Exploring the Effects on Student Learning and Engagement of COVID-19: an Innovative and Interdisciplinary Approach

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Educators are tasked with developing new pedagogical, communication, and assessment strategies to ensure the delivery of quality instruction to students. The nexus that exists between student engagement and teaching methods has been a sustained and distinct focus for higher education institutions. However, the emergence of the COVID-19 pandemic has forced institutions to adjust to distinct functionalities. With the shift to fully online models, there exists an opportunity to engage both faculty and students in innovative teaching–learning assessments and processes. Despite the myriad of challenges that COVID-19 introduces, our paper presents effective strategies, namely, the pedagogical community's focus on opportunities for student ownership in the learning process, the chance to engage students using an innovative social media strategy discussion format, and the formulation of syllabi that incorporate interdisciplinary strategies. Models that actively engage both sides of the educational spectrum will be catalysts for reform. We propose an educational structure that fosters inclusivity in the context of five focused domains: preassessments, prospective socioeconomic gaps, pedagogy, psychological health of students and faculty, and pandemic assessment.

INTRODUCTION

With incendiary speed, COVID-19 has transformed economies, health services, and education structures, informing new methods for remote teaching (1). The global impact of school closures in early March affected over 1.725 billion students in 193 countries (2). Guidelines provided by the U.S. state health organizations, state education departments, and state education licensing agencies were provided, but restrictions differed by state, creating ambiguity for how these interruptions would affect society (3). At issue was the education system's discrepancies in whether remote teaching would be a short-term fix or a long-term alternative (1).

Our paper focuses on the intersection of faculty and student engagement academically, professionally, and personally, the rationale being to better understand methods to engage students and energize faculty. The plight of students and faculty has individually been assessed as a result of the impact of COVID-19, but opportunities exist to synthesize these experiences for a better understanding of student engagement and incorporative practices (4–6). There is a

real opportunity to develop compassionate and collegial models for interdisciplinary approaches. Additionally, effective online strategies that explore various student learning styles, incorporate flexible learning, leverage technological resources and social media prowess, and emphasize faculty and student collaborative efforts will be needed. This paper is particularly useful for instructional plans of actions, but also for other countries to take note of the best ways to navigate these instructional difficulties, paying close attention to the economic devastation that the pandemic has caused (1).

DISCUSSION

Preassessment and preparation

The decision to conduct remote instruction in the United States took effect in March 2020 due to the increasing rates of COVID-19 cases across the country. The safety of students was prioritized and the essential elements of higher education, including preserving rigor and quality, were an important focus (7). This decision introduced heterogeneity into courses as universities failed to adequately consider the economic impact on students who rely on university facilities for adequate hardware and software. Students with an above-median socioeconomic status (measured by household income, parental education, and computer and internet access) were likely not subjected

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to purchasing new technological resources (8). However, for those who stringently relied on the on-campus facilities, their limited access to resources resulted in a significant paradigm shift as they sought to purchase adequate hardware and software not provided (7).

The extent to which the pandemic has resulted in learning loss, an increased dropout rate, and potential long-term economic ramifications within the context of higher education has received limited analysis. However, an awareness of the consistent disparities in the education system manifesting through racial and income divides exists (9). The shift to remote learning further emphasized the disproportionate learning losses for students of color (9). The already prevalent income gaps and racial divides in the education system will likely have long-term effects on the students who are unable to adjust to this new learning or cannot afford resources and those who may ultimately drop out of college (9). This of course will have long-term effects on the U.S. economy.

Recent estimates predict that the "average K–12 student in the United States could lose $61,000 to $82,000 in lifetime earnings, or the equivalent of a year of full-time work" (10). These figures only worsen when the racial context is factored in, particularly for students of color. In considering the impact of the dropout rate on white students, they would earn $1,348 less in a year (1.6% loss in income) over a 40-year working life (10). Hispanic students would earn $1,809 less (3.0% loss in income), and for black students, the figure is $2,186 less in a year (3.3% loss in income) (10). The total impact on earnings from these figures is estimated to be $110 billion annually. Of that sum, $98.8 billion would be associated with loss of learning and the rest ($11.2 billion) with the increase in the number of dropouts (10). As the pandemic progressed, universities considered methods to adapt to this paradigm shift. Some schools adopted a hybrid approach that included a mix of on-campus and remote learning when the requirements for restructuring student access to campus started to loosen. This approach required new pedagogical structures and goals.

Pedagogy

The sudden shift to remote instruction was challenging for both faculty and students. In-person classroom instruction has typically employed a range of active learning techniques. These include instructor-guided group work to develop and reinforce conceptual understanding, breakout sessions, debates, and participatory presentations. Remote learning eliminated much of that. Some students readily embraced this shift to e-learning, valuing its flexibility in terms of geographical location and time, whereas others experienced discomfort because of their limited digital literacy, or the absence of physical human engagement and camaraderie (11). A subgroup of students who benefited from remote learning is those who learn at their own pace, particularly English as a Second Language (ESL) students.

They now had the opportunity to learn and engage with the material at a slower pace if necessary. Perhaps this will be an area to watch in the future as we research methods to improve teaching and learning for ESL students. Finally, deliberate efforts were made to retain some synchronous aspects of learning to keep class function similar to prepandemic structures by using information management systems that instructors and students were already familiar with (7).

Some students benefited from the synchronous schedules and built-in class times from pre–COVID-19. Currently, those regimented schedules have been dismantled by remote learning with the adoption of more asynchronous work schedules, particularly in graduate schools. This addition has been particularly beneficial to international students. The flexibility in managing studies and adjusting to new working environments alleviated the anxiety of the new systems (7). Communicating changes to students was not seamless due to the multitude of changes to instruction that were taking place: new class outlines could not be published weeks ahead of the beginning of classes, increasing frustration for students.

Before the start of the spring quarter or mid-semester, faculty had to develop teaching structures that ensured the delivery of quality instruction while encouraging student learning and engagement. This is where the understanding of synthesizing student and faculty needs became important. Some of these methods included encouraging flexibility with course assessments, encouraging online proctoring, and where possible, canceling in-person finals to be replaced with take-home exams. Universities were presented with a unique challenge that forced instructional strategies for STEM-based courses to drastically change. Most science-based courses, although lecture intensive, also incorporate hands-on laboratory courses. These were adapted to incorporate lab demos, denying students experiences that would help develop problem-solving and critical-thinking skills, as well as gain exposure to reactions, materials, and equipment in lab settings.

Large classes in our respective institutions already found classroom management challenging prepandemic, and this was accentuated by the pandemic. Instructors turned to various pedagogical strategies, such as the increased use of technology, videos, quizzes, and increased teaching assistant (TA) participation. For example, a free iClicker student response system (SRS) was adopted over a previously used SRS (Tophat). Some variations in functionality existed between iClicker and Tophat. Class lectures designed for use with Tophat had to be adapted to iClicker. While iClicker was already used by some faculty in our institutions prepandemic, we saw a surge in use. For some, this was a new tool because they had not previously integrated iClicker or any other SRS in their pedagogy. Our institutions offered workshops to ensure compliance with and understanding of these tools. From a student's perspective, iClicker was used to incentivize attendance and participation by giving credit for class participation. In addition, instructors and TAs suc-

cessfully used Zoom chat to promote student engagement, and chats were used to gauge understanding of concepts and encourage peer learning (students responding to one another). Moreover, at the end of lectures, 10 minutes were dedicated to Zoom chat engagement with deliverables. Students were asked to write down one new interesting fact they learned and one concept they did not understand. This led to interesting discussions that lasted well beyond the 10 minutes. Students appeared to be more engaged and more inclined to participate than they would during in-person classes. Although this is anecdotal, it is worth investigating the effectiveness of incorporating social media style chats into routine class lectures through generational analyses.

In large undergraduate classes, a diversity of preferred learning styles and study strategies is to be expected. During the development of asynchronous portions of one of our large undergraduate classes, the question arose as to whether PowerPoint lecture notes should be provided in addition to the recorded lecture videos. The instructor's personal learning experience was informed by note-taking, thus resisting the need to disseminate lecture notes in addition to recorded videos. After a discussion with the TAs and millennials on social media, the decision was made to provide both video and lecture notes to enrolled students. The student perspective for making decisions like this is paramount. The mental anguish of the pandemic has had effects on both faculty and students, but faculty need to communicate with students to find out how best they can learn within the confines of remote learning. What may have been operable prepandemic may be detrimental to students under these conditions. Thus, the need to consider situations and model behavior using both perspectives is important.

Psychological support

Quarantine measures have shown success at controlling virus spread and have been used to ensure that students who might contract the virus would not return home to spread it to elders in their communities. This is particularly important as a safety measure for adults who may suffer from multiple morbidities or have geriatric syndromes that place them at the highest risk of COVID-related mortality (12). Physical distancing is a major part of public health COVID-19 control measures. However, physical distancing and quarantine procedures present varying degrees of social isolation that take a psychological and physical toll on students (13). The implications for students in isolation or remote learning settings include depression, generalized anxiety disorders, decreased sleep, and functional impairment (14). Additionally, international students face anxiety over changing immigration policies and restrictions. Students also have the added stress of not knowing how to adjust to the job market, as it is unclear how COVID-19 will impact hiring practices.

Faculty remain concerned with the overall health and advancement of their students, and virtual learning makes it difficult to ascertain whether students are thriving since

communication is impaired. Furthermore, for international students, virtual office hours might not be possible due to time differences. In addition to isolation, numerous other challenges arose in 2020, including the Black Lives Matter protests. This profoundly affected both faculty and students and was another instance where a synthesis of faculty and student concerns needed to be contextually assessed. Faculty were expected to deal fairly, respectfully, and compassionately with all students. While they gave their best effort, most faculty are not trained in mental health or crisis response (15). Therefore, FAQ pages and campus-wide syllabi alterations were necessary to delineate important stand-alone campus resources (including mental health services). These were helpful, especially when placed in one virtual location for easy access.

The University system offers a social structure that we have all become accustomed to. That structure was destroyed, presenting no time to adjust. Faculty taught from home or used empty campus classrooms due to internet uncertainty. Leaving home to go and teach in empty classrooms offered a link to the outside world and provided relief from isolation and a mental health boost. However, teaching in empty classrooms was challenging, oftentimes leaving faculty emotionally empty, because effective teaching includes reading student expressions and responding to those cues. Therefore, in our classes, we developed a strategy of enforcing retrospection breaks during lectures where we interacted with students and responded to Zoom chats, as students communicated frequently there.

Pandemic assessment

Learning assessment and program evaluation were challenging prepandemic and continue to offer challenging typologies for faculty. Assessment is complex because there is no generic solution. Instructors must develop sound learning objectives with methods to assess each objective. During the pandemic, institutions and instructors had to become creative to ensure fair and equitable assessment. Prepandemic, we already had challenges related to cheating and unfair practices by some students. Various websites popular among students purporting to be study aids may inadvertently have encouraged cheating. To combat this, instructors must give students what they need to succeed while ensuring assessment materials are not compromised. Some instructors offer comprehensive study guides or old exams that help students prepare for exams to dissuade students from using other online sources.

Institutions need to develop innovative assessment strategies while maintaining rigorous testing standards. In-person exams for large classes were already challenging prepandemic. There was evidence of students sending others to take their exams for a fee or trying to bypass examination tool security. Therefore, the use of innovative online proctoring tools (OPT) was implemented to ensure fairness. However, some OPT proved inefficient during

the pandemic. Those using live proctors were severely impacted by COVID-19. Live proctors were replaced by automated proctoring, which was a woefully inadequate alternative. To level the playing field, some instructors abandoned automated online proctoring and chose to give open-book or take-home exams instead. As the pandemic progressed, instructors increased their use of OPT while students became concerned. Chat forums were used by some students to voice displeasure and organize student support against the use of these tools. Instructors had to acknowledge that student privacy risks existed but had to help students understand that our institutions had conducted Vendor Risk Assessment (VRA) review processes for the various OPT prior to implementation on campus. The VRA was handled through campus information security offices, and institutions were confident that the OPT chosen complied with data privacy and data security standards. These were examples of considering how best to accommodate student and faculty expectations.

RECOMMENDATIONS

We propose a more permanent alteration to syllabi across disciplines, a new method of remote debate and discussion structures, as well as the proposition of policy expansion for student engagement, all of which can be later supported with empirical studies.

Long-term multidisciplinary approach

The integration of multidisciplinary approaches will remain fervent for the next few years, and alternative disciplines should mandate the integration of environmental and healthcare concerns to better prepare for another pandemic or similar natural disaster. Solid collaboration to develop adaptable research and teaching methods across disciplines would leave institutions in better shape to handle sudden changes. Substantive emergency preparedness plans will be crucial and business schools, law schools, education practicums, etc. should mobilize.

The nature of multidisciplinary approaches will need to be expanded. For example, during this pandemic, we have been exposed to how public administration and politics can affect healthcare and education policy, as well as social equity issues, etc. Understanding how disciplines are intertwined at the theoretical and conceptual levels will help to understand how to be better prepared for global and administrative dysfunction. This approach will require less time to adapt to changes if the preparation is pursued in advance.

Incorporate creativity into learning

Innovation within instructional patterns will take on a new form. We will see universities encouraging peer-to-peer learning and assessments, more self-directed learning con-

tent, computer-assisted learning, game-like activities, and adaptive tutoring systems. Several methods to incorporate creativity within academic structures have been proposed by Jennifer Gonzalez within *The Teacher's Guide to Tech 2019* (16). These include an emphasis on tools, assessment, split learning, productivity, and planning. Our own approach to engaging students might consist of the combination of peer-to-peer learning, game-like learning, and social media through the incorporation of debates or critiques using side-by-side videos, in a duet format. More specifically, TikTok social media strategists use this approach to make collaborative video duets. TikTok videos are usually short performances with creative editing. TikTok duets allow users to make commentary on an already existing video. Both videos appear side by side allowing the user to respond to and pause the original video while still offering their specific commentary. In an academic setting, this can function in the same way as a debate or discussion would in a classroom. This is one option to foster more discussion amongst students in an innovative manner. To our knowledge, this is not being used in classrooms and offers an innovative and interesting way for students to become acquainted with new software, learn from their peers, and remain engaged.

Policy initiatives

Governments and institutions must pay attention to student retention rates during and after the pandemic as an ongoing concern. Barriers to learning existed pre-pandemic and will only become more apparent as the pandemic proceeds. For instance, policies that offer support for students from low socioeconomic backgrounds, ESL students, and first-generation college students and account for racial disparities need to be addressed and be at the forefront of policy agendas both at the state level and within institutions. Students in rural communities are likely to need additional support to overcome the educational challenges created by COVID-19, and strategies will need to be long-term. Some of the initiatives could include free WiFi for students, increased but safe library access for internet, telehealth for the most vulnerable community members (also known as quarantine work bubbles), and joint ventures between government agencies and restaurants to provide meals for vulnerable students (9). Improving access to the internet and engaging with online learning platforms will likely be an important step to equalizing learning opportunities and preventing the widening of achievement gaps (17). Future research efforts should focus on how best to accomplish policy goals that are focused on both faculty and students. Future research goals should also be able to assess how best to accommodate international students in these instances.

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