Conducting Research during COVID-19: An Assistant Professor's Perspective

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Introduction

For many faculty members, conducting research serves as one of the critical drivers for why they have chosen a path in academia. I also consider myself among this group, and although I have encountered many challenges in conducting research that have made it feel like an oscillating curve of negatives and positives, my desire to keep exploring has always seen me through them. One event that I certainly did not expect to impact this curve and essentially temporarily flatline it has been the global health crisis related to the COVID-19 pandemic. This pandemic began in late 2019, and while many countries have–at least temporarily–seen through the worst, the US remains troubled by it and conditions seem to be getting worse in certain states, as of July 2020 (New York Times 2020). This constant threat has now created additional problems, that really begin to question whether higher education at universities can continue without tremendous costs to the health and safety of its workforce.

The true gravity of this situation hit me hard when reading several recently published news articles. The first article, which was published in July 2020, provided an alarming statistic– the majority of universities in the US (53%) still plan to have students attend classes in person in Fall 2020, as noted in Figure 1 (The Chronicle of Higher Education Staff 2020), even as the number of coronavirus cases and deaths in the US are on the rise. This fact has troubled many faculty members across the country, according to a New York Time article (Hartocollis 2020a) who have signed petitions requesting a change. In the same article, Dana Ward, an emeritus professor at Pitzer College in California directly stated, "Until there's a vaccine, I'm not setting foot on campus." (Hartocollis 2020a) These challenges are especially concerning to junior faculty, many of whom are assistant professors like me, because we need to return to a safe environment where we can conduct research easily and effectively as we watch the minutes of our tenure clock go by.

In this essay, I will draw attention to additional challenges that faculty face in trying to conduct research as we move through the COVID-19 pandemic. Certainly, these challenges are especially acute for assistant professors like me because time needed to conduct research is not a luxury while navigating a fixed timeline towards tenure. I also offer this perspective as an assistant professor at the advanced stages of a tenure-track position. Additionally, my research focuses on

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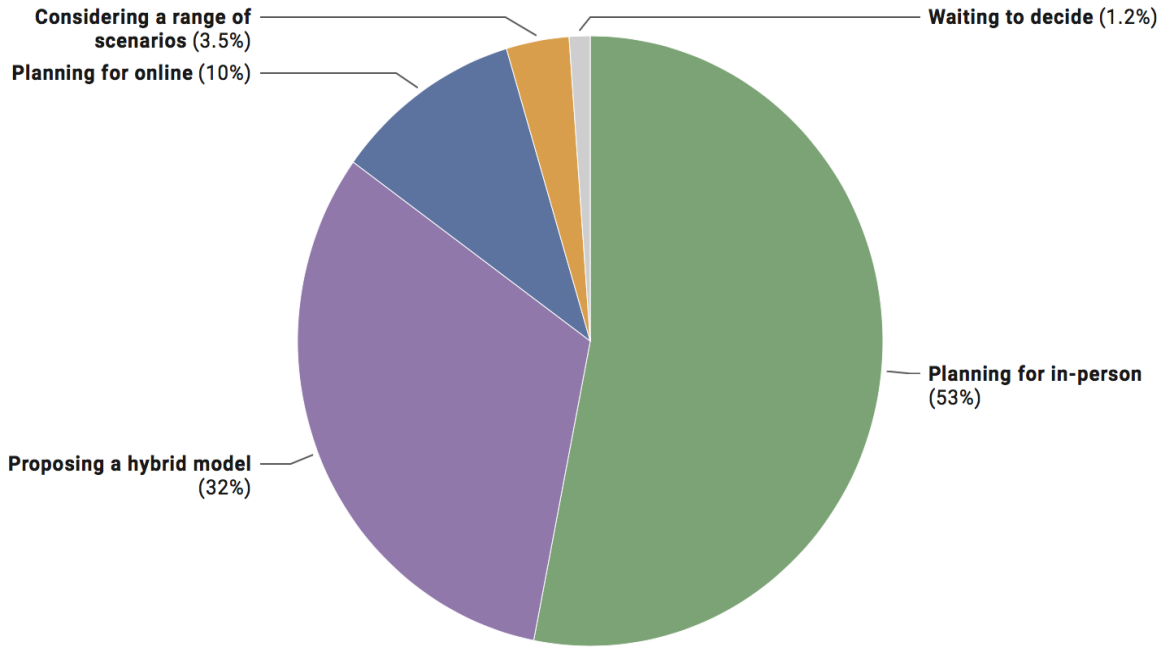
Figure 1

Colleges' plans to reopen in the fall 2020 semester. This chart is currently tracking roughly 1,210 colleges in the US.



water quality and sustainability and is highly experimentally driven. These attributes make me especially concerned about access to resources in the lab so that research projects can be completed and results can be published, while also maintaining a pool of students that can keep research activity progressing at a consistent pace. Bearing this background in mind, I would like to focus this essay on three topics that specifically discuss challenges to: (1) recruiting and retaining students with particular emphasis on international students, (2) acquiring funds to support research efforts, (3) and enabling and mentoring students to perform research tasks. These discussions will culminate in my final thoughts regarding the "path ahead" and how we must target specific outcomes to ensure that our ability to conduct research and advance science are never compromised.

Student Recruitment and Retention

The foundation of conducting research within a university setting is built on the graduate and undergraduate students that participate in it. If I were to create an analogy from my area of research expertise, environmental chemistry, I would say that they are essentially the "reactants" or "starting material" of a chemical reaction that are needed to make the reaction occur and subsequently generate products. Thus, it is impossible to produce anything without them. It is for these reasons that I want to begin this essay by focusing on this topic and especially because our ability to recruit and retain graduate and undergraduate students has become tremendously challenged during this pandemic. One of the main reasons for this is simply a logistical one – why would graduate and undergraduate students choose to come to university and conduct research when "social distancing requirements are nearly impossible to meet for many research areas," especially for "traditional modalities of bench science and human subjects research, as well as much field and archival research," as noted by Peter Schiffer and Jay Walsh (2020).

These issues are further exacerbated by the additional burdens being borne by international graduate and undergraduate students. Some students are not even able to enter the US due to current travel restrictions and "increased logistical hurdles to visa processing." (Schiffer and Walsh 2020) In addition, a recent Forbes article provided startling predictions suggesting that "the enrollment of new international students at U.S. universities in the Fall 2020-2021 academic year is projected to decline 63% to 98% from the 2018-2019 level," which was based on analysis conducted by the National Foundation for American Policy (Anderson 2020). At Purdue alone, such a drop would considerably reduce total student enrollment, as nearly 21-24% of all students (graduate and undergraduate) enrolled each year at the West Lafayette campus between 2014 to 2019 originated from countries outside the U.S. (Office of Enrollment Management, Purdue University 2020). There is no doubt that such a decline would have a tremendous effect on research productivity and output but would additionally limit our ability to use students' diverse background to think more creatively about research. Recent decisions made by the Trump administration have created additional turmoil, as they have set guidelines that will cause students to lose their visas if they only take online classes in the upcoming Fall 2020 semester.

This action is "using foreign students as pawns to keep all schools open, no matter the cost to the health and well-being of these students and their communities," as stated by Mark Rosenbaum, a lawyer who represents foreign graduate students at three California universities, in a recent New York Times article (Hartocollis 2020b). One can only wonder what psychological effects these events are having on international student who must be asking whether they are welcome to study and work in the US with or without the pandemic in the background. This policy has since been withdrawn.

Challenges in Acquiring Funding

In my mind, one of the most challenging and frustrating aspects of this COVID-19 pandemic lies in the financial difficulties that most of the world economies are facing as a result. These difficulties have trickled down to affect many aspects of our daily lives, but as a scientist it is obvious to see the strain it is placing on securing funds to drive research forward. I recently experienced this first-hand through two retracted funding opportunities. The first one felt more or less expected– a small seed grant typically given through my department was closed to applications in May 2020 due to austerity measures put in place for the 2020-21fiscal year. However, the second one took me much more by surprise – a large global chemical company was unable to fund a relatively small research project that was directly linked to the side effects their disinfectant might have on indoor surfaces when used to destroy the coronavirus. They stated that one of the primary reasons that they were unable to fund this project was due to the current downturn in the economy. This left me thinking about the following: if a large billion-dollar company is reluctant to fund a project which is directly related to the COVID-19 crisis, then who instead could we turn to for funds?

Unfortunately, there is no doubt that my personal experiences are emblematic of what lies ahead for funding research. Schiffer and Walsh noted in a recent op-ed that "most corporate, philanthropic and state government research funders will be strained in the coming months, auguring a period of constrained resources."(2020) One example of this strain was recently demonstrated by austerity measures proposed by the state of New Mexico. According to the

Santa Fe New Mexican newspaper, the state proposed to "slash, roughly 6 percent from research and public service projects at universities and 4 percent for broader university and public college funding from the state." (Gerstein 2020) If similar measures are enacted in other states across the US, such "belt tightening" measures would clearly have far reaching consequences for all research-active professors. It would most certainly also create additional stress for research-active assistant professors, who need funds to initiate and/or continue their research so that they can generate critical products needed to meet the metrics for tenure and promotion. I would also like to especially highlight the burden it places on women, such as myself, who are already confronted with bias in grant review panels and must be 2.5 times more productive to be judged as equally competent in grant applications (Barres 2006; Malisch et al. 2020). Such disparities are also positioned against the fact that during the pandemic, research productivity measured as a function of journal submissions was also well known to be highly gendered due to the unequal distribution of household and intellectual labor (Flaherty, 2020). These gender-based gaps will have dire consequences for individual career trajectories, rise to leadership positions, and overall scientific progress in a multitude of academic fields.

The Experimentalist's Roadblocks

It is amazing how often you do not miss something until it is gone. This statement is very relevant to how researchers who primarily engage in experimental work, such as myself, likely feel, as their research labs have never been stripped away from their hands; which has occurred over the past few months. In my case, the timeline of events for closing and reopening my research lab were probably not unlike others who do experimental work, which falls outside the scope of COVID-19 related research. First, my lab, along with others in my same research field, were closed down in mid- to late March 2020, where all personnel were restricted from entry and all analytical equipment that typically remains online were shutdown. Months followed that included tireless efforts by our lab manager and likely many others, in tracking the litany of constantly updated guidelines on how and when our labs could reopen. Finally, we were allowed to reopen in late July 2020 but with the following rules: (1) all personnel must notify administrators when they will make laboratory visits and must restrict activities to certain lab spaces, so that adequate space exists between personnel, (2) all personnel must wear various forms of personal protective equipment (e.g. surgical masks or face masks) while in the laboratories or building itself, and (3) have access to additional disinfectants and cleaning materials while in the laboratories as well.

Certainly, these requirements are necessary considering the many unknowns about COVID-19, but it really remains to be seen whether such measures will be sufficient to ensure a safe and healthy work environment. It also begs the question as to how long our labs can remain open when considering outside factors that remain beyond our control. An excellent example of this actually lies in the fact that students began arriving on campus in August for the fall 2020 semester. Will it be possible to remain safe within our existing research labs even when the hallways are filled with asymptomatic students who could possibly be infected? It remains to be seen if the closing and reopening of such research labs will be the beginning of a recurring cycle. Such a cycle will be especially challenging for researchers who are attempting to do long term bench-scale work or field studies, where continuity is an essential part of the experimental research process.

The Path Ahead

The COVID-19 pandemic is really one of the first times a global crisis has affected me so personally. It is hard to see how to move on from this point, but it is clear that we must take action to propose and implement changes that enables research at higher education institutions to continue on and which allows science to progress. I would like to recommend several actionable items that I believe will provide the first steps for such progress to be achieved. They are as follows:

- Bi-annual forum: To promote open dialogue amongst research active personnel, resources should be allocated for enabling research active faculty (tenure-track, clinical/professors of practice, and research faculty) and staff to meet bi-annually. This forum will enable attendees to discuss the research challenges presented due to the COVID-19 pandemic and strategies to mitigate them.
- Research lab transition assistance: Resources are needed for research faculty and staff to better streamline the processes (e.g. development of standard operating procedures and training exercises) associated with transitioning the on-campus lab settings so that they can adhere to strict safety protocols while optimizing and maintaining research productivity.
- Graduate student transition assistance: Graduate students are the life and blood of a productive and successful research laboratory. Greater resources must be provided to them to help transition research activities to the home environment, by providing better and more ergonometric workspaces.
- Research and development of virtual labs and artificial intelligence: A greater push should also be made towards advancing research related to virtual lab design, artificial intelligence, and remote learning. These areas of research will enable students to begin learning laboratory skills from a remote location and will expedite the time required to fully train them when they are later placed in a laboratory setting.

Overall, I hope that these initial suggestions offer a suitable and constructive foundation for generating other actionable items, that may enable us to effectively meet the research challenges presented to us in the uncertain times ahead.

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