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REVIEW

Undergraduate Learning in the COVID-19 Pandemic: Lessons Learned and Ways Forward

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Abstract: The SARS-CoV-2 coronavirus (COVID-19) pandemic is in constant evolution, much like the virus, and we must learn to adapt our undergraduate education and learning strategies to enable students to complete their studies. This narrative review focuses on what is currently known about the face-to-face and e-learning strategies of undergraduate medical students in resource-limited settings during the COVID-19 pandemic. The majority of studies, involving health professional students, took place in 2020. Few involved educators. Students have faced challenges with the transition to remote learning, for which a couple of interventions have been devised. Bridging the gap in access and utilisation of remote learning might have required more time, however, the COVID-19 pandemic has accelerated the learning curve and the transition from in-person to online learning.

Keywords: undergraduates, physical learning, e-learning, COVID-19, digital learning, online learning, face-to-face learning, traditional learning, remote learning, virtual learning

Introduction

In March 2020, the World Health Organisation (WHO) declared the SARS-CoV-2 pandemic in effect. It has impacted the lives of all. Universities and schools were closed, and onsite physical learning was restricted to limit the spread of the disease.[1,2] In the past year, several institutions resumed on-site education.

There has been a global decline in the number of COVID-19 cases since August 2021. The world has been battling a deadly pandemic that, by September 2022, had cumulatively claimed the lives of just under 6.5 million globally.[3] Much as though some scholars have documented that from the beginning of this pandemic, undergraduate educational institutions have been closed to try and curb the spread of COVID-19.[4] There has been some variability, both within and between countries.

Education has shifted from face-to-face interactions to online platforms. This may be possible for the majority of students, but consideration is needed for those pursuing programs in medicine, nursing, and dentistry.[1] The mental health crises brought about by COVID-19 have also reduced the academic performance of students.[5,6]

Before the pandemic, many institutions were run via a traditional face-to-face didactic model of learning, especially in low income settings.[7] Before the pandemic, a study performed on undergraduate engineering students found an e-laboratory fostered more active learning and enabled students to take more responsibility for their learning when compared to their traditional physical laboratory sessions.[8]

A review conducted in 2020 found that higher education institutions face several challenges related to asynchronous/synchronous learning integration. These included access to technology, online competence, academic dishonesty, lack of privacy, and confidentiality.[9] However, to the best of our knowledge at the time of the conduct of our review, there was no review conducted to compare and contrast the learning strategies of different undergraduate students during the COVID-19 pandemic. There is need to determine challenges encountered, solutions offered and future implications of

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effect of the COVID-19 pandemic on learning approaches of undergraduate students. We aimed to identify and consolidate previously published data surrounding undergraduate learning in the COVID-19 pandemic era.

Methods

A narrative review of published literature was conducted to gather evidence for gaining a better understanding of the scale and nature of the impact of the COVID-19 pandemic on undergraduate education learning.

Source of Information

Medline/PubMed, and Google Scholar databases were searched January 2020 to December 2021.

Search Terms and Delimiting

Search terms "online learning", "physical learning", "undergraduates" and "covid-19" were used. No additional articles were obtained from a manual search of the references of the retrieved articles, authoritative texts, personal contacts with experts, and reviews of unpublished work. Records obtained from the searches were manually screened to remove duplicates and to also identify articles that met our eligibility criteria.

Selection Criteria Employed

The inclusion criteria included:

1. An observational or interventional study describing the undergraduate education during the COVID-19 pandemic.
2. Peer-reviewed studies.
3. Studies published in English.
4. Studies published between January 2020 and December 2021.

Articles excluded were:

1. Studies whose full texts were not available online even after attempts were made to contact the corresponding authors of these papers.
2. Studies with wrong outcomes.

A table and themes were used to summarise the findings from the review.

Results

Teaching Methods, and Learning Experiences

Regional Evidence

In Germany, a multi-disciplinary survey found that students were ready to adapt to remote learning during the COVID-19 pandemic. These students had sufficient online resource management approaches.[10] In an undergraduate survey in Bangladesh, just under a quarter of students believed that online learning was ineffective. They stated barriers such as poor internet connectivity, an irregular electricity supply, and a lack of compatible devices.[5] Students from low-resource settings may have been more severely affected by the pandemic. A recent study from Uganda found that only 57 out of 214 (26.6%) students had access to a high-quality, stable internet connection.[11] Students from low-income countries faced more technological challenges when compared to their counterparts from higher-income settings.[12] However, there is a need for greater clarification of the difference between low- and high-income settings as well as between urban and rural areas within these countries for us to be able to make generalisations as shown in Table 1.

Table 1 Studies About Undergraduates Learning During the COVID-19 Pandemic

Reference	Country	Year of Data Collection	Study Population	Sample Size (n)	Research Methods, Study Design	Main Results/Findings
Dutta et al (2021)[13]	India	2020	Medical students; nursing students	1098	Quantitative and qualitative, Cross-sectional	First-year students were significantly dissatisfied compared with other students. Overall, 42% of all students were found to be dissatisfied with distant learning. Students had mostly negative comments about online learning.
Mirza et al (2021)[22]	Pakistan	2020	First-year undergraduate students	10	Qualitative, cross-sectional	COVID-19 has negatively impacted students' quality of lives due to the challenges in procuring resources to support e-learning. Poverty is a major challenge to the use of online learning. Many students from resource-limited settings lack digital skills, self-learning, and English reading skills.
Schmitz et al (2021)[15]	Germany	2020	Medical students	58	Prospective cohort	An online platform is efficacious for surgical education and can be adopted during the COVID-19 pandemic.
Gin et al (2021)[17]	USA	2020	Science, technology, engineering, and math (STEM) undergraduates	66	Qualitative, cross-sectional	Online learning has presented great challenges for students with disabilities.
Lewis-Kipkulei et al (2021)[27]	USA	2020	Special education undergraduates	6	Qualitative, cross-sectional	A hybrid curriculum of round table and flipped classroom positively impacts students' engagement and participation.
Naujoks et al (2021)[10]	Germany	2020	Humanities, Social Sciences, and Theology; Sciences; Business, Economics, and Law; Engineering; and Medicine Undergraduate students	247	Quantitative, Cross-sectional	Students are digitally ready to shift to digital learning but are unable to apply enough resource management strategies.
Zhao et al (2021)[19]	China		University students	406	Qualitative, Cross-sectional	The level of learning environment comfort and amount of physical activity affect students' satisfaction with distance learning.
Saha et al (2021)[5]	Bangladesh		Undergraduate students	180	Qualitative and quantitative, Cross-sectional	Students are unsatisfied with the COVID-19 pandemic remote learning which has brought a heavy toll on their mental health and learning.
Soria and Horgos (2021)[28]	US	2020	College students	27,118	Quantitative, Cross-sectional	35% and 39% of students had a major depressive disorder and generalized anxiety disorder respectively. Students' risk for mental health disorders during the COVID-19 pandemic is affected by their health and safety, financial, and academic stressors.
Wester et al (2021)[20]	US	2020	Undergraduate biology and chemistry students	73	Quantitative, cross-sectional	Students had a significant decrease in engagement with a shift to remote learning
Chan et al (2021)[29]	China	2020	Nursing students	56	Quantitative, Prospective interventional	Students' perceived learning satisfaction predicts students learning engagement.
Anwar et al (2021)[21]	Pakistan	2020	Medical and dental undergraduates	283	Quantitative, cross-sectional	Students appreciated e-learning with females displaying more positive a
Wang et al (2021)[23]	Western China	2020	Clinical medical students	369	Quantitative, cross-sectional	Female and junior students predominantly experienced high levels of perceived stress with online learning during the pandemic
Ping et al (2021)[30]	Malaysia		Undergraduates pursuing a programming course	270	Quantitative, cross-sectional	There is no significant difference in the performance of students with or without physical classes
Kiarie and Muindi (2021)[31]	Kenya		Undergraduate students	71	Quantitative, cross-sectional	Students had good technical skills to facilitate online collaborative learning

Medical vs Non-Medical Students

The COVID-19 pandemic disrupted the education of all undergraduate students. When COVID-19 began some final-year medical students were able to continue with their clinical education after being absorbed into their health-care systems to provide the additional human resources needed to address the local demand for more health-care workers.[1] In contrast, the education of students pursuing non-health profession courses was fully halted, especially in settings that were not well prepared for the transition to online learning.

E-learning is less effective for health-care students in their years of clinical study because their core training requires strong interpersonal interactions with patients.[1,13,14] Online learning can lead to improved focus and interaction with better learning outcomes. It is also time efficient and convenient.[13]

In a bid to find solutions to adapt medical education to the pandemic, interventions such as video-based online surgical training platforms,[15] have been developed to deal with restricted face-to-face learning. A recent cohort study found that medical students who used blended learning digital strategies compared favorably with colleagues who only used physical textbooks.[15]

There is a need to foster strong authentic collaborations between the disciplines that teach procedural knowledge.[16] We need to tackle the effect of the pandemic on the acquisition of procedural knowledge (application of what you know) as this is harder to obtain than declarative knowledge (what one knows).

A study involving students with disabilities at US universities found online learning presented novel challenges for them.[17] These include mental health issues (eg, depression, anxiety), loss of reduced testing center environment, and insufficient extended testing time. Educational institutions need to focus on the provision of equitable remote education tools to help undergraduates continue with their studies during and after the pandemic.

Students' Satisfaction with Online Learning

In India, about half of the health-care students surveyed were dissatisfied with e-learning. This was due, the main, to issues around interaction and focus, practical learning, and content.[13] A survey published by the Center for Higher Education Studies explored the experiences of undergraduate students with disabilities and found that only 20% of undergraduates with disabilities reported higher satisfaction scores with online learning.[18] In the same report, 33% of the surveyed students reported no change in satisfaction levels with the full shift to online learning.

A comfortable physical environment, in terms of light, temperature, and a desk, can improve satisfaction with online learning.[19] This finding is not generalizable. Wester et al surveyed science students from 23 institutions, undergoing remote education, and found a significant decrease in student engagement as measured as a construct of students' behaviors, cognition, and emotions.[20] Contrary to this, a study conducted among medical and dental students in Pakistan found that most students appreciated the shift to e-learning, and they were well prepared for the transition.[21] Students from all corners of the world have expressed varying levels of satisfaction with e-learning. Their respective institutions should take this into account to improve their learning during the COVID-19 pandemic.

Challenges

Poverty has limited many undergraduate students from developing countries from obtaining the desired results from virtual learning because of the inability to access online education.[22]

Poor interpretation of the written English language has also been identified in non-English-speaking countries as a major drawback.[22]

Student mental health concerns have also been exacerbated by the pandemic. Several studies have found that it has profoundly affected students' mental health.[5,6,22,23]

Five experienced educators, from the fields of medicine, music, and magic, highlighted four major challenges including difficulty in discerning a learner's needs, lack of privacy for learners, failure to physically correct students' learning errors, and reduced spontaneity in students' learning environment.[16]

Naujoks et al found that students experienced challenges with time management, seeking academic help, and lacking structure in their learning environment.[10]

Other key challenges encountered include travel restrictions, less-developed online assessments and evaluations, a lack of technical and technological skills, and a lack of online confidentiality.[2,9,24]

Solutions Offered

In response to these unforeseen challenges, many solutions have been devised.

A SERU (Student Experience in the Research University) COVID-19 survey found there is a need to reduce financial barriers, expand mental health services available for students, and enhance their safety from physical or emotional violence during learning.[6,18]

The establishment of small learning support groups can help improve interactions between students when studying online.[10]

Other solutions include the adoption of a technology-enhanced learning hub. This shifts the mode of teaching, changing the assessment and evaluation of students by their faculty. The postponement of most in-person university activities and the creation of university-based support task forces may mitigate the students' crises driven by the COVID-19 pandemic.[2,9,24]

To solve the challenge of reduced physical activity of students, Zhao and others suggest that learning institutions could incorporate indoor or outdoor physical activity sessions between classes to promote better physical and mental health.[19]

Governments and non-government organizations need to fund educational institutions enabling them to procure resources, technological tools, and mental health support services to improve access to and use of remote learning.[5]

An educators' guide that can be used by any discipline, and especially for educators teaching underprivileged students (eg, low-income, students of color), has been developed to help educators address faculty needs for online course delivery in response to the COVID-19 pandemic.[25]

Future Directions

We need to understand that education/workforce development is a big business (both public and private sector). It is important to invest in interventions that will benefit the productivity of the students and the communities and also translate into public/private sector benefits.

We need access to translated content allowing students from non-English-speaking countries to fully use free educational resources. There is a need to provide online mental health support to students in addition to the institutions' online learning resources. There is a need for improved bandwidth and reduced internet costs across both rural and urban settings.

Free online learning resources should be readily disseminated in developing countries.[22]

Moving forward, perhaps we also need to embrace a wider adoption of the "flipped classroom" model in both medical and non-medical education. This involves providing students with educational materials in the form of papers or videos, before having a face-to-face discussion with live feedback.[26] Since, as Liang et al argue,[4] no one knows when or if, this pandemic will end, we need to create learning environments that are immune to the constant threats, disruptions, and crises in the present world.

Lewis-Kipkulei et al found that students in one rural university attested that their participation and engagement in learning was positively influenced by a combination of round-table discussion and flipped-type classroom hybrid curriculum models.[27] This study involved few undergraduate participants and so for this to be generalizable, we need to test the same hybrid curriculum in rural and urban settings of undergraduate students.

When considering the challenges faced by students with the shift to online learning, Houghton et al recommend active management of their learning environment. This involves educators developing clear expectations for each online session to improve focus and time management, the provision of purposeful communication, and preparation with shared alternatives in case of technology failure. We need to ensure that proven active learning strategies are maintained in and after the pandemic.[27]

Conclusion

Undergraduate health profession education has been the most studied during the COVID-19 pandemic. Students faced several challenges with the transition to remote learning, but a couple of interventions have been devised. In preparing for an uncertain future, where the education systems will most likely be exclusively digital, there is a need to design remote educational services in advance. Proactivity allows us to identify challenges and act on them to fast-track the adoption of online learning. Teaching institutions cannot remain closed in the advent of the current pandemic. We must devise new ways of ensuring that education remains open.

Disclosure

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