



BENCHMARKING ANALYSIS

Meeting Practical and Hands-On Learning Requirements During COVID-19

May 2020

In the following report, Hanover Research presents the results of a benchmarking and best practices analysis of policies and practices related to meeting practical requirements within a computer based simulated environment.



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EXECUTIVE SUMMARY

RECOMMENDATIONS

Based on an analysis of policies and best practices at reviewed institutions and within existing literature, Hanover recommends:

Encourage instructors of courses and programs with practical requirements to focus on learning goals as they plan for an extended shift of content online.

A review of policies at peer institutions and literature on best practices for meeting practical requirements in an online environment suggests that instructors should focus on learning goals as they decide how to adapt their programs. Because conditions do not permit full delivery of programs designed to be in-person, instructors should decide which learning goals can be met in an adapted online course and which cannot.

Explore technological tools that can be used to simulate practical requirements.

Several existing technological tools and platforms, such as simulated lab experiments or historical events; virtual reality tools that can teach medical, trade, and even veterinary science lessons; and websites for matching business courses with company-designed projects can help ensure students progress through their programs. Some such resources, including those in the [Concord Consortium](#) or [OASIS](#) collections, are currently being offered for free or are exclusively open-source. The institution should explore how such alternatives can replace in-person or hands-on requirements. For its business courses, the institution may want to consider partnering with [Riipen](#), which pairs courses with company-designed projects to give students practical experience, or use [Giild](#), which allows students to personalize their own at-home learning projects.

KEY FINDINGS

Successfully moving programs online requires identifying central learning goals of each course and working with students to make sure their needs are met. Educators working in all disciplines and programs, including those that contain a practical component, recommend focusing on learning goals as a way to facilitate the transition to remote instruction. For courses and programs that include a hands-on or practical component, such as lab courses, identifying which learning goals can be met through online delivery can help the instructor plan.

Fulfilling all practical requirements may not be possible, but institutions can still find ways to help students progress. In some cases reviewed institutions have relaxed or eliminated certain practical requirements (such as for teacher education, particularly when updated local guidelines for teacher education programs are available). In others, however, institutions and instructors have adapted requirements by shifting their focus, for example by allowing students in teacher colleges to complete a practicum in Non-Traditional Instruction. Literature discussing educators' experiences of, and recommendations for, shifting to an online modality indicates that an explicit focus on helping students meet their own goals can help ensure the overall course goals are met.

Technological, Artificial Intelligence (AI), and Virtual Reality (VR) tools provide institutions with numerous options for replacing practical requirements. Several technologies developed before COVID simulate lab activities, anatomy classes, history reenactments, and practical (certification and technical) training, and a significant subset of these are open-source. New tools have also been created. Such tools could help ensure continued progression for students in fields such as the sciences, trades, and other programs. The crisis has also prompted educators to share a plethora of resources for teaching online.

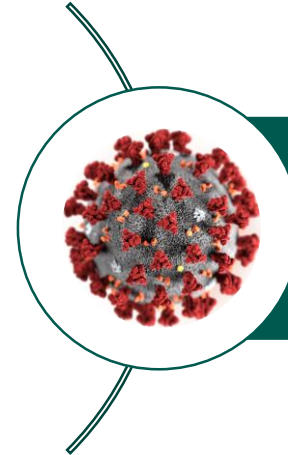
RESEARCH QUESTIONS AND METHODOLOGY

METHODOLOGY

To assist institutions developing policies related to meeting practical competencies within a computer-based environment as a result of COVID-19, Hanover conducted a benchmarking study of institutions with innovative policies and techniques for meeting students' practical requirements. Hanover also reviewed literature to understand best practices in making this transition and innovative tools that would assist in this endeavor.

The following analysis is based on a review of information drawn from institutional websites and publicly available data sources. The report aims to help evaluate which policies may be best leveraged at the institution and what tools highlighted within industry literature can help ensure students' continued progression through their programs.







RESEARCH QUESTIONS



In response to COVID-19, what trends exist among institutions with regard to fulfillment of experiential learning and practical requirements?

OVERVIEW OF BENCHMARKING AND BEST PRACTICES

Overall strategies for meeting practical requirements can be broken down into three sets of general policies, and several formats can help ensure practical requirements are met:

General Policies and Practices	Meeting Practical Requirements
 Focusing on learning goals and prioritizing those that can be met through online delivery can help instructors as they shift their courses online.	 Existing internet and technological programs can allow students to find internships, complete real company projects, and even receive technical training online.
 Successfully meeting requirements through online delivery requires understanding and accommodating students' needs.	 Video platforms and other resources can help students in art and performance-based programs complete assignments.
 Relaxing or paring down practical requirements may be necessary as a result of the need to shift online.	 New and existing software, virtual reality, and other technology-based tools can assist in completing requirements for lab courses as well as both clinical and non-clinical medical instruction.

TRENDS ANALYSIS: GENERAL POLICIES AND PRACTICES

SHIFTING PRIORITIES

Determining how learning goals can be met, rather than insisting on meeting all original requirements, is key to managing the transition to an online environment.

For example, Brown University [advises](#) faculty to consider when helping students complete labs and lab reports “whether the key objective of the lab is (or could be) data analysis, rather than data collection.” If the former, the instructor can provide students with online or dummy data that can allow them to complete the analysis. The College of William and Mary, in its resources for faculty on “instructional resilience,” similarly [encourages](#) faculty running lab courses to focus on learning objectives, and notes that some learning objectives may simply need to be “set aside” for when classes can meet again face to face. Other instructors writing about their experience shifting to an online environment, such as [Dr. Michelle Miller](#) from Northern Arizona University, note that “student goals will take center stage” regardless of the course.

Some institutions have canceled or pared down in-person activities and requirements.

Science Magazine [reports](#) that many graduate students involved in lab-based projects have experienced confusion and uncertainty about how to carry on with their projects. While some students said they felt pressure from their Principal Investigators (PI) to report to the lab, other PIs or advisors unambiguously prioritized graduate students’ safety – even while, in some cases, allowing minimal lab activity to continue. Institutions such as [Stanford University](#) and [University of Wisconsin-Madison](#) have strongly urged faculty to ensure undergraduates continuing with field research to respect state laws regarding social distancing, and [encourage](#) faculty to consider alternatives.

ACCOMMODATING STUDENT NEEDS

Successfully moving education online requires understanding students’ needs, access, and technological ability.

Educators from the [Modern Language Association](#), the [University of Wisconsin-Madison](#), and elsewhere urge teachers planning to move their course online to “gather information about students’ access to the internet and comfort” with different kinds of technology, and to “collaborate with students to make a backup plan if they don’t have internet access at home.”

Relatedly, educators advise each other to work with students’ existing technological ability (which may be limited). For example, the nonprofit organization [ArtProf](#) advises teachers in a YouTube video that students will be more successful if they are not required to monitor course communication through a new platform. Instead, professors should communicate with students through channels they already monitor. Instructors at community and technical colleges similarly [reported](#) adjusting to issues including low bandwidth and students’ lack of equipment by organizing discussions through applications such as FaceTime.



Source: [ArtProf](#): “5 Tips for Teaching Studio Art Online”

TRENDS ANALYSIS: GENERAL POLICIES AND PRACTICES

PARING DOWN REQUIREMENTS

Faculty experience suggests that institutions should not try to recreate the in-person experience online.

Existing guidance emphasizes the difference between [emergency remote teaching](#) and the full development of an online learning environment. Educators such as [Flower Darby](#), [Rebecca Barrett-Fox](#), and [Jacqueline Wernimont](#) have worried that institutions may lose credibility if they try too hard to fully recreate their courses online. These instructors, based on their own experience, advise colleagues to [remember](#) that “moving online with inadequate support is a short-term solution.” Similarly, a [worksheet](#) licensed through Creative Commons and shared by [Portland State University](#) urges faculty to simplify teaching down to the “rule of two” (i.e., finding two principles, two skills, two ways students can participate, etc. for each lesson).

Institutions are dropping or replacing face-to-face requirements.

An [interview](#) with Harvard Graduate School of Education (HSGE) Dean Bridget Terry Long reveals that “relaxing requirements” was one of the initial ways the HSGE dealt with the crisis. The Graduate School at Pennsylvania State University has similarly [instructed](#) programs that typically require in-person oral examinations or public seminars to conduct these requirements via videoconferencing. This suggests that although certain tools may exist that institutions can leverage to ensure students’ continued progression, institutions should also acknowledge that students may simply not be able to complete programs with the full experience they would have otherwise had.

RUNNING LAB ACTIVITIES FROM HOME

Although lab activities can be conducted while students are at home, safety and other concerns may force instructors to pare down requirements. Heather R. Taft of Colorado State University Global recommends the following guidelines:

✓ Try to connect the labs to course objectives

For example, in a lesson with a learning objective requiring students to use a microscope to identify structures in a cell, the learning object can be modified to allow students to learn structure identification using images available online

✓ Preach safety as much as possible

Establish safety protocols as you would in a real laboratory, include online safety videos, and make sure to discuss complications at home that do not exist in a lab, such as kids and pets

✓ Be available online

Instructors should expect that students will have many questions as they begin their at-home lab experiments. To best assist students, instructors should make themselves visibly available to assist students.

✓ Make lab instructions as simple and clear as possible

This could include opening a discussion board for students to post questions, allow and encourage students to answer one another’s questions, and be lenient on grading if it appears that instructions were not well understood

Source: Adapted from Taft, [Chronicle of Higher Education](#) (2020)

TRENDS ANALYSIS: EXPERIENTIAL LEARNING AND TRAINING REQUIREMENTS

INTERNSHIPS AND OTHER FIELD-BASED REQUIREMENTS

New and existing platforms can allow students to complete internships and company-based projects virtually. [Riipen](#), a Canadian software company aiming to “extend experiential learning to all students,” works with higher education programs to match students to industry partners with a particular project need. Riipen’s [library](#) of in-class projects includes projects created by companies which educators can request to conduct as an in-class course for students.

Completing internships may still be possible in the current environment. The director of the career center at Brandeis University [writes](#) that, despite record high levels of unemployment, business closures, and social distancing measures caused by the COVID-19 pandemic, students can gain work experience through [virtual internships](#) and [micro-internships](#). Platforms such as [Giild](#), a web-based platform that facilitates project-based learning from home, have begun allowing students to use their tools for free. Institutions may want to consider developing guidance including easily accessible options for students seeking or requiring such experiential learning opportunities.

SPOTLIGHT: Career and Technical Education

The company zSpace offers Virtual Reality training in several career and technical education (CTE) topics, including automotive training, welding, and manufacturing.



Source: [zSpace](#)

SPOTLIGHT: Teacher Education

Some teacher trainees may not receive the same training they otherwise would, while others have shifted their focus.



Teacher Education Colleges may be able to adjust their requirements according to local guidelines.

Information [compiled](#) by the American Association of Colleges for Teacher Education ([AACTE](#)) on state guidance around Educator Preparation Programs (EPP, or teacher certification) in the United States illustrates the limited options facing colleges of teacher education under current conditions.



Non-Traditional Instruction has become a focus for many institutions.

Several institutions, such as the [University of Kentucky College of Education](#) and the [Western Kentucky University Office of Professional Educator Services](#), have developed policies that allow or encourage students to meet requirements through Non-Traditional Instruction (NTI) programs. These candidates have shifted their focus to technology-based resources and shared such resources among themselves. The Graduate School of Education at the [University of Buffalo](#) encourages its students “to become inventive” as they fulfill their student-teaching requirements, including through developing online course material or using social media to identify families with tutoring needs. Students at the University of Pennsylvania’s Graduate School of Education have even developed remote theater projects [to combat COVID](#).

Overall, such institutions have taken advantage of the challenges posed to student teaching requirements to provide training in new methods of instruction.

TRENDS ANALYSIS: ART AND PERFORMANCE-BASED REQUIREMENTS

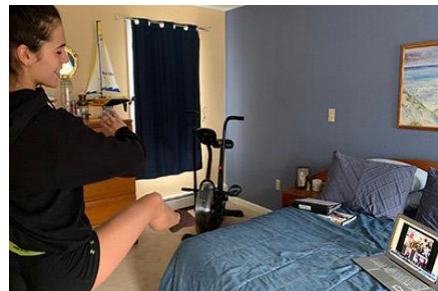
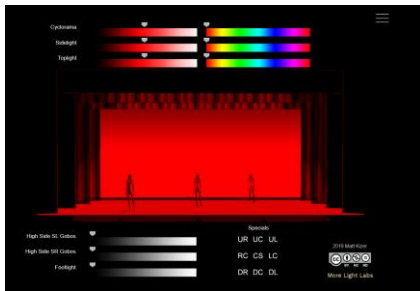
ONLINE PERFORMANCE-BASED EDUCATION

Instructors of studio and performance-based art courses are supporting each other in finding ways to continue their programs online.

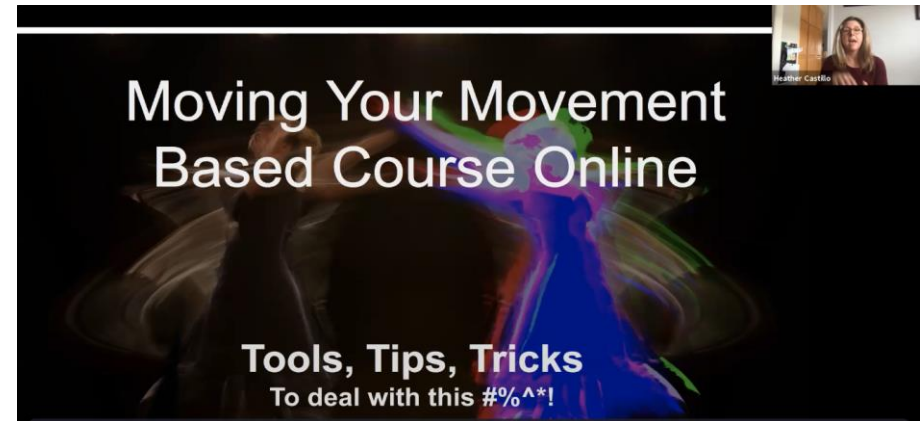
For example, Boston College's Center for Teaching Excellence, in collaboration with Warren Wilson College, offers [resources and tips](#) for instructors of creative and performing arts courses. The Dance Studies Association has also compiled a list of [resources for moving dance-based pedagogy online](#), including scholarly research as well as videos, podcasts, and dance classes. Instructors have similarly compiled tips and tools for online teaching of [theater](#), [music](#), and [production](#).

Instructors of performance-based courses have developed creative methods of delivering course content and assignments.

For example, Bridgewater State University assistant professor of theater and dance Emmett Buhmann has worked with his production students via an [online light lab](#). BSU professor of dance Donna Dragon plays music during her Zoom classes to inspire students to dance together. She has also worked to upload her students' final projects to YouTube.







Source: [Bridgewater State University](#)



Source: Castillo, [Dance Studies Association](#) (2020)

Tools for recording and uploading videos:

-  **Panapto**
Platform that allows teachers and students to record, upload, and manage videos in a secure video library. Includes other features such as searching inside videos and video quizzes
-  **Twitch**
Allows groups to collectively design and stream video channels
-  **Screenflow**
Allows teachers to record and edit videos supported by a variety of export formats
-  **Kaltura**
Provides a single platform that powers real-time, live, and VOD experiences. Also includes virtual classrooms and other tools

TRENDS ANALYSIS: LAB-BASED AND MEDICAL REQUIREMENTS

SIMULATIONS AND VIRTUAL REALITY

Technology-based tools can help meet practical requirements, particularly in laboratory courses and medical studies. Certain existing platforms have helped reproduce classroom and experiential activities through a simulated environment. For instance, the [MERLOT](#) system “provides access to curated online learning and support materials and content creation tools.” Covering a wide range of disciplines, the system permits members to create their own content and build course e-portfolios.

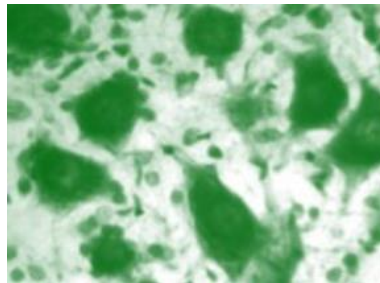
In other examples, the [AstroSims](#) Project at Foothill Community College is working to develop astronomy simulations and provides links to simulations developed elsewhere. A Stanford University professor even created a [GIF](#) file to virtually demonstrate field ecology methods for catching invertebrates to students, and a project at UCLA provides modules in digital neuroscience.

Examples of Digital Neuroscience

UCLA's Modular Digital Course in Undergraduate Neuroscience Education (MDCUNE) offers modules on a range of topics such as those illustrated below:



Module:
Bioinformatics/Neuroinformatics
Source: [UCLA MDCUNE](#)



Module: Rat Spinal Cord Image Archive

Examples of Online Science Lessons

The MERLOT system provides access to curated online learning materials, including simulated lessons and support materials, covering a range of disciplines from music to science. The examples below are focused on laboratory simulations.

Ideal Gas Law Simulation



An effective tool to help students learn about all aspects of the ideal gas law. One of the best web gas law simulations.

Material Type: Simulation
Author: John Gelder
Date Created: February 19, 2001
Date Modified: April 13, 2020
Peer Review: ★★★★★
User Rating: ★★★★★

[Bookmark](#) [More info](#)
[Go to material](#)

Source: [MERLOT](#)

Biological animations and tutorials



Key biological concepts animated as narrated and stepped tutorials, along with quizzes.

Material Type: Animation
Author: Sumanas, Inc.
Date Created: June 23, 2005
Date Modified: May 4, 2020
Peer Review: ★★★★★
User Rating: ★★★★★

[Bookmark](#) [More info](#)
[Go to material](#)

TRENDS ANALYSIS: LAB-BASED AND MEDICAL REQUIREMENTS, CONT.

TOOLS FOR VIRTUAL LABS

The list below illustrates resources for continuing lab courses online:

Instructor-Created Labs

- **iNaturalist** - "Citizen science" tool for participants to record observations in nature; can serve as data for lab experiments
- **Zooniverse** - "Citizen science" tool with projects for "everyone to take part in real cutting edge research" in several disciplines

Virtual Labs/Simulations

- **MERLOT** - A collection of simulation activities not limited to science disciplines
- **BeyondLabz** - Provides simulated chemistry, physics, and biology experiments
- **Labster** - Simulates lab experiments
- **BioInteractive** - Offers classroom resources and planning tools for undergraduate biology courses
- **PhET** - Offers simulated, interactive math and science experiments

Lab Kits

- **Hands-on Labs** - Provides material for more than 700 lessons across nine science disciplines
- **Carolina** - Offers "more than 200 hands-on investigations" to help meet course requirements
- **E-Science Labs** - Provides online students with an "authentic" lab experience

Additional Tools

- **ChemCollective** - A collection of virtual labs and learning tools. Organized by Carnegie Mellon University
- **Teach the Earth** - Online classroom environments for geoscience courses, managed by the National Association of Geoscience Teachers
- **JOVE (Journal of Visualized Experiments)** - Peer-reviewed scientific video demonstrations from laboratories at top research institutions

Source: Adapted from Taft, [Chronicle of Higher Education](#) (2020)

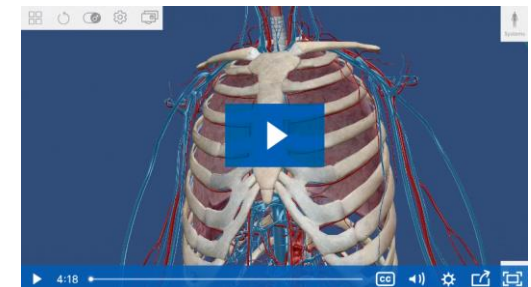
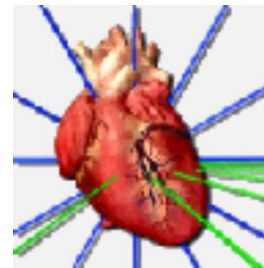
Health Sciences Education

Since well before COVID-19, health providers and institutes for teacher education have been [experimenting](#) with the use of virtual environments in medical education. For example, the company zSpace has created virtual learning platforms for [medical learning](#), partnering with products such as [Visible Body](#) to allow for the study of anatomy and other subjects in a virtual environment.

Since the outbreak of COVID-19, the American Medical Association (AMA) has curated a [list](#) of potential resources for medical educators, including both nonclinical teaching tools such as [Thumbroll](#) - an app that illustrates medical processes for trainees -- and clinical instruction tools such as [Acquifer](#), a platform offering integrated illness scripts and virtual patient cases.

Examples of Simulated Medical Lessons

Technological tools permit medical students to study topics such as electrocardiography and human anatomy in a simulated environment



Source: [zSpace](#); [Visible Body](#)

APPENDIX: RESOURCES FOR MEETING PRACTICAL REQUIREMENTS

OVERVIEW OF RESOURCES FOR PRACTICAL REQUIREMENTS DURING COVID-19

The following list represents resources that educators have compiled and circulated since or before the start of COVID-19 that can help meet practical requirements as instruction moves online. The list is meant to be illustrative rather than comprehensive.

Institution or organization	Resource
American Medical Association	• Curated list of COVID-19 resources for medical educators
American Association of Colleges of Teacher Education	• Resources for educator preparation
ArtProf	• Video with tips for teaching art courses online
Association of College and University Educators	• Online teaching toolkit
Boston College Center for Teaching Excellence	• List of “Teaching Through Disruption” resources, including resources for creative and performing arts courses
Brown University Center for Teaching and Learning	• Resources on student assignments during times of disruption
Concord Consortium	• Collection of free STEM simulation resources
Dance Studies Association	• Resources for moving dance-based pedagogy online
DePaul University	• Shared spreadsheet allows educators to see the remote teaching resources other institutions are using
Foothill College	• AstroSims Project (simulations for the astronomy education community) developed by Astronomy Department. Includes a list of additional astronomy simulation tools
Hastac	• Google Document of non-proprietary online education resources
Keep Teaching	• Online exchange on a variety of topics related to online instruction
Modern Language Association (MLA)	• Compilation of resource guides for “moving your course online”
National Association of Geoscience Teachers	• Manages Teach the Earth , a tool providing online resources for educators in the geosciences and related fields
Openly Available Sources Integrated Search (OASIS)	• Search tool housed at SUNY Geneseo’s Milne Library that helps educators discover open content
Portland State University	• Houses list of alternatives to grading used by different institutions during the pandemic
College of William and Mary Studio for Teaching & Learning and Innovation	• Resources for Instructional Resilience , including ideas for running lab classes
University of California – Los Angeles (UCLA)	• The Modular Digital Course in Undergraduate Neuroscience Education (MDCUNE) offers free neuroscience labs for undergraduates
University of Windsor	• List of resources compiled by Learning Specialist Dave Cormier compiled a for moving courses online, including a spreadsheet of virtual lab activities.
University of Wisconsin-Madison	• Compilation of resources for the “COVID-19 Online Pivot” compiled by member of Geography Department
zSpace	• Virtual Reality (VR) trainings in a variety of fields, ranging from animal sciences to welding

Source: Institutional and organizational websites (see embedded hyperlinks)



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