What does effective education look like in the context of COVID-19, and how can subsequent successes and challenges be measured in order to ensure the future of online learning and the educators that make it possible?

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Abstract*—*This research paper explores the impact of the COVID-19 health crisis on the education sector by unpacking the challenges and successes of the forced migration of professors and their curricula onto online learning platforms. Quantitative research was conducted in the form of a domestically focused survey to determine the success of those teaching models and the transition to online education by focusing on the experience of educators. This paper ultimately argues that under the specter of a pandemic, the ensuing online education has been as successful as possible, and that despite a myriad of global negative impacts, COVID-19 has opened the door to reform traditional learning, allowing educators to take advantage of this golden opportunity to unlock the power of online education.

1 INTRODUCTION

This research paper poses the question: what will make or break the success of online education, and the transition to online learning environments, in the midst of COVID-19, and how does one measure that success in a climate of such instability?

Regarding collegiate transitions from offline to online learning, well established best practices and clear criteria for success already exist, with research dating back as far as 2002. However, how many of these guidelines and principles apply to emergency situations such as a global pandemic? Do the techniques and recommendations hold true with constraints such as shifting an entire learning experience online within a week?

This paper will answer these questions by first contextualizing COVID-19 in order to introduce the impact that this pandemic has had on the education world and beyond. It will then debate the complexities of defining success in such a

unique and unknown educational climate, before introducing the research conducted for this paper. A comparison between offline (in-person) and online learning will then be made. Following that, the paper will discuss the challenges and successes experienced by the educational world in the midst of COVID-19.

This paper will argue that while best practices for moving offline education to an online environment can be applied successfully under normal, non-critical circumstances, a set of different best practices is needed to accommodate a pandemic. An emergency teaching model has therefore emerged, that focuses on simplicity, robustness, and above all else, flexibility. This paper ultimately argues that the success of this emergency teaching model is dependent on educators, and the support, resources, flexibility and confidence which they possess.

For the purposes of this paper, online education will be defined using Stern's (Stern 2016) definition of online learning as any learning that does not take place in a traditional classroom, and instead takes place across distance. The type of distance learning that this paper will focus on is distance learning which occurs using the internet.

2 IMPACT OF CORONAVIRUS-19

The coronavirus disease 2019, COVID-19 henceforth, is a new strain of virus that has not previously been seen in humans. The virus can lead to an array of symptoms, varying from mild to severe. The virus puts people over the age of 60 and people with underlying health conditions at the highest risk (CDC 2020). This novel virus has caused an international pandemic, impacting health, economies and education across the world.

The health impact of COVID-19 has been profound. The first documented case of COVID-19 surfaced in China in late 2019, before spreading globally. As of March 12, 2020, the virus had been confirmed in 125,048 people worldwide, with a mortality rate of 3.7% (Mehta et al. 2020). By June 13th, the number of cases exploded to 7,553,182 cases, with a total of 423,349 deaths globally (Organization 2020).

This pandemic has also had an unprecedented impact on education systems around the world, affecting more than 1.6 billion students – this number

represents 91% of all the students in the world. This pandemic is a once-in-a-generation "black swan" event — an unpredictable or unforeseen event with extreme consequences— in terms of the resulting economic and societal consequences. (Krishnamurthy 2020).

In the United States alone, school closures affected at least 55.1 million students, forcing 124,000 public and private schools to move to online education, giving many educators a mere seven to ten days to transition their teaching models and curricula (Sharma 2020). According to the United Nations Educational, Societal and Cultural Organization (UNESCO), more than 160 countries closed their schools nationwide, impacting over 87% of the world population. (Krishnamurthy 2020). With these new challenges, over 60% of graduate student have listed "unable to complete graduation requirements" as one of their top three challenges (Volkers 2020).

The instability of the transition to online education and the unknown future of teaching realities has been felt deeply by students, many of whom are now questioning the value of their education: students at more than 25 U.S. universities are filing lawsuits against their colleges, the students unsatisfied with the caliber of education and demanding partial refunds. In addition to these refunds, a decline in student enrollment, state funding and research could equate to a loss of $1 billion for colleges this year (Binkley 2020).

3 RESEARCH AND METRICS OF SUCCESS

This section will introduce the research conducted for this paper. In order to contextualize the research, this section will first discuss and define metrics of success for online learning and how they should be measured.

It should first be acknowledged that measuring success in higher education is historically problematic, often driven by a desire to convert student success into data, which then becomes dollars. This is often achieved by embedding analytics into learning management systems used by colleges, which fails to disaggregate the nuances of success, and too often obscures the complexity of student success, thus creating a narrow and instrumental view of education (Fawns, Aitken, et al. 2020).

An additional problem with metrics is that they offer a myopic view. In some cases, many students only see the payoff of their education well after they graduation (Aitken et al. 2019; Aitken 2020,this issue).

This type of strict, data centric approach reveals several dangers. First, this approach creates a culture of performance and stakeholders — students and educators alike — skew their results in effort to generate favorable data (Hodges et al. 2020). Second, by focusing exclusively on measurable outcomes – and whether or not those measures focus on the right direction — students miss an opportunity to explore critical and creative thinking (Naidoo and Williams 2015). Third, the data is being used to arm non-experts — including algorithms — to measure teachers' performance against one another, creating a risk-adverse environment where are no longer exploring, no longer experimenting and fear making mistakes (Fawns, Aitken, et al. 2020).

That being said, many researchers have focused on measuring the success of online learning during COVID-19 by comparing it to pre-COVID-19 learning. However, this type of comparison does not take into account that this is many higher education students' first experience of full time, online education and it is therefore difficult to gauge the quality of the online teaching, as many students do not have a frame of reference.

Furthermore, the teaching model educators are pursuing is one of crisis, and it not being pursued out of choice. Currently, the education world finds itself in the midst of a global pandemic. This means that the teaching measures being put in place are stop-gap measures — not the first-principle design of instructional experience (Krishnamurthy 2020). Educators should therefore not be expected to replicate a robust educational ecosystem when they face emergency and crisis. Rather, the chief aim during this pandemic should be providing temporary access to instruction and instructional support that is both quick and reliable (Hodges et al. 2020).

This researcher therefore determined that for the purposes of this paper, research should be focused on markers of professors' success in implementing online education. This research approach accepted that student satisfaction in the midst of COVID-19 would not be an accurate barometer for success due to the haphazard transition and crisis management forced upon colleges and students, and

therefore assumes that if professors felt successful and supported, this would be the most accurate predictor of successful online learning.

The author therefore conducted quantitative research, generating a survey focused on the experience of higher education professors in the United States. This next section will introduce that research, providing context, data and graphics. This will then be referenced throughout the paper.

Survey questions centered around collecting data on the experience of professors' move to online education. Questions sought to uncover what professors' experiences of emergency teaching had been like, their comfort level in online environments, the support they received from their college administrations and how they were tracking or measuring the success of the transition. For a full list of survey questions and results, see *appendix 1.*

In order to ensure that survey data was not biased - for example by the financial clout of ivy league colleges, subjects that lend themselves well to online learning, or focused merely on colleges in a certain geography - a diverse cross section of colleges were selected as survey recipients, and a similarly diverse set of professors were contacted.

The following colleges were contacted: University of California Berkeley, University of Georgia Tech, Syracuse University, Massachusetts Institute Technolgoy, University of Texas, University of North Dakota, University of Iowa, California State University of Northridge, Seattle University, University of Washington.

4 COMPARING OFFLINE AND ONLINE EDUCATION

In the midst of COVID-19, researchers and educated have argued to varying extents about whether online education is inferior to offline education, and vice versa. This paper argues that there are different modes of teaching, each with their own advantages and disadvantages, and that despite these differences, the "principles of learning and teaching online are not different from learning and teaching on campus" (Fawns, Jones, and Aitken 2020). This paper argues that the real differentiator affecting professors' and students' negative experiences of online education is the emergency model that has emerged as a result of COVID-19, rather than online education itself. This argument will be outlined by first

introducing educational challenges that COVID-19 has introduced, before introducing unexpected benefits of the online learning and finally providing arguments against online education.

Online education amidst COVID-19 presents a new set of challenges and limitations for students as in general, in person activities have been suspended (Sun, Tang, and Zuo 2020).. In addition, students experience these challenges differently depending on their area of study. For example students of the sciences who would typically conduct in lab research are unable to access physical laboratories to collect data or field samples; for the same reasons, students are unable to access physical textbooks shelved away in on-campus libraries. Similarly, dermatology students cannot conduct any of the following virtually: assessing texture of skin or performing biopsies or scraping with potassium hydroxide (Loh, Hsiao, and Shi 2020).

Another example of education being hindered by a lack of in person experiences is optometrists. In order to maintain their license to practice, optometrists must keep up with continuing education credits. However, some of these credits can only be obtained in face-to-face classes, a restriction enforced by the Association of Regulatory Boards in Optometry (ARBO). And only recently, in the midst of the pandemic, did the board relax these restrictions, allowing optometrists to earn their credit so as long as they are able to interact with a live instructor (Bailey 2020).

Despite the above constraints of online education in the midst of COVID-19, professors are discovering advantages (some of which are unanticipated) with the transition. In particular, many are finding that online education promotes collaboration in unexpected ways. Fawns and Jones, two professors from the University of Edinburgh, found that many of their students who were previously less active in an offline setting were speaking out more on asynchronous discussion boards (Fawns, Jones, et al. 2020).

Another advantage of online education is its use of video conferencing, which can increase the number of mentees a mentor can coach at a given time. For example, multiple students may join a physician's medical appointment — at the patient's and attending physical's discretion — and allow them to learn fundamental dermatology concepts which can help their learning even in the absence of in-person visits (Loh et al. 2020).

Krishnamurthy posits that in the same way technology companies noticed a dip in productivity when their employees first transitioned to remote work, educators observed the same dip in productivity before productivity actually met, and in some cases, exceeded the pre-COVID-19 outputs. (Krishnamurthy 2020).

In contrast, some researchers and educators maintain that online eduction is inferior to offline education, suggesting that distance and technology impede learning. For instance, one Australian vice-chancellor stated that "face-to-face interaction will never be matched in quality by other modes of communication" (Bansal 2020).

Further, Gewin (Gewin 2020) argues that the tools needed for online teaching are unreliable. He suggests not using live conferencing for every facet of the course because guarantees cannot be made about the quality of the video stream and some platforms can get overloaded and crash. This is sound advice, however according to the survey conducted by this paper, most of the professors delivered their lectures using live video, over 69%. Furthermore, many of these professors did not experience technical issues when delivering their lectures, with 60% never encountering a technical glitch and 36% experiencing glitches between one and three times.

5 CHALLENGES

Educators have faced many challenges in transitioning their curricula onto online platforms, many of whom have a lack of online experience, which has had profound impacts on their teaching methods and migration onto online environments. This section considers the preparation and training that educators received around how to migrate curricula online, and then once online, how to teach effectively.

As the pandemic unfolded, teachers found themselves with a time deficit wherein they were rushed to transition to online learning despite a lack of training and experience.

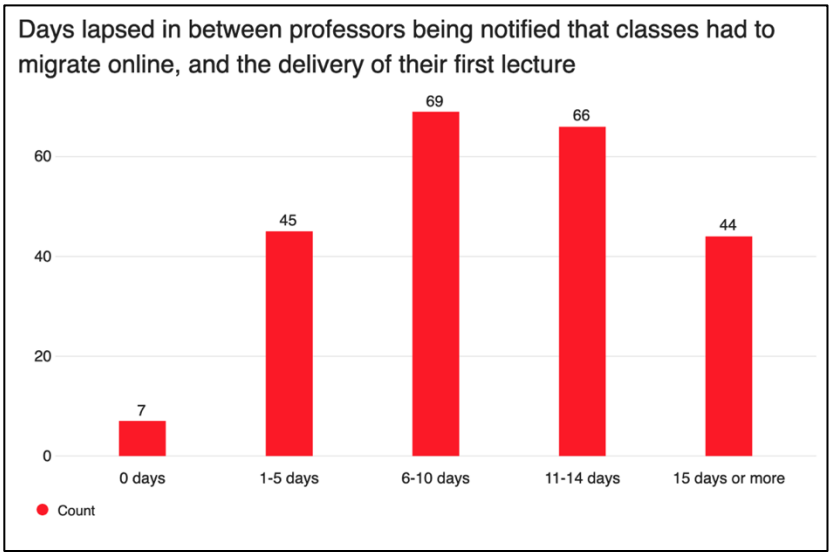

Figure 1 — Days lapsed between professors being notified that classes had to migrate online, and the delivery of their first lecture

According to the survey results shown in *figure 1*, 81% of professors had less than 14 days to deliver the first online lecture, from the moment they received notification from their administration. In addition, 66% of all the professors surveyed received less than a 1 hour of training on how to deliver online education. These numbers are startling given that the typical amount of time required to plan, prepare, and develop a curriculum for a single online university course is six to nine months (Hodges et al. 2020). Researchers like Fawns, Aitken and Jones (Fawns, Aitken, and Jones 2020) support the argument that regardless of online training and experience, online education can only be successful with skilled staff dedicating time for each student. They state that "changing from on-campus to effective online teaching requires time, support, and faculty development."

An additional challenge facing educators is that professors often underestimate the level of effort required to move their courses online, when really they should be rejecting the false notion that a curriculum can simply be moved online. Research, such as that referenced in *Research* section, demonstrates the uncomfortable reality that higher education institutions have been slow to acknowledge: transitioning to online education requires a significant amount of effort. Figure 2 demonstrates that while only 24% of professors of the surveyed professors stated that only a little to no effort was required to prepare the delivery of an

online lecture, 76% stated that the preparations took either a moderate amount, a lot, or a great deal.

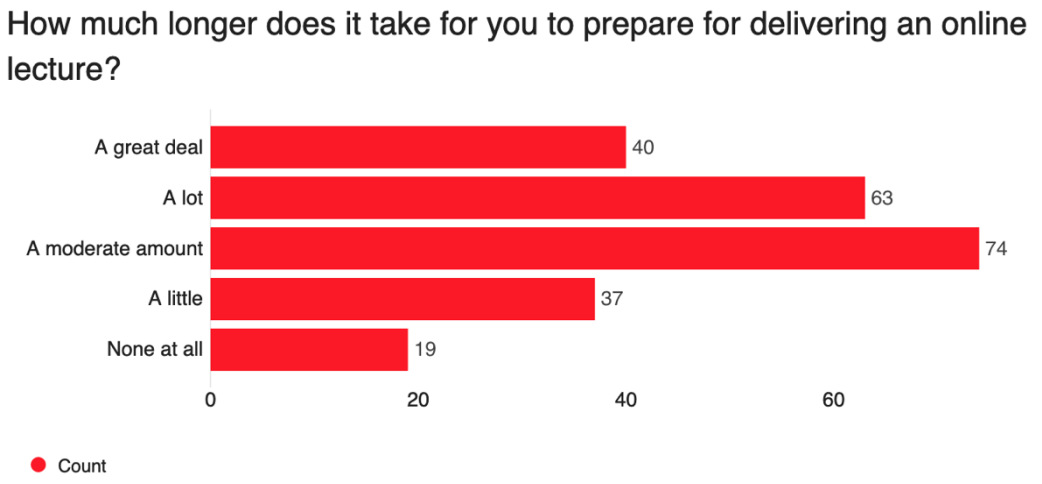

Figure 2 — The effort involved in preparing an online lecture

In addition to a lack of both training and time, instructors (as well as students) encountered, and continue to encounter, technical issues such as insufficient computing hardware, software bugs, or a lack of internet bandwidth. For these reasons, researchers such as Gewin (Gewin 2020) argue that the quality of video feeds cannot be guaranteed and instructors should therefore not rely on live video. However, survey results from the research conducted for this paper stand in contrast to Gewin's argument. Findings demonstrate that in fact a majority of professors never encountered a technical issue that derailed a lesson: 59% reported zero technical issues, while 36%, the second largest group, reported one to three failures.

Finally, it should be noted that under non-emergency situations, instructors can turn towards other staff members and educators who are dedicated to assisting them with transitioning to online education. However, due to the scale of the online migration necessitated by the education realities of COVID-19, students and professors alike must prepare for the reality that the resources — both human and technical — will surpass their capacities and as a result, the learning experiences offered to students will be neither well planned, nor fully featured (Hodges et al., 2020)

6 SUCCESSES

It is indisputable that COVID-19 has had a negative global impact, shattering healthcare systems and economies, while rocking communities around the world, and yet, in the midst of this pandemic, the education world has encountered some unexpected benefits and success.

An unexpected success of online education during COVID-19 has been the focus on mental health. With the shift to online education, administrators and educators are taking a step in the right direction and stressing the importance of mental, emotional and physical health. According to the survey conducted for this paper, over 60% of professors were provided guidance on ensuring the mental health of students.

In any transition from offline to online education, whether in a pandemic or not, it is expected that students will experience performance penalties or fail to complete courses (Gewin 2020). For this reason, among others, institutions are accommodating students by switching from letter grades to pass/fail options (Hodges et al. 2020). This accommodation mirrors how the Nursing and Midwiferey Council (NMC) has altered their standards, providing education providers the flexibility needed as they approach their final six months in the program, all while ensuring that learning outcomes are met (Leigh et al. 2020).

Another unexpected benefit occurred in the medical field where the industry saw an uptick in telepractice and telesupervision. According to Volkers (Volkers 2020), prior to COVID-19, only 9% of faculty used the technology. Whereas now, over 60% have begun routinely using it. Some of these faculty members now believe that the adoption of these technologies "diversify clinical education opportunities and provide students with more comprehensive clinical experiences across the full scope of practice across the lifespan."

Another hidden benefit of the pandemic is that it has served as a forcing function for universities to take advantage of this unprecedented opportunity to not only pinpoint deficiencies in education but as an opportunity to "speed up reform of online education through innovative course content, state-of-the-art technology and efficient management." (Sun et al. 2020). It's no surprise then that when educators were surveyed for this research paper and asked whether they would

incorporate any technology, techniques or skills adopted during the first semester of online teaching, 87% professors agreed.

In addition, at least one nursing school saw a significant improvement in the proficiency of their students when COVID-19 forced their education to go online. A study was conducted where sixty training nurses in Tongji Hospital were divided into two groups, one group taught in the traditional (offline only) methods, while the other group supplemented their traditional mode of learning with MOOC (massive open online courses). The results of the study revealed that the addition of online instruction not only helped alleviate the lack of clinic nursing teaching resources, but also improved the initiative of students to learn independently (Zhou et al. 2020). As such, the nursing school intends to incorporate some online learning even after education returns back to "normal".

So far, we have discussed the benefits and implications of online education in the midst of COVID-19. But the transition does not come without a cost. The level of effort to produce online lectures is significant. When surveyed for this paper, 76% of professors stated that preparing the lecture takes a moderate amount or more, with 17% stating it takes a great deal.

This is further evinced by one survey respondent who shared how the experience of teaching online has been eye opening:

> *"To be honest, I didn't realize how behind in technology I was as a traditional faculty member. I have learned so much in the past few months (zoom, YuJa, blackboard. I am very thankful. It will help immensely as I put more courses online. Also, I have been very successful in getting great industry speakers to easily zoom in to class for presentations. This is something I hope to continue."*

In summary, the pandemic has offered educators a unique opportunity. This is an unprecedented time to "embrace principles of learner engagement, synchronous delivery and adaptation, and opportunities for learners to develop individual and social meaning through educational material" (Seymour-Walsh et al. 2020).

7 CONCLUSION

To finish, this paper focused on the transition from offline to online education in the midst of COVID-19, and determined that the success of such a transition rested upon the shoulders of educators. Further, this paper argued that in order to measure the success of an online transition and subsequent online learning in a climate of such instability, the most reliable and useful data would be collected from the educators themselves – those responsible for creating and dispersing the online learning.

To conclude, while best practices migrating classes online do exist, a different set of best practices is needed to accommodate teaching during a pandemic. The research conducted for this paper evinced that there was no uniform set of best practices, rather professors navigating a new teaching environment by collectively relying on simplicity, trial and error, robustness, and above all else, flexibility. This paper ultimately argues that the success of this emergency teaching model is dependent on educators, and the support, resources, flexibility and confidence which they possess.

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9 APPENDIX

Raw survey results included as part of final submission and titled "pre-post-covid19-survey-results.pdf"