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Faculty Perceptions of STEM Student and Faculty Experiences During the COVID-19 Pandemic: A Qualitative Study (WIP).

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In 2019, Andrea received the Outstanding Young Investigator award for both North Carolina A & T State University and the College of Science and Technology. In 2018, she was selected as a 2018 National Science Foundation - NC A & T ADVANCE IT Faculty Scholar. She also received the 2018 CoST Teaching Excellence Merit Award. Dr. Ofori-Boadu received both the 2017 NC A & T - CoST Rookie Research Excellence Award and the 2017 North Carolina A & T State University (NCAT) Rookie Research Excellence Award. Under her mentorship, Dr. Ofori-Boadu's students have presented research posters at various NCAT Undergraduate Research Symposia resulting in her receiving a 2017 Certificate of Recognition for Undergraduate Research Mentoring. In 2016, her publication was recognized by the Built Environment Project and Asset Management Journal as the 2016 Highly Commended Paper. Andrea has served as a reviewer for the National Science Foundation (NSF), Environmental Protection Agency (EPA), and several journals and conferences.

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Faculty Perceptions of STEM Student and Faculty Experiences During the COVID-19 Pandemic: A Qualitative Study (WIP)

Abstract

The recent outbreak of COVID-19, considered as being a lethal pandemic by the World Health Organization, has caused profound changes in the educational system within the U.S and across the world. Overnight, universities and their educators had to switch to a largely online teaching format, which challenged their capacity to deliver learning content effectively to STEM students. Students were forced to adapt to a new learning environment in the midst of challenges in their own lives due to the COVID-19 effects on society and professional expectations. The main purpose of this paper is to investigate faculty perceptions of STEM student experiences during COVID-19.

Through a qualitative methodology consisting of one-hour zoom interviews administered to 32 STEM faculty members from six U.S. Universities nationwide, faculty narratives regarding student and faculty experiences during COVID-19 were obtained. The qualitative research approach involved identifying common themes across faculty experiences and views in these narratives.

Some of the categories of emerging themes associated with faculty perceptions on student and faculty experiences included: student struggles and challenges, student cheating and the online environment, faculty and student adaptability, faculty and student needs and support, and university resources and support. Best practices to facilitate online teaching and learning employed by STEM faculty were also discussed. Key findings revealed that students and faculty had both positive and negative experiences during COVID-19. Additionally, there was a greater need for consistent policies to improve the online student learning experiences.

Recommendations to improve STEM student experiences include increased institutional resources and collaboration between faculty and the university administrators to provide a coherent online learning environment. Preliminary findings also provide insights to enhance institutional adaptability and resilience for improving STEM student experiences during future pandemics. Future research should continue to explore institutional adaptation strategies that enhance STEM student learning during pandemics.

Introduction & Background

The novel infectious disease SARS-COV2 leading to COVID-19 outcomes has engendered a global pandemic during the recent year and overwhelmed countries worldwide at an incendiary speed. The World Health Organization declared COVID-19 as being a deadly pandemic because of its infectious nature, its rapid spread across various countries, and its impact on medical and institutional communities [1]. Challenges were also observed within the educational system and some are discussed here [2].

Overnight, universities and schools across the U.S and across the world had to transition to some form of distance learning in order to satisfy the educational needs of students and programs and keep faculty, staff, and students safe. Social distancing and the usage of new technological tools for remote learning constituted a new challenge for faculty and students alike. Various other struggles encountered in the midst of a pandemic (e.g., economic impacts on individuals and family) all tested the degree of resiliency and adaptability of both faculty and students to establish and sustain a coherent educational system. Universities were especially challenged when given lack of immediate procedural or resourceful commodities for transitioning to an online learning environment in a rapid and timely manner [3]. These changes resulted in huge burdens on faculty members, students, and universities to cope with this transition and deliver a full or partial online teaching and learning environment in an efficient manner.

The research on COVID-19 effects on Universities is growing in varied areas. For example, since the start of the pandemic in early March, several studies have discussed general methods of COVID-19 transmission reduction within campuses and proposed several solutions including screening and multi-layer mitigations strategies to offer universities a safe way to fully or partially deliver online learning and stay open [4],[5],[6]. Other studies have focused on discussing the impact of COVD-19 on mental health for college students as well as their educational performance as a result of these effects. In particular, these studies describe the need for implementing adequate supportive measures targeting mental health issues during COVID-19 when transitioning to an online learning system [7],[8],[9],[2].

Some studies have shown the preference of students for in person teaching as opposed to remote learning during the early shutdown and transitioning period of the pandemic [10],[11],[12]. However, the online learning environment has been extensively studied as an effective teaching tool if coupled with accurate planning and the effective use of virtual learning supportive tools (e.g., learning and classroom management software, virtual platform communication tools) as well as proper instructional layout [13],[14]. Some of the main benefits of online learning include: added flexibility in place, enhanced participation due to anonymity, improved technological and web conferencing skills development, enhanced instructor proficiency, and faculty eagerness to integrate learned technology later to also improve face-to-face course delivery [15]. Drawbacks include possible faculty difficulty with adapting to newer technologies, lack of technical support, and lack of student readiness [16].

As a result of the occurrence of COVID-19 pandemic, the transition to move from a formerly traditional or hybrid educational system to a largely online was sudden. Therefore, this presented immediate challenges for those who were unprepared. The main purpose this paper is to look at student and faculty experiences during the pandemic in the Spring semester of 2020 through the lens of faculty. This work is part of a larger study funded by the National Science Foundation (NSF) to address the decision-making process in STEM students during COVID-19

through the lens of students, faculty, and administrators at various institutions. Findings can be compared to other current and ongoing studies in the field, where research can contribute to solutions and strategies to better prepare for maintaining student STEM learning in any future pandemic.

Methods

This research is a qualitative study. Common themes were identified based on recorded faculty perceptions and opinions through interviews with 32 faculty members across six universities nationwide. This study was reviewed through the North Carolina Agricultural and Technical State University Institutional Review Board (Approved Human Subjects Protocol # 19-0198)

In these interviews, the faculty members were asked a series of 10 questions focused on experiences encountered and steps taken to mitigate impacts on learning during the COVID-19 changes that occurred in Spring 2020. Faculty were specifically asked to provide their views of student functioning and behavior following the impacts of COVID-19 in Spring 2020 and the results of their Universities transitioning to a virtual learning environment. Faculty also provided recommendations on strategies to improve STEM students functioning, behavior, and performance impacts in the event of a future pandemics. Specific examples of these questions included: "Explain how and why the COVID-19 pandemic impacted the functioning and behavior of your STEM students", "Explain how and why you responded to changes in STEM student behaviors and functioning during the COVID-19 pandemic." or also "Explain how and why the COVID-19 pandemic impacted your institution." The ten interview questions discussed with faculty professors are found in Table 1. During the interviews, some of the responses required follow-up questions to obtain a point of clarity or to pursue a point of interest. All of the responses were recorded and transcribed via the ZOOM communications software, along with note taking by the researcher. Faculty participants were given the choice to end their respective interviews at any point, as well the option to withdraw any specific comments.

The faculty zoom interviews consisted of 4 professors of Asian Race, 19 professors of White Race, 7 professors of Black or African American Race and 2 identified as other Race. Additionally, in terms of sex, 22 professors were male and 10 were female. In addition, 11 professors were teaching at Historically Black Colleges and Universities (HBCU), 18 belonged to Predominantly White Institutions (PWI) and 3 served at Minority-Serving Institutions (MSI).

Interviews were subjected to a transcription process which entailed taking raw zoom transcriptions and correcting against recordings, faculty were given an opportunity to review the transcriptions and make corrections. A theming procedure consisted of meticulously going through each interview and highlighting themes of interest for further discussions through a process of inductive or deductive coding. This manual theming was supplemented using the NVIVO software to identify common words and phrases leading to any additional or missed themes. Throughout this process, discussions and checks were conducted with the research team for agreement on final themes.

Table 1: Interview questions with faculty

Question No.	Question
Q.1	Tell me about yourself.

Q.2	Explain how and why COVID pandemic impacted the functioning and behavior of your STEM students.
Q.3	Explain how and why COVID pandemic impacted the performance of your STEM students.
Q.4	Explain how and why you responded to changes in STEM student behaviors and functioning during COVID pandemic.
Q.5	Explain how and why you responded to changes in the performance of your STEM students during COVID pandemic.
Q.6	Explain how and why COVID pandemic impacted your institution.
Q.7	Explain how and why your institution responded to changes in student behavior and functioning during COVID pandemic.
Q.8	Explain how and why your institution responded to changes in student performance during COVID pandemic.
Q.9	Recommend and explain strategies that can be used to improve STEM student functioning, behavior, and performance during future pandemics.
Q.10	Is there anything else that you would like to share with me?

Results & Discussion

The varied themes were aggregated into multiple categories having some commonality. These categories contributed to our understanding of the experiences and challenges of both students and faculty, where some categories overlapped in concepts. Below, ten main findings are discussed.

a) Student struggles and challenges

A common theme around "Student struggles at home and in their daily lives" was obtained. Struggles referred to technical, financial and/or emotional struggles at home during the pandemic. This led to negative impacts affecting their ability to focus on their mainly courses online, and to maintain favorable grades. Several professors described student difficulty with internet quality, connectivity and access, and lack of study spaces available in their home. A number of students also complained about the lack of technological resources such as laptops to access their online courses, as well as other issues with technological tools (e.g., Zoom), which inhibited their capability in joining classes within the expected time-frame.

Other students complained of financial restrains, as well as emotional and family disputes in moving back home. Some faculty also observed that students had issues with their current jobs as well as obtaining paid internships leading into the summer months following. These struggles all created challenges and distractions in students being able to achieve optimal performance in the largely new online teaching environment caused by COVID-19.

Quotes from faculty:

"Okay, so I had a very small, like, I mean a handful of students that when they went home, and they were from rural parts of North Carolina, they were not able to have internet access. I also had some students that did not have a computer so they were using their phone, and then, you know, went to a friend's house if they had to do anything on the computer. Also, I did get a couple of emails about like the grandparents being at the house and where students

couldn't hear very well. So, they had to speak loudly. Some of the students who were home had younger siblings and therefore they became the babysitter's when the parents were gone." (Research Participant 21)

"So, I noticed with the pandemic transition that a lot of students were having issues with being able to access their work. Indeed, that was because they didn't have adequate access to internet at their home. Some students would tell me that they were only able to get internet at a relative's house, one day out of the week, in order to be able to do their work. The reason being is that at they at their home, they didn't have the internet or they didn't have a computer. So, they would have to go to their grandmother's or their aunt's house to be able to do all their assignments" (Research Participant 23)

b) <u>Student cheating behavior, cheating factors and prevention approaches</u>

During faculty interviews, student cheating was a common and serious complaint having a significant effect on student functioning and even the faculty's ability to maintain grading consistency and fairness. Various faculty mentioned the challenge of preventing cheating in the online environment despite the availability of cheating prevention tools (e.g., browser lockdown, proctored exams, delayed score and answer availability). Consequently, strategies for rigorous testing and the necessity for the implementation of multiple anti-cheating techniques were recommended by faculty during the interviews. Some faculty felt that stress induced by the COVID-19 pandemic was the major driving factor leading to increased occurrence of cheating behavior, along with the ease of access to unfavorable non-university websites with course content, exams and test results shared by previous students.

<u>Quotes from faculty:</u>

"I think a lot of my responses are going to be framed in terms of a really significant experience I had with academic integrity issue. I really had a big academic integrity and scandal issue from the online exams that I offered, and this was for an introductory class, where basically 200 students of the 800 used an online forum to look up solutions to an exam during the exam. A lot of my energy was then focused on dealing with the fallout with this behavior" (Research Participant 4)

c) <u>Faculty needs & struggles with online teaching</u>

Faculty also encountered difficulties in adapting to the online environment themselves. In some cases, faculty interviewed were not referring to themselves, but what they also observed across their departments with other faculty members. Faculty that were particularly challenged were those who lacked knowledge of online teaching tools and those unwilling to make use of workshop trainings as the transition period was occurring. Faculty also complained of the increased workload during the COVID-19 pandemic transition period. Workload changes resulted due to increased communications required, and rapid lecture development for the online platform.

Some faculty were particularly challenged when their courses demanded more technical delivery of material, such as the use of software programs, or tools to supplement laboratory equipment and field work experiences. Faculty demanded more resources and access to technological tools that were not always provided or made readily available. Some faculty

appeared to adapt over time or rely on the support of help of other experienced faculty members. Some faculty also felt that university leaderships was not cognizant of faculty overload or faculty well-being during these events. Indeed, a few professors mentioned that they were overwhelmed with sudden transition to the online teaching format and would had appreciated if universities took more of a leadership role in providing adequate organizational structure to make this transition smoother, especially when it comes to faculty training for online teaching.

Quotes from faculty:

"I would recommend better leadership from the universities and professors from the very beginning as to what is possible. I think that at least in my case, I was prepared for a pandemic because I had online versions of our labs, which is something very rare. Most people didn't have that, in fact I ended up sharing my online labs with other professors who didn't have anything." (Research Participant 8)

d) Student behavioral and performance changes

Faculty members noticed a prominent decrease in student communication and interactivity within the online class settings as well as a significant reduction in study performance primarily at the start of this transition online as discussed by the student struggles in theme (a). Multiple professors also reported a slight increase in student dropout rate and difficulty of students to meet set course deadlines. In many cases, student recovery was observed as students accepted and adapted to expectations and requirements, as well as faculty offered leniency in makeup work as the semester progressed.

Faculty also noted student emotional alterations as a result of the COVID-19 pandemic, where anxiety, stress or fear of course performance and life-changes were expressed. This resulted in some cases of disinterest from students towards studying during the pandemic transition period. Perpetual worry about grades and progression was also remarked in student behavior. Other faculty members mentioned that access to online course content, was in some cases, a common factor towards decreased attendance for designated course meetings. Some students felt they could visit the material later and learn independently, especially given the competing needs or distractions in their home.

Additionally, there seemed to be a relationship with student performance, and faculty preparedness for online teaching. Indeed, some faculty members felt themselves or other faculty members were well prepared with online course content and were accustomed to the online learning environment before the occurrence of pandemic. This may have facilitated student performance and adaptation in those particular courses, especially knowing that faculty members observed enhanced study activity for some students and even improved performance.

Quotes from faculty:

"Now once we moved into the COVID-19 period, I could see that some of the students weren't engaging that much with the material. I reached out to those students by email, and just said, you know, after a couple weeks, I can sort of view who's engaging with the material and who isn't. In this case, it doesn't seem like you're engaging all that much" (Research Participant 5)

e) Needs resulting from student difficulties

Obvious needs for students include reliable internet access and computers that would provide consistency in learning across students of all background, and in particular those experiencing financial challenges. Immediate access to support and resources through the university to better understand hardware and software challenges should also be provided. Multiple faculty members also described the necessity to provide not only the professors and faculty with compulsory training on online teaching, but also students with appropriate guidance on how to be an online student. Even though most students were accustomed to technology in their daily lives, there was a marked need for extended workshops on how to use technology effectively as a part of the online learning process and how to work more independently. Furthermore, the Covid-19 pandemic revealed that some students needed cognitive flexibility and creative thinking with independent learning in the online environment.

Other needs also revolved around the requirement to provide adequate online learning experiences for all students, including those living with disabilities (e.g., ADHD, anxiety). Increased need for counseling services was also mentioned by faculty, due to COVID-19, and in some cases were unmet by the Universities. Student clubs were also heavily affected during this period which inhibited their important role in providing and developing additional skills and community for students. Likewise, student internships and other field experiences were halted limiting the ability of students to apply learned educational skills to jobs. Means to provide these varied experiences should be explored in the online environment and have not be extensively addressed yet. Some faculty from particular fields (e.g., nursing and clinical experiences) felt that this lack of need field experiences would be damaging to the student learning and later functioning in the profession.

Quotes from faculty:

"Yes, students definitely need training on how to be an online learner. So, one of the things that I had to do for students was a training session on how to navigate blackboard and how to use Pearson's learning tool on their laptop. Going back and forth from there, how to convert files to PDF and how to upload that into Blackboard and how to use their phone to do it" (Research Participant 21)

f) Methods of online learning & student perceptions

Interviews with faculty members revealed various methods of online course delivery and teaching approaches. Faculty delivered online content using both asynchronous and synchronous formats to meet STEM needs and course requirements. Some faculty felt that the asynchronous (i.e., no specific meeting times online) approach provided the greatest flexibility providing for continuous availability of online learning material for students to follow at their own pace. However, other faculty members felt the synchronous method provided more structure and opportunity for finer understanding of materials and especially for particular math based, or very technical courses. When using the synchronous approach of specific meeting times, faculty members mentioned enhanced methods included the use of breakout rooms as well as group settings within the ZOOM online software to improve student and faculty interactions.

Faculty spoke of the mixed acceptance towards online learning. Most interviews revealed a discomfort or dislike from students towards the online learning system. Many students had a strong desire to return to classical face-to-face learning and interaction. This preference can be partly explained by the difficulties encountered by students in adapting to the online environment

and include struggles with homework overload and lack of hands-on lab or field activity that facilitated learning. However. some students preferred the online learning as an improved learning alternative going forward and those were likely the students with reduced adaptation issues. Most faculty felt that normally strong students found ways to naturally adapt, whereas students that previously struggled with content, had more challenges in moving to online and were likely the ones to drop the course. There were some exceptions to this observed behavior.

Quotes from faculty:

"I chose to do asynchronous lectures this semester for my graduate students. The main reason I chose it is because it would be easier for the students to be able to manage their time. They are not restricted to show up for a lecture at specific time and that gave them more flexibility. I think with my graduate students that turned out to be efficient. For my undergraduate students, on the other hand, I started offering more opportunities for synchronous engagement with them. And so, particularly like after exams that I would give, I will offer them some chance to go over some of the answers and I extended that opportunity later in the class" (Research Participant 12)

"Yeah, so there's a lot of impact. Just because being a land grant school, a lot of it is built on lab work and face to face interaction. Most of the students had never done any of that type of online learning and so a majority of them didn't like that, I'm like, I tried, and they're like, we really know you tried, but we miss the in-class type of learning" (Research Participant 11)

g) Enhanced faculty support to students

Most of the faculty interviewed provided extended educational and moral support for students oftentimes utilizing their personal creativity to solve courses challenges during this period. Additionally, support was provided to students also following institutional directives for faculty leniency and understanding towards students, especially during the transition period to online courses. This increased flexibility and forgiveness from specific faculty was critical in helping students succeed. Some of the efforts undertaken were demonstrated in the form of enhanced resource access and provisions such as extended zoom hours or additional online learning material availability. Faculty also increased communication between themselves and students. This meant accessibility through fast email responses or extended office hours and deadlines. In many other cases, faculty implemented grade change or due date leniency to their students, and created extra credit opportunities to increase grades. Others were brisk in modifying the class policies and structure through syllabus changes or class format to assist students. Faculty interviewed did mention that students complained that other faculty were not as lenient of forgiving. There may be some bias in the professors that responded to this survey, where they are faculty that were more concerned about the impact of COVID on professors.

Quotes from faculty:

"In order to enable themselves to adjust, I modified the assignment deadlines sometimes to help the students. I also didn't penalize as much. So normally, if I would have the period where I said something was due at 12 pm, I might increase that by half a day. So, a lot of

adjustments were done to help students accommodate to the online environment" (Research Participant 3)

"So, I made classes built around group projects and exams. And so what I did was I changed the last project rather than it being group project, it became individual, so that people weren't trying to navigate group work with a stranger online through a newly synchronous environment. I also cancelled the second midterm and gave only a final exam" (Research Participant 9)

h) Universities response and efforts

Universities tried to provide reasonable resources in a reactive manner. Some of these resources included but were not limited to counseling and moral support for students living with mental problems, financial support (although limited in some cases) to students, and various resources for faculty and departments to integrate online learning in their classrooms. Most Universities also tried to encourage faculty to help and support students and demanded more leniency in grading and timelines for assignment submission. University leadership also offered pass/fail and late withdrawal options to reduce impact on student performance.

Although we observed a general positive effort from universities, some faculty reported that their universities were challenged in adapting through ongoing changes and as a result were inefficient in providing clear guidance. This has been attributed to a lack of teaching resources, lack of support and disorganization, a poor or delayed reactivity to moving online, a general lack of guidance or misinformation, and reduced efficiency in providing effective means of communication. Some faculty complained that where there was increased communication, faculty and students experienced communication overload resulting in reduced effectiveness and quality of communication.

Quotes from faculty:

"I think you know the other thing too is the internal institutional response. There was the pass-fail option new policy on all classes that the university implemented and I think that made a big difference in lowering students' anxiety about the COVID-19 situation regarding moving to online classes" (Research Participant 19)

"The university allowed students to retro actively change to sort of pass-fail grading. And they didn't have to make that decision until after the semester ended, so they could wait until their grade came back and then decide if they wanted to choose the pass-fail option. The university also made sure that students could retroactively drop a class with no penalty. So, there were a lot of avenues that were available to students who might have otherwise felt like they had to not keep trying" (Research Participant 9)

i) Possible future solutions, recommendations and improvements to consider

Practical future solutions and recommendations were provided by faculty during the interviews. One common recommendation was to create as well as maintain an enhanced online educational, teaching and research environment to meet student needs. This will have to be achieved through increased institutional resources and continued collaboration between faculty and university administrators. In terms of educational resources, this means providing adequate

technological tools such as computers or tablets for those with a financial need. Other improvements included: 1) implementation of time management best practices in courses targeted toward improving student performance (e.g., structured block work, task prioritization, time audits), 2) innovative strategies to deter student cheating in the online environment, 3) policies to ensure all faculty receive online training during the onboarding and hiring period, and 4) enhanced compassion and understanding from certain faculty members towards students who encounter additional difficulties due to COVID-19 (e.g., illness, loss of jobs, lack of quiet home environments) and 5) recognition of faculty overload and needs. Faculty were concerned about delays in research and even the engagement of undergraduate student in that research as a result of the pandemic. Some universities found ways to rotate faculty and graduate researchers to work in labs, while keeping work spaces clean, and while following guidelines. All meetings and modeling work was conducted in the online environment. However, considering undergraduate student participation in research was still significantly reduced, safe solutions and innovative approaches are needed to continue hands on learning and research for undergraduate students, even through pandemics.

Quotes from faculty:

"I think maybe like a Best Practices Guide for students taking online classes would be beneficial, how to effectively manage one's time since I think time management is really key. It's key in any situation, especially for incoming students, not quite knowing how is college different than high school. Managing their time would be giving student a lot more freedom. So, I think implementing Best Practices Guide, strategies for time management, as well as setting out schedules would give them ample opportunity for breaks as it hard for students to sit in front of a computer all day long" (Research Participant 5)

Conclusion & future work

In this study, multiple common themes reflected faculty perceptions of student experiences and difficulties. General themes of interest were thoroughly described and discussed (e.g., student behavioral and performance changes, student struggle at home and in their daily lives, student cheating). Faculty identified needs that became evident as universities transitioned to online learning during the pandemic and community lockdown. Future recommendations and possible solutions were also presented (e.g., generation of a coherent online learning environment, enforcement of stricter policies to prevent cheating, and consistent training of faculty on online tools). Future work on this grant initiative will involve Spring 2021 interviews with faculty to look at changes and experiences that continued or improved over the Fall 2020 semester, and merging themes with those gleaned from student and administrator experiences across the larger project.

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References

[1] E. Mahase, "Covid-19: WHO declares pandemic because of 'alarming levels' of spread, severity, and inaction," *Bmj*, p. m1036, 2020.
[2] P. Sahu, "Closure of Universities Due to Coronavirus Disease 2019 (COVID-19): Impact on Education and Mental Health of Students and Academic Staff," *Cureus*, 2020.
[3] E. Dill, K. Fischer, B. McMurtrie, and B. Supiano, "As Coronavirus Spreads, the Decision to Move Classes Online Is the First Step. What Comes Next?," *CHE*, 27-Jul-2020. [Online]. Available: https://www.chronicle.com/article/as-coronavirus-spreads-the-decision-to-move-classes-online-is-the-first-step-what-comes-next/. [Accessed: 19-Oct-2020].
[4] S.-Y. Cheng, C. J. Wang, A. C.-T. Shen, and S.-C. Chang, "How to Safely Reopen Colleges and Universities During COVID-19: Experiences From Taiwan," *Annals of Internal Medicine*, 2020.
[5] A. Elbanna, G. N. Wong, Z. J. Weiner, T. Wang, H. Zhang, Z. Liu, A. V. Tkachenko, S. Maslov, and N. Goldenfeld, "Entry screening and multi-layer mitigation of COVID-19 cases for a safe university reopening," 2020.
[6] A. D. Paltiel, A. Zheng, and R. P. Walensky, "COVID-19 screening strategies that permit the safe re-opening of college campuses," 2020.
[7] C. Son, S. Hegde, A. Smith, X. Wang, and F. Sasangohar, "Effects of COVID-19 on College Students' Mental Health in the United States: Interview Survey Study," *Journal of Medical Internet Research*, vol. 22, no. 9, 2020.
[8] Y. Zhai and X. Du, "Mental health care for international Chinese students affected by the COVID-19 outbreak," *The Lancet Psychiatry*, vol. 7, no. 4, 2020.
[9] T. Elmer, K. Mepham, and C. Stadtfeld, "Students under lockdown: Comparisons of students' social networks and mental health before and during the COVID-19 crisis in Switzerland," 2020.
[10] D. Blizak, S. Blizak, O. Bouchenak, and K. Yahiaoui, "Students' Perceptions Regarding the Abrupt Transition to Online Learning During the COVID-19 Pandemic: Case of Faculty of Chemistry and Hydrocarbons at the University of Boumerdes—Algeria," *Journal of Chemical Education*, vol. 97, no. 9, pp. 2466–2471, 2020.
[11] E. Chen, K. Kaczmarek, and H. Ohyama, "Student perceptions of distance learning strategies during COVID-19," *Journal of Dental Education*, 2020.
[12] S. Abbasi, T. Ayoob, A. Malik, and S. I. Memon, "Perceptions of students regarding E-learning during Covid-19 at a private medical college," *Pakistan Journal of Medical Sciences*, vol. 36, no. COVID19-S4, 2020.
[13] F. Martin, T. Sun, and C. D. Westine, "A systematic review of research on online teaching and learning from 2009 to 2018," *Computers & Education*, vol. 159, p. 104009, 2020.
[14] J. Giddens, K. Curry-Lourenco, E. Miles, and E. Reeder, "Enhancing learning in an online doctoral course through a virtual community platform," *Journal of Professional Nursing*, 2020.
[15] D. A. Graham, "Benefits of Online Teaching for Onground Teaching at a Historically Black Colleges and Universities," *Online Learning*, vol. 23, no. 1, 2019.

[16] S. Appana, “A Review of Benefits and Limitations of Online Learning in the Context of the Student, the Instructor and the Tenured Faculty,” *International Journal of E-Learning*, vol. 7, no. 1, pp. 5–22, 2008.