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A Faculty Roundtable on Instructional Challenges during the Pandemic

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Dr. Khan's multidisciplinary research encompasses a broad area of environmental epidemiology with specific emphasis on vulnerable populations including children and adolescents. His current research activities can be categorized into two major areas. He investigates the neurobehavioral (NB) health effects of environmental and occupational exposures as well as the mechanisms of action of neurotoxic contaminants. Furthermore, he evaluates the efficacy of community-based interventions for reducing health disparities in the areas of water, hygiene, infectious diseases, and occupational noise exposure. Over the last couple of decades, he has investigated neurobehavioral and mental health effects of metals, air pollutants and pesticides in children and adolescents in the United States, Egypt, Ecuador, and South Asian countries including India and Bangladesh. At present, he is examining early-life endocrine-disruption potential of environmental contaminants and concurrently exploring if such disruption has any adverse impact on brain development later in life. His current intervention research program is tracing suitable low-cost educational intervention for children, adolescents, and other vulnerable populations for minimizing chemical and microbiological exposures and infectious diseases.

In addition to his research, Dr. Khan teaches a variety of graduate and undergraduate courses in population health such as epidemiology, environmental health, and global health. He regularly publishes articles in peer-reviewed journals with both undergraduate and graduate students and presents his research activities in national and international conferences in the US and beyond including the National Hearing Conservation Association (NHCA) annual conference.

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A Faculty Roundtable on Instructional Challenges during the Pandemic

Abstract

This article highlights instructional experiences from various disciplines at SHSU during the COVID-19 pandemic. The serious global health threat has hit us hard, posing enormous challenges to the educators who had to switch to virtual and hybrid modes of instruction through major modifications of teaching methodologies, lab strategies, and even grading criteria. The authors of this paper participated in a series of roundtable discussions to share their course delivery experiences during the pandemic. We attempt to share our key findings, which may benefit other educators and help them adopt alternative instructional approaches in other institutions. Instructional challenges in a wide variety of courses such as Digital Electronics, Industrial Robotics, Programmable Logic Controller (PLC), Software Engineering, System Modeling, Epidemiology, Human Diseases, Environmental Health, and Intermediate Business Analysis were mitigated using alternative or modified approaches. Hands-on and in-person learning activities (e.g., laboratory experiments and data analysis) were substituted by innovative strategies such as online exercises via simulation, statistical software, enhanced use of audiovisual tools, and synchronous and asynchronous online instructions. Instructors also reported more frequent troubleshooting experience while using blended formats of instruction. Several other socio-cultural barriers of effective teaching were also noted. While individuals with children struggled to cope up due to school and daycare closures, individuals living alone struggled with depression and anxiety due to limited in-person interactions amid widespread stay-at-home order. The struggle was exacerbated for students who were tested coronavirus positive or caregivers for immediate family members. The pandemic also had a major psychosocial impact on individuals in academia who lost their loved ones or became unemployed. In a nutshell, both students and instructors were not able to perform their academic responsibilities effectively and had to sacrifice learning goals to some extent.

Electronics and Computer Engineering Technology (ECET) – Challenges and Solution

Typically, the main difference between a pure engineering program versus an engineering technology program lies in the courses' hands-on portion. Thus, almost every course has the laboratory portion integrated in the course curriculum. Due to the stay-at-home order, the university suspended face-to-face instruction and moved completely online for Spring 2020 and Summer 2020 semesters. This affected the ECET courses to the max due to the lab portions of the courses. The university resort back to a hybrid model in Fall 2020 and Spring 2021, where the lectures will be synchronous via zoom and labs will be in person, with proper social distancing and security measure. One of the significant positives that came out of this pandemic is the complete “remote” lab opportunities that were developed throughout summer and employed during the Fall and partly in Spring.

A. Remote LAB – Spring/Summer 2020:

In Spring 2020, the instructors faced a steep challenge due to the university campus's complete shutdown. Since the course syllabus was designed to accommodate the lecture portion before introducing the LAB activities, a major portion of courses was left with LAB components only, which needed in-person laboratory access. However, the tech giants and distributors of several such lab equipment’s worked with the university and helped resolve this crisis. For example, the Automation and PLC (Programmable Logic Controller) class needed access to

Studio 5000 to construct ladder logic and FactoryTalk to learn HMI (Human Machine Interface) programming. The distribution company named TechLab, in collaboration with another vendor Amatrol, allowed free access to their learning management system (LMS), where they had the virtual emulator (e-simulator). Even though the students could not access the physical trainer, they could finish the LABs with appropriate knowledge and experience. For the digital electronics LABs, it was not the case, though. The FESTO, another vendor did not have any such emulator for digital gates and circuits. So, the instructor had to choose a free online simulation tool called logic.ly (free software) to complete the remaining labs on the counter, full adder etc. For summer, the industrial robotics course moved to online as well. We used to teach the students programming the FANUC (robot manufacturer company bases in Japan) arms we have in our lab and perform few tasks. Due to no access to laboratories, we used the FANUC's "Roboguide" simulation software. Once again, the student licenses were expensive and due to budget cuts, we had to minimize the number of LABS to be performed. The major challenge was for the final project for the courses. Since this was supposed to be group work and due to social distancing, that was prohibited, the level of project to be completed was made significantly less, so one person can finish the project. The students were instructed to do a video recording and upload it to the server and share it with the class for them to watch the built prototype, and it's working principle with a zoom presentation to follow.

B. Hybrid/blended format in Fall 2020/Spring 2021:

In Fall 2020, new challenges were introduced. Since the students' survey indicated their in-person instruction preferences, the instruction delivery moved to a blended model of zoom lecture and in-person LABs. The major challenge was to meet the 6-feet requirement for social distancing during the LAB setup. Our LABS are generally equipped with 24 workstations for each student. During Fall 2020 and continuing in Spring 2021, the class was divided into two groups, and each LAB was performed in two days. This helped maintain the social distancing. However, instructors had to cut down some topics to accommodate that. Many students complained about their network connectivity during zoom classes due to over usage and capacity. The video recording was uploaded for the students who missed or had trouble during synchronous zoom sessions. Some other delivery methods were examined and adopted in some other courses like split week, rotation-based, or 7.5-week class. Pre-recorded LAB videos were uploaded with help of instructor and teaching assistant so the students can watch the video beforehand to minimize the physical contact during LAB hours.

C. Security Measures –in Fall 2020/Spring 2021:

Since the instruction moved to a blended format and students were coming in-person in the LAB from potential different locations and environmental settings, it could have been disastrous and may spread the virus. Several precautions and security measures were taken to mitigate these challenges. Face covering was mandated during LAB hours. Each LAB was equipped with a hand sanitizer dispenser and sanitizing wipes stations. Instructors included few extra notices in the course syllabi as below, in addition to daily class briefing.

1. Students will work in group of 12, rotating between weeks. You MUST show up on your assigned day and may not join with other groups on alternate days due to social distancing. STRICTLY ENFORCED.

2. MUST wear "MASKS" through the duration of LAB, minimal contact with others, no entry to LAB without mask. STRICTLY ENFORCED.

3. MUST use the disinfecting wipes/sprays to clean workstations being used BEFORE and AFTER each LAB. This will be your responsibility. STRICTLY ENFORCED.

4. MUST watch the uploaded LAB videos beforehand, there will be minimal instruction from TA/instructor due to physical distancing. STRICTLY ENFORCED.

5. If you have any symptoms of fever, cough, sore throat, diarrhea, throwing up or breathing difficulties, immediately notify your instructor via email and do not come in the class, you will risk other students. Instructor will work with you to find an alternative way to make up for the missed lectures/labs. STRICTLY ENFORCED.

6. The lab bench must be cleaned, disinfected, and all wires must be returned to the hooks provided in the lab room before leaving the room. STRICTLY ENFORCED.

In addition to those, the students showing slightest symptoms were asked to quarantine for at least 14 days. On case by case basis, students were only allowed back in class after a COVID-19 negative test result. There was regular zoom briefing with the impacted student as to make him stay calm, and not to stress over missed assignments or LABS, and given the chance to make up when student feels better. Table I is from course feedback by students showing the mean (M) and standard deviation (SD) for couple questions related to the COVID-19 measures taken for different courses in Fall 2020 taught by the instructor in scale of 0-5. It shows majority of the students felt safe in the 6-feet, rotations based face-to-face labs. Second column clearly shows engineering technology students faced hard time due to lack of more hands-on experience during the pandemic. The response rate is quite low and could have been improved.

TABLE I: Student feedback on ECET course transition

Courses → **Question↓**	**Freshman Course**		**Junior Course**		**Senior Course**	
	M	**SD**	**M**	**SD**	**M**	**SD**
The instructor has strived to compensate for difficulties created by COVID-19.	4.2	1.05	4.65	0.87	4.57	0.77
Difficulties created by the COVID-19 pandemic negatively impacted my ability to be successful in this course.	2.6	1.2	3.39	1.37	3	1.47
Response rate (%)	70.59		55.56		76.67	

Population Health (PH) – Challenges and Solution

A. Online – Spring/Summer 2020:

The Population Health (PH) department at SHSU offers 50-60% of the undergraduate and 75% of the graduate courses through in-person classroom sessions. As the ongoing pandemic emerged in Spring 2020, the instructors had to transform all in-person classes into synchronized online lecture using Zoom. Various socio-economic and cultural barriers produced by the pandemic eventually prohibited students in joining the classroom sessions. Therefore, instructors

started to follow a hybrid learning model for various courses. In this approach, instructors needed to teach half of the enrolled students in a course face-to-face in the classroom while broadcasting the same lecture synchronously via Zoom for the remaining half. In several other courses, in which the instructors only offered online sections (i.e., remote learning), hands-on learning activities embedded in the curricula were replaced by audiovisual instructions. On some occasions, the change in the mode of instructions impacted the student learning objectives. The following sections discuss several instructional challenges encountered by the instructors of the Population Health department.

B. Hybrid/blended format in Fall 2020/Spring 2021:

In Fall 2020 and Spring 2021, several typical in-person sections of PH courses were offered in blended formats keeping social distancing in the classroom. For instance, in an undergraduate course titled "Human Diseases", students were split into two equal groups. Half of the class could join in person on a given week with the other half attend the class via Zoom. The model followed a rotation system so that each group could attend the face-to-face sessions every other week. However, this blended model faced several learning and instructional challenges including poor sound quality over zoom and frozen screen, and instructors challenge to deliver lecture at the same time to both in-person and remote students. In addition, the instructor could not hear the questions from the remote learners on several occasions and natural movement across the podium was blocked due to constant presence in front of the desktop monitor for remote students. A significant number of students continued to skip in-person learning sessions citing COVID-related health, family, or other socio-economic reasons, thus missing out on accomplishing several of the student learning objectives. Finally, the lack of group activities was a notable shortcoming of the blended format prohibiting students to build the leadership skills.

To minimize these obstacles, the human disease course instructor did a survey among the students asking them the preferred class format in the middle of the Fall 2020 semester. More than 80% of the students reported that synchronous Zoom sessions for all the students would be the most effective and convenient format. The instructor, therefore, decided to offer the lectures via synchronous Zoom sessions from mid-November until the end of the semester in mid-December. The Environmental Health and Epidemiology course aims to provide training on a broad spectrum of field data collection and analysis techniques, including training on epidemiological data analyses using statistical software, measurement of environmental and occupational health exposures using field equipment, and community-based public health interventions. However, the ongoing COVID-19 pandemic forced the faculty of PH to offer these active learning courses primarily in an online format in Fall 2020, not allowing many students to build much needed field experiences that are very important for many public health professions. Hence, the course instructor transformed the real-life demonstrations into 10-15 minutes video clips using Kaltura Media in Blackboard and Zoom. For instance, the undergraduate epidemiology instructor developed a video to show how to navigate an epidemiological dataset (using SPSS statistical package) and perform basic statistical analyses to test hypotheses. The course evaluation for Fall 2020 revealed that students understood and enjoyed most of the critical epidemiological and exposure measurement concepts by watching the instructional and/or YouTube video clips.

C. **Critical findings for PH Courses**:

The faculty of PH have learned a lot from their instructional experience in Fall 2020, which had eventually helped them modify the instructional plan for spring 2021. Our online courses

experiences suggest that students get inspired and motivated by learning the subject matters through instructional video clips developed and posted by the instructor, YouTube video clips, or documentaries. This is a key finding since many students will continue to rely on remote learning during pandemics, natural disasters, or other socio-economic hardship in the Southwest. We plan to develop more instructional videos with the voice of the instructor embedded. On the other hand, our findings regarding the blended format with rotation between groups for in-person and remote class teaching were mostly negative. In Fall 2020, an array of instructional and learning challenges were identified by both the students and instructors involved in hybrid teaching, many of which are very difficult to mitigate or resolve. Consequently, the department of PH has decided not to offer any further coursework in the blended format. Table II shows the Mean (M) and Standard Deviation (SD) data from Fall 2020 student feedback in scale of 0-5. It clearly shows students struggling with online/hybrid methods over the regular face-to-face instructions. The response rates are remarkably higher provided the technical challenges students faced during the pandemic.

TABLE II: Student feedback on PH course transition

Courses → **Question ↓**	**Sophomore Course**		**Junior Course**		**Senior Course**	
	M	**SD**	**M**	**SD**	**M**	**SD**
The instructor has strived to compensate for difficulties created by COVID-19.	3.41	1.42	3.39	1.42	4.04	1.11
Difficulties created by the COVID-19 pandemic negatively impacted my ability to be successful in this course.	3	1.50	2.91	1.43	2.41	1.35
Response rate (%)	81.93		96		86.25	

Business Analysis (BA) Course – Challenges and Solution

A. Online/Asynchronous – Spring/Summer 2020:

Intermediate Business Analysis is a course that teach students how to form appropriate inferences about the population from sample data. It is a business core course and is taught by the faculty of Economics and International Business. With the arrival of the COVID-19 pandemic in the United States, the university quickly responded by switching from traditional in-person classes to a completely remote instructional delivery. The university was flexible in how the instructors chose to teach remotely- some chose to teach synchronously while others taught asynchronously. As the school transitioned into a remote model in the Spring of 2020, the instructor chose to teach the classes asynchronously using pre-recorded lecture videos. With no prior experience in online teaching, the transition involved overcoming a steep learning curve in a concise amount of time. This included learning about and acquiring the necessary equipment to produce these videos, examining a myriad of software available to support in the production of these videos, and getting familiar with the process of video capturing, editing, and formatting. Beyond the technical aspects of the process, a significant amount of time was spent planning how to effectively deliver the material through these videos. Videos were posted in the LMS (Learning Management System) twice a week to replace the in-person lectures. Homework assignments and exams were also administered via the LMS. Previously, exams were scheduled to be taken in-person and proctored

by the instructor. In contrast, exams after the pandemic were administered online, and students could take the test at any time within a given set of days. Although a lockdown browser was implemented during the exam, the software's monitor feature that would allow it to record the student while taking the exam was not used. This was decided since the feature required students to have a webcam that may or may not be available to them after the transition.

B. Hybrid/blended format in Fall 2020/Spring 2021:

In the Fall of 2020, the university adopted a blended course model where the student would meet in-person once a week, and the materials would be delivered remotely for the rest of the week. In most classes, students were given the option to participate in the class remotely if they wanted to avoid physically attending the class once a week. This model resolved some of the limitations discussed earlier where elements of both the synchronous and asynchronous delivery models could be applied. The lectures were remote and asynchronously delivered to allow for greater flexibility, while the in-person meeting days were set aside for more student-centric and active learning activities. The pre-recorded lectures were segmented by topics keeping previous student feedback in mind. Although peer interactions such as think-pair-share or small group works were limited due to social distancing requirement. Furthermore, the synchronous streaming of the in-person classes through Zoom and recordings being posted later, the students' attendance declined overtime significantly. Table III shows the mean (M) and standard deviation (SD) data from Fall 2020 student feedback in scale of 0-5. It also proves the instructor claim of students' preference to in-person classes more. The response rates are moderately high.

TABLE III: Student feedback on BA course transition

Courses → **Question ↓**	**Freshman Course**		**Freshman Course**		**Freshman Course**	
	M	**SD**	**M**	**SD**	**M**	**SD**
The instructor has strived to compensate for difficulties created by COVID-19.	3.14	1.5	3.85	1.22	3.97	1.15
Difficulties created by the COVID-19 pandemic negatively impacted my ability to be successful in this course.	3	1.31	3.24	1.54	3.94	1.11
Response rate (%)	76.32		80.95		81.4	

Computer Science (CS) Courses – Challenges and Solution

A. Online – Spring/Summer 2020:

During the Spring 2020 semester, the COVID pandemic hit hard on the USA, and all face-to-face classes are required to move online. These sudden changes were novel to both students and instructors. The Software Engineering course, which promotes active learning, needed a significant change. Initially, the students required to complete a complex group project through collaborating among themselves via weekly meetings, brainstorming, and other collaborative practices. They also needed to present the project's feasibility, progress, and final product implementation with reports. However, due to the sudden move to online and COVID-19 scare, some students were going through mental stresses. Active learning, a primary goal of this Software

Engineering course, was hampered since students were not familiar with online-based collaborations. Group presentation via zoom was a novel thing; however, students often faced technical difficulties like accessing the internet, camera, and microphone settings. The exams were initially designed to check the in-depth knowledge of various concepts and require drawing figures and solving real-life software engineering concepts. However, it was challenging to ensure academic integrity, and questions needed to be changed to accommodate online exam.

On the other hand, System Modeling and Simulation requires a deeper technical understanding of mathematics. Often, these mathematical concepts need to be explained thoroughly for better understanding. If the students do not grasp the mathematical concepts clearly, it is hard to implement the concept with a programming language. Teaching complex math problems with step by step process online is troublesome. Though the university provided some tools to help with that problem, technical support was not always available. All the lectures were recorded and uploaded to the Learning Management System- Blackboard cloud. All mathematical concepts broke down into small steps, and each of those small steps was explained thoroughly. All the solutions and explanations of mathematics uploaded to the Blackboard as a pdf file, and the associated explanation recorded and uploaded. All exams are designed in such a way so that the student can finish that within minimum technological support. Again, due to the unavailability of online resource restrictions, maintaining academic integrity was challenging. Many exchange students suffered from acute mental stress since they were very far from their families in other countries and shared with the instructor.

B. **Hybrid/blended format in Fall 2020/Spring 2021**

In Fall 2020, the university adopted a blended hybrid approach, where the students had the option to take the course entirely remotely; they could join the class face-to-face and via zoom. The following actions were implemented to reduce the challenges from the previous semesters.

1. For the Software Engineering course, all presentations were in person. Only students presenting are required to come to the class for the presentation. It can ensure the CDC guidelines of social distancing. If anyone is taking the course remotely, they were able to join via zoom.

2. All exams were in person with very few exceptions. An in-person exam ensures the evaluation process is up to the standard and academic integrity can be well maintained.

3. Class lectures are modified to ensure an active learning-based approach that ensures student participation. In class, quizzes are more frequent, and they contain a small part of the total grading. Students were enthusiastic about the hybrid approach and liked to participate during the lecture.

Table IV shows the mean (M) and standard deviation (SD) data from Fall 2020 student feedback. It shows students torn between in-person and blended models with a slight preference towards in-person instruction methods. The response rates are higher compared to university average.

TABLE IV: Student feedback on CS course transition

Courses → **Question↓**	**Sophomore Course**		**Sophomore Course**		**Senior Course**	
	M	**SD**	**M**	**SD**	**M**	**SD**

The instructor has strived to compensate for difficulties created by COVID-19.	3.58	1.41	4	1.12	3.58	1.41
Difficulties created by the COVID-19 pandemic negatively impacted my ability to be successful in this course.	3.38	1.43	3	1.46	3.38	1.43
Response rate (%)	78.43		80		78.43	

Survey Results and Discussion

After the Spring 2020, there was a series of student evaluation and feedback about the transition and instruction delivery methods, conducted by the university. Table V shows the **"mean"** for the questions asked to the students relating the disciplines involved in this roundtable and the university overall in scale of 0-5.

TABLE V: SHSU overall and degree specific feedback on transition

Question Asked	**SHSU**		**ECET**	**PH**	**BA**	**CS**
	M	**SD**	**M**	**M**	**M**	**M**
I continued to learn effectively following the transition to remote instruction	3.69	1.35	3.62	3.96	3.32	3.37
I remained engaged with the course content following the transition to remote instruction	3.7	1.33	3.64	3.93	3.37	3.53
I remained engaged with my peers following the transition to remote instruction	3.37	1.42	3.36	3.51	2.98	3.2
I spent more time on this course following the transition to remote instruction	3.48	1.28	3.62	3.49	3.42	3.52
Zoom was helpful for your learning	3.96	1.18	4.12	4.01	3.91	3.84
Blackboard was helpful for your learning	4.17	1.02	4.16	4.29	3.95	3.85
Kaltura was helpful for your learning	4.14	1.03	4.33	3.68	4.17	3.62
Email was helpful for communication	4.48	0.85	4.45	4.63	4.35	4.4
Texting was helpful for communication	4.48	0.81	4.29	4.38	4.4	5
The phone was helpful for communication	4.28	0.96	4.65	4.38	3.5	4
Response Rate (%)	35.62		29	39.9	32.4	

The first four questions in the above table clearly shows the challenges students faced after the online transition. The mean is low, meaning most student preferring the face-to-face hands on learning for Engineering and Science courses, rather than completely online. Hybrid/blended method resolved some of these concerns by the students; however, still there are obstacles like technical difficulties, internet availability and others. The poor response rate can be explained due to unknown and terrified environment at the beginning of the pandemic, bundled with uncertainty over course completion, mental anxiety of the students and most importantly a reliable network

connection from home. Most of our students are first generation and takes care of online submission and work from university network. The last few questions show that the university communicated with the students very well and used great online tools for lecture delivery in general.

A recent study by Orlov et al. [1] found that student performance on a standardized assessment was worse on average in the COVID-19 Spring term compared to the previous semesters. While they did not find any evidence of the results being driven by any specific disadvantaged demographic group, instructors who used active learning methods in their class could mitigate some of the negative effects. Synchronous delivery using a web conferencing tool such as Zoom has a greater likelihood of the instructors' familiarity with the platform from past usage and its ability to approximate the traditional classroom setting. It can facilitate classroom interactions and allow students to ask clarifying questions during live sessions. Opportunities to interact may also allow students to feel a sense of community [2] which can be vital, especially in the time of the pandemic when students were socially isolated. On the other hand, asynchronous delivery of content allows students more flexibility and provides a more consistent experience to students who may struggle or cannot join synchronously due to personal or technical reasons. Furthermore, it helps alleviate some issues associated with synchronous delivery, such as environmental distractions or situational factors (such as broadband quality, home situation), which can determine the session's quality. Before the pandemic, active learning activities such as problem-solving exercises in small groups were part of the in-person classes. One of the main challenges in delivering content asynchronously is incorporating active learning methods to make the learning experience more student centric. While popular active learning approaches in a traditional classroom setting such as think-pair-share are difficult to achieve in an asynchronous setting, one of the more commonly suggested approaches of incorporating active learning and student interaction is a discussion board [3], [4]. To make the process more dynamic, use of student generated audio and videos are suggested as a way of engagement and reflection about the course materials [5]. This setup can be useful in some settings. However, perhaps less so for more analytical courses such as Business Analysis [6]. It may also be more in use for small classroom settings [7]. Beyond the setting, some other issues with this approach entail students feeling burdened with the additional time spent on producing content for the discussion board and sustaining student interest to encourage participation. The structure of the blended format's in-person classes, where some students are in class while others join via Zoom, may make student engagement tricky. Polling software could be used to enable more student participation. Besides, classroom exercises should be designed so that the activities are more dynamic than students solving problems in isolation. These changes may improve student interaction and sustain their attendance, enhancing their learning experience and class satisfaction.

Conclusion

The main goal for this roundtable was to share the challenges and possibly collaborate within multiple disciplines and find a common platform to address the challenges posed by COVID-19. The authors felt it really helped them cope up and address the issues faced by sharing the contexts and perspective. While the instructors strive to continually improve their courses and incorporate the new learnings from their own experiences, the transition calls for more rigorous research to evaluate the collective experiences of students and instructors in different disciplines and develop teaching models that can effectively merge student-centric approaches with greater student flexibility to improve their learning outcomes.

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