Clinical Pharmacy, Lenexa, Kansas, USA

Correspondence

American College of Clinical Pharmacy, 13000
W. 87th Street Parkway, Suite 100, Lenexa, KS
66215-4530, USA.
Email: accp@accp.com

Abstract

This commentary provides an overview of the current literature and best practices for online learning and assessment within the didactic curriculum of pharmacy education, building on the 2022 ACCP commentary addressing remote experiential learning. Lessons learned from online delivery of curricula and best practices for programs to create the optimal online learning environment for students are reviewed. Although benefits of online learning have been found, such as flexibility, convenience, and efficient use of time, with similar short-term student performance, the potential long-term implications on pharmacy students are not fully known, particularly concerning board pass rates, job attainment, and knowledge/skills application in the workplace. This commentary reviews and recommends the types of teaching modalities that align best with an online format for knowledge acquisition and student satisfaction. The most challenging part of didactic curricula to teach remotely is skills development. Proficiency in skills (e.g., compounding preparations or physical assessment) is best evaluated in person to promote student self-confidence in pharmacy practice and patient care. This commentary reviews the needed components for designing quality online courses, all in the context of remembering the significance of instructor engagement. The commentary also discusses the importance of bidirectional feedback for the instructor and student and the deliberate use of formative assessments of learning to gauge student performance. A review of online summative and high-stakes assessments is included with a focus on ensuring academic integrity while also minimizing any impact on student performance and anxiety. As pharmacy education has learned from the experiences with the COVID-19 transition to online learning, consideration should be given to best practices regarding when and how to use online modalities to teach students and foster student learning. Regardless of the

This document was prepared by the 2021 Educational Affairs Committee: Dawn E. Havrda, Pharm.D., FCCP, BCPS (Chair); Andrew J. Crannage, Pharm.D., FCCP, FNKF, BCPS (Vice Chair); Angela L. Bingham, Pharm.D., FCCP, FASHP, FASPEN, FCCM, BCCCP, BCNSP, BCPS; Kristen M. Cook, Pharm.D., BCACP; Susan E. Hamblin, Pharm.D., FCCM, BCCCP; Andie E. Lloyd, Pharm.D.; J. Russell May, Pharm.D., FASHP, FNAP; Jessica R. Merlo, Pharm.D., BCACP; Kaely G. Miller, Pharm.D., MBA; Christina A. Spivey, Ph.D.

Approved by the American College of Clinical Pharmacy Board of Regents on August 25, 2023.

format, courses should engage the student and instructor and be evaluated routinely to promote achievement of learning outcomes.

KEYWORDS

distance learning, online instruction, pharmacy education

1 | INTRODUCTION

Online learning in pharmacy education has increased over the past decade. The COVID-19 pandemic severely affected education across the globe. To protect the health of students, institutions discontinued typical face-to-face teaching and rapidly scaled-up a transition to online learning. Online learning is defined as learning that takes place over the internet. This may be part of blended or hybrid learning, which includes online and face-to-face instruction. Online learning may be synchronous, occurring in real time; or asynchronous, occurring with instruction from an earlier time.¹

The switch to online learning during the pandemic and its impact on pharmacy education and pharmacist performance in the long term has not been fully realized, particularly the impact on board pass rates, job attainment, or pharmacist knowledge and skills application in the workplace. Short-term outcomes of course performance and student preference have been reported. Evaluations of online learning during the pandemic have found benefits of more flexibility, improved use of time, student convenience, and more time for self-care, with similar academic performance.²⁻¹¹ Challenges noted with online learning included poor student time management, communication barriers, impaired communication skills development, technical obstacles, social isolation/lacking a sense of belonging, and lack of engagement within the activity/course with faculty and in the curriculum.^{4-8,12-14} Many students noted a preference for a hybrid of online and in-person teaching.^{5,6,15,16} With skills teaching and assessment, active learning, or team-based learning activities, student preference for learning varies, with recent literature noting in-person learning is preferred to virtual.^{10,12,17-19}

Given the increased use of online learning and considering practices for professional development of future pharmacists, it is important to understand what knowledge, skills, and behaviors within the pharmacy curriculum can be taught online and assessed while also recognizing the challenges students may encounter in remote learning environments and offering strategies to overcome the potential negative impacts. This paper provides best practices for online learning and assessment in the didactic curriculum of pharmacy education and the potential implications on pharmacy student outcomes. The best uses of online or remote learning in experiential learning were previously described in a 2022 ACCP commentary.²⁰

2 | BEST USES OF ONLINE LEARNING

Transitioning lecture content to an online platform is more straightforward than other teaching modalities. For example, in-person lectures

and learning were compared with online lectures and learning within a medical and pharmacy student course. Before the pandemic, the course was taught in person with a recorded lecture option and was moved to an online, virtual course during the pandemic. Examination scores were similar independent of the course delivery.¹¹ A systematic review and meta-analysis of synchronous distance education compared with in-person education in health science students found no difference in knowledge acquisition and greater student satisfaction with the online format.²¹

Problem-based learning (PBL) and small group discussion delivered online has been assessed in a few studies in the pharmacy education literature with mixed results. In these studies, online discussion resulted in lower participation/interaction with students than in person. A preference for face-to-face learning was discovered in some studies, and PBL scores after the session were higher in the face-to-face group. Students did feel they could adapt to online learning easily and appreciated a more blended learning approach.^{9,13,22} Virtual and in-person team-based learning (TBL) has been evaluated, with student preference toward face-to-face TBL. Students felt the in-person TBL was more effective for accountability, preparation, motivation, and team dynamics and engagement, as well as provided a better learning experience to allow application of knowledge.¹²

Other health professions literature reported that student perception of online learning during the pandemic was ideal for acquiring knowledge, but not effective for developing clinical, technical, and interpersonal skills.^{23,24} This perception led to a lack of self-confidence in students when caring for patients.²³ In the pharmacy literature, skills-based assessment in an online format has focused on objective structured clinical examinations (OSCEs) and interprofessional activities.^{2,3,8,10,19} One study compared student scores from a virtual OSCE with those from an in-person OSCE. The overall scores were similar between the groups on the assessment; however, there were small, but significant differences in some cases within the assessment. Students felt more prepared for the in-person OSCE, and the virtual group noted more technical challenges.⁸

A crossover study of pharmacy students in Australia evaluated virtual laboratories/modules compared with hands-on real laboratories. The laboratories involved specialized equipment that illustrated pharmaceutical concepts (rheology and surface and interfacial tension). The knowledge gained was similar between the virtual and hands-on laboratories. Students preferred the virtual modules for ease of understanding and acquiring background knowledge; however, they felt the hands-on laboratories were more interesting and helped more with understanding and remembering the concept.²⁵ There is a place for virtual laboratories or modules in acquiring the needed knowledge for skills, but it cannot replace hands-on learning when proficiency is

needed, such as with extemporaneous compounding of non-sterile and sterile products, physical assessment (i.e., taking blood pressure or heart rate), or demonstrating use of devices (i.e., use of glucometers, inhalers, and injectable dosage forms).^{25,26} A hybrid approach that combines online, self-paced modules to prepare for hands-on, in-person skills practice and proficiency would be preferred for skills that need to be reproduced in practice.

3 | DESIGNING QUALITY ONLINE COURSES

Designing a quality online course for pharmacy students involves key principles that can be applied to a variety of teaching modalities. The success of an online course relies on creating an accessible learning environment that appeals to the needs of a diverse student body. A key component in this design is creating an organized, typically modular, approach with clear expectations and learning objectives.²⁷⁻²⁹ Learning management platforms and syllabi should be easy to navigate yet comprehensive, providing a “home base” for academic and personal support. Syllabi and course pages should provide readily available information on contact information for course coordinators/instructors, technological support services, academic resources, and accessible mental health resources.^{27,29-31} Even if not routinely used, regularly scheduled, virtual office hours are useful in increasing faculty presence and encouraging interaction. Efforts should be made to show faculty involvement in the course because a visible commitment to student support is necessary for online course success.^{28,31,32}

In addition, in designing an online course for diverse learners, efforts should focus on presenting content in a way that enhances student engagement and learning. This involves creation of activities to present information in a variety of formats to engage students in self-directed, self-paced learning.^{27,31} Information can be presented synchronously or asynchronously to students through lectures (live or recorded), videos, articles, and podcasts, as well as include supplemental resources for gathering further information.^{27,33} Faculty should ensure that videos and other technology allow for closed captioning, changes in speed, and other needed mechanisms to maximize accessibility.²⁷ In addition, an online learning environment should lean into active learning despite potential challenges of employing traditional active learning strategies.³⁴ Synchronous online sessions can be used for real-time demonstrations, peer evaluations, team-building activities, and small group discussions.^{30,35} For these sessions, it is necessary to set clear expectations for participation requirements, including use of camera functions.^{14,27,29} Consider providing recordings for relevant portions of synchronous sessions to allow for self-paced viewing at a later time.³³ In asynchronous sessions, video recordings or virtual simulation software can allow for unique activities related to counseling, complex patient cases, and interprofessional education.

With different learning formats, instructors should be prepared to create assessments that align with the format to ensure appropriate evaluation and formative and summative measurements of learning.³⁰ High-stakes examinations, or assessments that determine a student's

outcome in a course, are more challenging in this environment and should be augmented with multiple, lower-stakes opportunities such as pre/post-activity reflections, scheduled weekly or modular quizzes, video-recorded encounters, and peer evaluations.^{27,28,30} To ensure the success of these assessment strategies, all assessments should be clearly mapped to learning objectives, and students should be provided rubrics and/or criteria on which they will be evaluated before the time of the assessment.^{27,28,30}

Finally, quality online courses rely on a culture of feedback and transparent incorporation of feedback.^{27,31} End-of-course evaluations, though helpful, but should not be the only mechanism of obtaining feedback. Courses should be designed to contain multiple channels for student feedback throughout the course and should be designed specifically to enhance engagement and ownership of learning.^{27,32} Students should also be given the opportunity to evaluate the effectiveness of course management and the workload associated with the course or select assignments.²⁷

4 | BEST PRACTICES IN ENGAGING LEARNERS

Strategies for engaged learning in the online setting and the expectations of faculty and students are described in Table 1. According to current literature and expert opinion from higher education, it is important to promote classroom engagement and collaboration, create balanced and inclusive learning opportunities, provide effective resources, and engage in assessment and two-way collaborative feedback.^{15,31,36-50} Although engagement may come in many different forms in pharmacy school, it is important to realize that no single approach will apply to all learners and a variety of formats should be used within a course and the curriculum. Consideration of the learner should be a primary focus as online formats are decided and designed. The instructor and students must be able to connect and communicate about their learning to allow for incorporation of individual learning preferences. Students need to be able to engage in the content individually, with their peers, and with the instructor to foster their learning, as well as have an opportunity to voice any concerns or questions to the online community. As the autonomy of students and their familiarity with their own learning process and online learning grows, the amount of faculty engagement required in a course will change.^{30,42} To ensure the success of all learners, the degree and expectations of virtual engagement should be made clear at the start of the course and documented in the syllabus. All students should feel a sense of trust with the instructor in order to engage in the online classroom, teaching activities, feedback sessions, and assessments of learning.³⁸

5 | ONLINE ASSESSMENT

Best practices for online high-stakes assessment have not yet been established, but there are several factors that instructors should

TABLE 1 Best practices for engaged learning in the online setting and faculty/student expectations. ^{15,31,36-50}

Strategy	Faculty expectations	Student expectations	Additional considerations
Promote classroom engagement and collaboration	<p>Clearly explain expectations and grading regarding engagement and online interaction</p> <p>Recognize that synchronous activities may offer collaborative advantages over asynchronous activities</p> <p>Design interactive classroom techniques</p> <ul style="list-style-type: none"> • “Design your exam” activities • Flipped classroom techniques with short pre-recorded educational videos, pre- and post-assessments, and live class discussion • Team-based learning, problem-based learning, or other small group activities using breakout groups • Online games and quiz tools (examples: Menti, Kahoot!) <p>Ask active questions for initiating discussion</p> <ul style="list-style-type: none"> • Call students by name • Engage students who are willing to and those who are less willing to interact • Embrace the “void of silence” when asking questions of the class • Use discussion boards in the platform of choice (example platforms: Microsoft Teams, Yammer, SharePoint, social media platforms) <p>Include autonomous and collaborative virtual skills teaching and practice using tools designed for health care training</p> <ul style="list-style-type: none"> • Critique of a patient counseling demonstration • Telehealth OSCE • MyDispense tool • Patient counseling pairing for practice • As appropriate, include electronic health records or support systems for patient care-related topics <p>Use creative visual aids or videos for discussion and explanation of more complex topics (examples: YouTube or Osmosis videos for demonstration)</p>	<p>Accept self-management of the learning process</p> <p>Complete assignments before class</p> <p>Interact with classmates in a small group or paired setting</p> <p>Turn on video monitors during live synchronous classes</p> <p>Participate in questions and acknowledge that being called on to answer a question is not a punishment</p> <p>Embrace flexibility and versatility in courses</p> <p>Use cell phones and technology as intended during virtual classes and activities</p>	<p>Strategies require time input from both faculty and students</p> <p>Avoid relying on one strategy exclusively</p>
Create balanced and inclusive learning opportunities	<p>Create a sense of community</p> <p>Create a safe online environment in which all students are welcome to engage</p> <p>Provide a venue for students to express concerns or fears about online learning at the start of a course</p> <p>Accommodate both synchronous and asynchronous learning styles</p> <p>Recognize that blended learning may offer advantages over traditional in-person and online-only pedagogies</p> <p>Ensure that any closed-captioning functions are enabled in the platform used</p>	<p>Respect the varied interactive learning environment</p> <p>Respect answers provided by peers and viewpoints expressed in small group settings</p> <p>Provide honest answers to pre-conceived concerns about online learning</p>	
Provide effective resources	<p>Participate in faculty development programs regarding best practices for online instruction and mastering use of the technology to increase comfort level</p> <p>Test technology before instruction to identify potential challenges</p> <p>Ensure learners have access to resources and tools to enhance their organization, understanding of expectations, and technological capabilities; for example:</p> <ul style="list-style-type: none"> • Video-based tutorials regarding course • Learning resources 	<p>Fully use resources, tools, and tutorials provided by faculty to support success</p> <p>Clarify expectations and proactively contact faculty when additional support or resources are needed</p>	<p>Institutions should provide devices that can be “checked out” if needed</p>

TABLE 1 (Continued)

Strategy	Faculty expectations	Student expectations	Additional considerations
	<ul style="list-style-type: none"> Road maps Links to technological support and university services Set clear expectations for success and participation Provide clear structure, including transparency regarding assignments and due dates Provide timely responses to learners in a manner that has been pre-established		
Engage in assessment and bidirectional feedback	Embed continuous formative assessments such as polls or peer review/engagement into instruction Provide timely feedback to learners Use various strategies to solicit feedback from learners and adjust in real time, when feasible <ul style="list-style-type: none"> Surveys Discussions with learners 	Participate in formative assessments Provide timely feedback to faculty regarding effectiveness of teaching with an increased focus on factors potentially affected in the virtual setting such as organization, communication, and incorporation of technology	

Abbreviation: OSCE, objective structured clinical examination.

consider to create the best testing environment possible. One factor includes assessment techniques that: help maintain academic integrity; have minimal effects on student performance; address potential student anxiety; use effective exam questions; and prevent any inequity issues. A major concern with students taking exams in an online format is maintaining academic integrity because it is commonly believed that cheating is easier when taking online exams.^{51,52} Methods of cheating could include the student having someone else take the exam, using additional materials or the internet without permission, exchanging ideas with others taking the exam in the same room (or not) on different computers, and/or faking technical problems to gain more time or retake the exam after seeing portions of it.^{53,54}

One way to confront concerns related to academic integrity is to use in-person proctored exams at a testing center. However, traveling to a testing center may create a hardship for students who are in different geographic locations; for example, transportation may be unavailable or too expensive, or a testing center may not be nearby. Several alternative methods for minimizing cheating on online exams have been described and are widely used.^{51,54–56} At a minimum, students should be reminded of the honor code and the importance of academic integrity with any assessment. For online high-stakes assessments, confirming student identity is important and should be incorporated into online assessment plans.⁵⁴ Software using artificial intelligence can be deployed with a webcam to detect any unusual movement that could be construed as cheating behavior, and a proctor can then review any flagged events after the exam. A simpler method is using a webcam to video record each student during the exam because it is assumed that the awareness of being recorded will deter students from cheating. A less labor-intensive method is to have a proctor view multiple students at once through video connections during the exam. This remote proctoring appears to minimally affect students' exam performance.^{57,58} Additional strategies to deter

cheating include randomizing the order of questions and/or answer choices (for multiple-choice questions), having all students take the exam at the same time, and preventing backward navigation during the exam.

Another potential issue with online exams is student anxiety. Test anxiety can negatively affect student performance.⁵⁹ In a study of undergraduates in medical sciences, 32% reported more stress with remote online exams.⁶⁰ The areas of highest concern were exam duration, mode of question navigation, and technical problems. Practice with mock online exams may decrease student stress. In addition, there are several habits that students can adopt to help manage anxiety, including checking equipment and internet connectivity before the exam; selecting a quiet setting in which to take the exam; carefully reading all instructions and exam questions; and using breathing exercises to help stay calm during the exam.⁶¹

Attention must be given to the development and types of questions asked on online exams.⁵² To ease grading, questions can be made more straightforward. However, this potentially shortchanges learners because these questions tend to measure “knowing” rather than “knowing how.” Faculty should be intentional in designing online questions, such as multiple-choice questions, that are focused on higher-order cognitive skills of application, analysis, and problem solving. Furthermore, students can copy exam questions for sharing with others. Creating a large bank of potential test questions may help prevent this problem, as may using more application-based questions.⁵⁴

6 | CONCLUSION

As pharmacy education incorporates more use of online learning, the student experience and outcomes should be considered. Not all courses may lend themselves to full online learning, and evidence of student performance and perceptions with knowledge and skills

acquisition should be considered. Lecture-based content allows for similar performance in an online (synchronous or asynchronous) setting; however, incorporation of active learning depends on the type of active learning and may be best incorporated into a hybrid format. Teaching of and evaluation of clinical skills has been successful with virtual OSCEs and lends to pharmacy students learning in an environment where they may practice (i.e., telehealth or telepharmacy). However, given the importance of communication skills in pharmacy, evaluation of clinical skills in person also allows for a full assessment of skills when providing patient care virtually or in person. A hybrid format that uses online preparation for in-person practice should be considered, particularly for any skill in which proficiency is needed.

When designing an online or hybrid course, engagement is a key component. Key elements to consider include communication of expectations in the syllabus and on the learning management system and access to support (technical, educational, mental health); content should be engaging and promote achievement of learning objectives; and student input and feedback should be solicited and acted on. In pharmacy education with the need to demonstrate achievement of educational outcomes and accreditation standards, high-stakes summative assessments are expected. Careful planning should go into how assessments will be conducted to promote academic integrity, reduce student anxiety, and provide a good testing environment. Student feedback on the assessment process should be requested and incorporated to continually improve processes. Incorporating these principles can result in high-quality online pharmacy didactic course instruction.

FUNDING INFORMATION

There was no external funding for this work.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

ORCID

Andrew J. Crannage  <https://orcid.org/0000-0002-8898-1493>

Angela L. Bingham  <https://orcid.org/0000-0002-1113-2872>

Kristen M. Cook  <https://orcid.org/0000-0002-7046-4703>

Susan E. Hamblin  <https://orcid.org/0009-0008-5400-9752>

Andie E. Lloyd  <https://orcid.org/0009-0000-7714-5281>

J. Russell May  <https://orcid.org/0000-0002-7231-459X>

Jessica R. Merlo  <https://orcid.org/0000-0002-4623-5273>

Kaely G. Miller  <https://orcid.org/0009-0004-0491-830X>

Christina A. Spivey  <https://orcid.org/0000-0002-8792-8420>

REFERENCES

- Means B, Toyama Y, Murphy R, Bakia M, Jones K. *Evaluation of evidence-based practices in online learning: a meta-analysis and review of online learning studies*. Washington (DC): U.S. Department of Education, Office of Planning, Evaluation, and Policy Development; 2010 Sep contract number: ED-04-CO-0040.
- Gortney JS, Fava JP, Berti AD, Stewart B. Comparison of student pharmacists' performance on in-person vs. virtual OSCEs in a pre-APPE capstone course. *Curr Pharm Teach Learn*. 2022;14:1116–1121.
- Scouler S, Huntsberry A, Patel T, Wettergreen S, Brunner JM. Transitioning competency-based communication assessments to the online platform: examples and student outcomes. *Pharmacy*. 2021;9:52.
- Liu L, Caliph S, Simpson C, Khoo RZ, Neviles G, Muthumuni S, et al. Pharmacy student challenges and strategies towards initial COVID-19 curriculum changes. *Healthcare*. 2021;9:1322.
- Elnour AA, Hajal AA, Goaddar R, Elsharkawy N, Mousa S, Dabbagh N, et al. Exploring the pharmacy students' perspectives on off-campus online learning experiences amid COVID-19 crises: a cross-sectional survey. *Saudi Pharm J*. 2023;31:1339–1350.
- Senhaji-Tomza B, Unni E, Ng KE, Lonie JM. Pharmacy student perceptions of remote learning and wellness during the pandemic: lessons learned from a metropolitan commuter city. *Curr Pharm Teach Learn*. 2023;15(2):130–138.
- Nagy DK, Hall JJ, Charrois TL. The impact of the COVID-19 pandemic on pharmacy students' personal and professional learning. *Curr Pharm Teach Learn*. 2021;13:1312–1318.
- Moroz S, Andrade R, Walsh L, Richard CL. Student performance on an objective structured clinical exam delivered both virtually and in-person. *Am J Pharm Educ*. 2023;87:1000088.
- Hussain A, Chau HV, Bang H, Meyer L, Islam MA. Performance of pharmacy students in a communications course delivered online during the COVID-19 pandemic. *Am J Pharm Educ*. 2021;85(10):8617.
- VanLangen KM, Sahr MJ, Salvati LA, Meny LM, Bright DR, Sohn M. Viability of virtual skills-based assessments focused on communication. *Am J Pharm Educ*. 2021;85(7):8378.
- Nilad SD, Lin E, Bailey J, Truong C, Gaboyan S, Mittal A, et al. Learning outcomes in a live virtual versus in-person curriculum for medical and pharmacy students. *ATS Scholar*. 2022;3(3):399–412.
- Shoair OA, Smith WJ, Abdel Aziz MH, Veronin MA, Glavy JS, Pirtle SJ. Pharmacy students' perceptions and attitudes toward face-to-face vs. virtual team-based learning (TBL) in the didactic curriculum: a mixed-methods study. *Med Educ Online*. 2023;28(1):2226851.
- El Magboub A, Haworth IS, Sutcliff BT, Romero RM. Evaluation of in-class and online discussion meeting in a biopharmaceutics problem-based learning class. *Curr Pharm Teach Learn*. 2016;8:811–820.
- Muhaimin M, Habibi A, Riady Y, Alqahtani TM, Chaerunisaa AY, Wijaya TT, et al. Covid-19 distance and online learning: a systematic literature review in pharmacy education. *BMC Med Educ*. 2023;23(1):367.
- Frederick KD, Havrda DE, Scott D, Gatwood J, Hall EA, Desselle SP, et al. Assessing student perceptions of blended and online learning courses in pharmacoeconomics, management, and leadership. *Am J Pharm Educ*. 2023;87(4):9001.
- Hamilton LA, Suda KJ, Heidel RE, McDonough SLK, Hunt ME, Franks AS. The role of online learning in pharmacy education: a nationwide survey of student pharmacists. *Curr Pharm Teach Learn*. 2020;12(6):614–625.
- Thomas D, Solder JA, Cropp CD, Beall J. Pharmacy student perceptions of a virtual pharmacogenomics activity. *Healthcare*. 2022;10:286.
- Kharaba Z, AlAhmad MM, Elnour AA, Hajal AA, Abumweis S, Ghattas MA. Are we ready yet for digital transformation? Virtual versus on-campus OSCE as assessment tools in pharmacy education. A randomized controlled head-to-head comparative assessment. *Saudi Pharm J*. 2023;31:359–369.
- Van Hooser J, Olsen AW. In-person or online? Exploring student pharmacists' perceived change in interpersonal skills between two delivery formats. *Pharmacy*. 2023;11:55.
- Gallegos PJ, Hoffmaster BS, Howard ML, Lancaster JW, Pluckrose D, Smith BA, et al. Remote experiential education: a silver lining for the COVID-19 pandemic. *J Am Coll Clin Pharm*. 2022;5:107–110.
- He L, Yang N, Xu L, Ping F, Li W, Sun Q, et al. Synchronous distance education vs traditional education for health science students: a systematic review and meta-analysis. *Med Educ*. 2021;55:293–308.

22. Al-Dahir S, Bryant K, Kennedy KB, Robinson DS. Online virtual-patient cases versus traditional problem-based learning in advanced pharmacy practice experiences. *Am J Pharm Educ.* 2014;78(4):76.
23. Abbasi MS, Ahmed N, Sajjad B, Alshahrani A, Saeed S, Sarfaraz S, et al. E-learning perception and satisfaction among health science students amid the COVID-19 pandemic. *Work.* 2020;67(3):549–556.
24. Baczek M, Zagańczyk-Baczek M, Szpringer M, Jaroszyński A, Woźakowska-Kaplon B. Students' perception of online learning during the COVID-19 pandemic. *Medicine.* 2021;100(7):e24821.
25. Schneider J, Felkai C, Munro I. A comparison of real and virtual laboratories for pharmacy teaching. *Pharmacy.* 2022;10:133.
26. Lewis D. *The pedagogical benefits and pitfalls of virtual tools for teaching and learning laboratory practices in the biological sciences.* The Higher Education Academy—STEM; York (UK); 2014 Nov.
27. National Standards for Quality Online Learning. Quality online courses—national standards for quality online learning [Internet]. 2019 <https://www.nsqol.org/the-standards/quality-online-courses>
28. Office of Distance Learning [Internet]. Quality course design. <https://odl.fsu.edu/online-instruction/quality-course-design>
29. Sahu PK, Dalcik H, Dalcik C, Gupta MM, Chattu VK, Umakanthan S. Best practices for effective implementation of online teaching and learning in medical and health professions education: during COVID-19 and beyond. *AIMS Public Health.* 2022;9(2):278–292.
30. Lo CK, Hew KF. Design principles for fully online flipped learning in health professions education: a systematic review of research during the COVID-19 pandemic. *BMC Med Educ.* 2022;22(1):720.
31. Pesaturo KA, Cho HJ, Castandea AT, Reilly NV, Verbetsky CA. Teach BIG: a framework-based approach to online teaching and learning. *Curr Pharm Teach Learn.* 2022;14:933–937.
32. Wut T, Xu J. Person-to-person interactions in online classroom settings under the impact of COVID-19: a social presence theory perspective. *Asia Pac Educ Rev.* 2021;22:371–83. Available from: -383. <https://doi.org/10.1007/s12564-021-09673-1>
33. Motycka CA, St Onge EL, Williams JS. Asynchronous versus synchronous learning in pharmacy education. *JCT.* 2013;2(1):63–67.
34. Venton BJ, Pompano RR. Strategies for enhancing remote student engagement through active learning. *Anal Bioanal Chem.* 2021;413(6):1507–1512.
35. Chen E, Kaczmarek K, Ohshima H. Student perceptions of distance learning strategies during COVID-19. *J Dent Educ.* 2020;85(Suppl 1):1190–1191.
36. Anksorus HN, Bradley C, VanLangen KM, Renfro CP, Mingura ML, Sourial M. The catalyst for change in teaching and assessing virtual laboratory skills. *Curr Pharm Teach Learn.* 2021;13:1550–1554.
37. Shahba AA, Sales I. Design your exam: a novel active learning technique to increase pharmacy student engagement in the learning process. *Saudi Pharm J.* 2021;29:1323–1328.
38. Rothstein A, Haar M. Best practices for encouraging student participation in both face-to-face and virtual environments. *J Allied Health.* 2020;49(4):e161–e165.
39. Munusamy S, Osman A, Riaz S, Ali S, Mraiche F. The use of Socratic and yammer online tools to promote interactive learning in pharmacy education. *Curr Pharm Teach Learn.* 2019;11:76–80.
40. Mak V, Fitzgerald J, Holle L, Vordenberg SE, Kebodeaux C. Meeting pharmacy educational outcomes through effective use of the virtual simulation MyDispense. *Curr Pharm Teach Learn.* 2021;13:739–742.
41. Pires C. A SWOT analysis of pharmacy students' perspectives on e-learning based on a narrative review. *Pharmacy.* 2023;11:89.
42. Rhim HC, Han H. Teaching online: foundational concepts of online learning and practical guidelines. *Korean J Med Educ.* 2020;32(3):175–183.
43. Dost S, Hossain A, Shehab M, Abdelwahed A, Al-Nusair L. Perceptions of medical students towards online teaching during the COVID-19 pandemic: a national cross-sectional survey of 2721 UK medical students. *BMJ Open.* 2020;10:e042378.
44. Choe RC, Scuric Z, Eshkol E, Cruser S, Arndt A, Cox R, et al. Student satisfaction and learning outcomes in asynchronous online lecture videos. *CBE Life Sci Educ.* 2019;18(4):ar55.
45. Cridland C, Drape T, Marine S, Gillaspay G. Ten best practices for taking experiential learning online. *Biochem Mol Biol Educ.* 2019;49:9–14.
46. Diez-Pascual AM, Jurado-Sanchez B. Remote teaching of chemistry laboratory courses during COVID-19. *J Chem Educ.* 2022;99:1913–1922.
47. Hsia SL, Landsfeld A, Lam K, Tuan RL. Implementation and evaluation of a 10-week health equity curriculum for pharmacy students. *Am J Pharm Educ.* 2021;85(9):8579.
48. LeBlanc JM, Pruchnicki MC, Rohdieck SV, Khurma A, Dasta JF. An instructional seminar for online case-based discussions. *Am J Pharm Educ.* 2007;71(3):42.
49. Molefe LL, Mabunda NF. Online teaching and learning: experiences of students in a nursing college during the onset of COVID-19. *Curationis.* 2022;45(1):a2372.
50. Reinhart A, Malzkorn M, Doing C, Beyer I, Junger J, Bosse HM. Undergraduate medical education amid COVID-19: a qualitative analysis of enablers and barriers to acquiring competencies in distant learning using focus groups. *Med Educ Online.* 2021;26(1):1940765.
51. Holden OL, Norris ME, Kuhlmeier VA. Academic integrity in online assessment: a research review. *Front Educ.* 2021;6:1–13.
52. Focus F. *Assessing online learning: strategies, challenges and opportunities.* Madison (WI): Magna Publications; 2021 Jul.
53. Janke S, Rudert SC, Peterson A, Fritz TM, Daumiller M. Cheating in the wake of COVID-19: how dangerous is ad-hoc online testing for academic integrity? *Comput Educ Open.* 2021;2:100055. <https://doi.org/10.1016/j.caeo.2021.100055>
54. Mate K, Weidenhofer J. Considerations and strategies for effective online assessment with a focus on the biomedical sciences. *FASEB Bioadv.* 2022;4:9–21.
55. Higbea A, Bald E, Isaacs AN, Ritcher SK, Stamm PL, Kassel LE. Forging ahead from adaptations of teaching during the COVID 19 pandemic: perspectives from multiple pharmacy programs. *J Am Coll Clin Pharm.* 2021;4:101–112.
56. Morgan K, Adams E, Elsobky T, Darr A, Brackbill M. Moving assessment online: experiences within a school of pharmacy. *Online Learn J.* 2021;25(1):245–252.
57. Hall EA, Spivey C, Kendrex H, Havrda DE. Effects of remote proctoring on composite examination performance among doctor of pharmacy students. *Am J Pharm Educ.* 2021;85(8):824–828.
58. Jaap A, Dewar A, Duncan C, Fairhurst K, Hope D, Kluth D. Effect of remote online exam delivery on student experience and performance in applied knowledge test. *BMC Med Educ.* 2021;21:86.
59. Woldeab D, Brothen T. 21st century assessment: online proctoring, test anxiety, and student performance. *Int J E Learn Distance Educ.* 2019;34(1):1–10.
60. Elsalem L, Al-Azzam N, Jum'ah AA, Obeidat N, Sindiani AM, Kheirallah KA. Stress and behavioral changes with remote E-exams during COVID-19 pandemic: a cross-sectional study among undergraduates of medical sciences. *Ann Med Surg.* 2020;60:271–279.
61. Selsken. Best practices for dealing with test anxiety in an online setting | blackboard help for students [Internet]. <https://bbhelp.uark.edu/best-practices-for-dealing-with-test-anxiety-in-an-online-setting/>

How to cite this article: Havrda DE, Crannage AJ, Bingham AL, et al. Best practices in online/distance pharmacy practice course didactic instruction. *J Am Coll Clin Pharm.* 2024;1-7. doi:10.1002/jac5.1983