Successful Higher Education Continuity Plans Amid and Beyond the Pandemic: University of Sharjah Model

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Abstract

The report introduces the Education Continuity Model along with the factors impacting the success of education continuity plans amid and beyond the global pandemic, which was based on experience, lessons learnt, and data collected during the implementation of plan during the pandemic at the University of Sharjah (UOS), United Arab Emirates (UAE). The model was designed to ensure smooth transition from traditional face-to-face teaching and learning to remote (or virtual) teaching and gradual return to "new normal". The UOS approach to education continuity was based on a quadrupole closed-loop model that is founded on four interlinked factors along with continuous dynamic evaluation and feedback from students and instructors; the main stakeholders involved in the education process in the institution. The model was methodically implemented in three phases following the COVID-19 restrictions and protocols to ensure the safety and wellbeing of the UOS community, without compromising the quality of education and avoiding delays in education processes that many may prolong the students' academic journey and delay their graduation.

The implementation of three phases of the UOS model during the pandemic proved to be effective in many ways. The effort and dedication of leadership, instructors, students, and support staff during the three phases provided the institution with exceptional opportunities to manage class schedules and explore cost effective solutions, which had a great impact of students experience and expectations. A summary of the advantages and opportunities, challenges and lessons learned will be detailed in the report with focus on pedagogies, logistics and cost-effectiveness. In addition, the report presents evaluation, feedback, and assessment of the effectiveness of the implemented continuity plan in the three phases. Students' feedback, perception, and academic performance during the implementation phases will also be presented.

1. Introduction

The official announcement of the World Health Organization (WHO) of the discovery of the coronavirus, which was called COVID-19, came on January 9, 2020. The virus was recognized as a global pandemic by WHO on March 11, 2020, due its health effects that was identified by epidemiologists to attack the respiratory system resulted in a wide spread of the virus across the globe with no vaccine or medicine to pretecta gains the spread of the virus. By the beginning of April 2020, there were over 0.7 million cases reported in over 205 countries around the world, with a death toll of almost forty thousand people [1]. The number of cases continued to increase dramatically reaching over 3.5 M in May 2020. To control the spread of the virus, countries around the world, imposed distancing, confinement measures and strict health protocols that included mandatory face masks and capacity reduction. As a result, countries and around the world-imposed lockdown, which included closure of educational institutions at all levels. By the end of April 2020, more than eighty counties around the world mandated the lockdown forcing educational institutions to carry out educational activities remotely. The latter had a great impact on the education process, where according to UNESCO reports, schools, and universities in 185 countries were closed effecting over 1.5 billion students in these countries [2]. It is approximated by the same report that this amounts to almost 89% of the total registered students [2].

In the United Arab Emirates, the first 27 confirmed cased were reported in early March 3, 2020, and increased rapidly until it reached its peak on Jan 29, 2021, with a total of 3,743 cases reported [3]. The country-imposed lockdown along with strict health protocols that included transferring all educational activities to distance learning. The latter included all private and governmental schools and higher education institutions. The initial announcement came from the Ministry of education on March 5, 2020, and took effect in the following Sunday, i.e., March 8, 2020. Educational institutions at all levels started the transformation to distance learning by offering courses online using various virtual communication portals and Learning Management Systems (LMS) tools. As a result, learning moved from the traditional face to face to homes with the aid by digital technologies to meet the educational attributes. During the first 2 weeks of the implementation of the MOE circular, over 1.2 million students across the country stared e-learning [4]. It should be noted that institutions in the UAE were prepared for such sudden move, with plans that dates to 2017 focused on implementing transformation through the incorporation of technological tools in support and facilitating teaching and learning [5]. In this plan, institutions at all levels were encouraged to prepare the needed infrastructure along with professional development training for instructors as well as support service. This made the transition to virtual learning smoother, and in a matter of few weeks, all educational institutions in the country were fully online.

The University of Sharjah was among the first institutions in the UAE that moved to online teaching on March 8, 2020, which was only a few days after the UAE announcement on March 5, 2020. This was mainly due to the readiness of the institution prior to the COVID-19, where the University took strategic initiatives to increase the adoption of technology in teaching and learning. The latter included building strong supporting infrastructure that included advanced Learning Management System (LMS), recording studios, digital instructional design workshops and certified professional training on utilizing technological tools to support the education process and associated activities. Through the Information Technology Center, the Institute of Leadership in Higher Education, instructors were provided with the required structured professional development training in technology and pedagogy. Prior to March 2020, the University was planning to implement technologically driven teaching and learning methodologies such as flipped classes, blended learning, etc., in incremental basis with KPI's to ensure adequate utilization of technologies by the end of the 4-year strategic plan. These plans were instrumental in the kicking off the COVID-19 response and the transition to remote learning.

The University was recognized as the lead institution in the country and the region that was able to smoothly transfer teaching and learning and ensure the continuity of the education and business operations. The success of the University of Sharjah was mainly due to careful planning that is led by three standing committees that were formed to oversee and establish the required governance, guidelines and policies needed to carry out the plans throughout the pandemic. A dynamic quadrupole model was developed based on factors affecting the continuation of education, business as well as support services. The model was updated regularly and implemented in phases, depending on the circumstantial development and situational changes evolved during the pandemic. In addition, the model is

periodically updated based on feedback and situational assessment collected from stakeholders that include students, instructors, and support staff. Effectiveness was assessed using various parameters that include students' performance, perception, satisfaction, and experience during the implementation phases.

In this research report, the University of Sharjah education and business continuity model will be explained in detail, starting with governance committees and factors considered in setting up or developing the model. Next, an assessment of the effectiveness of the model from the students' perception and the careful examination of the student performance and correlation to per COVID-19 to ensure course and program outcomes are achieved. Challenges faced in each phase will be presented along with plans and actions taken to mitigate or overcome such challenges. The report will also present students and instructors' feedback, which was collected from exit surveys that were conducted periodically during the implementation phases. The latter sections of the report will focus on the University plans for post COVID-19, which will be based on the experience and lessons learned during the implementations phases as well as experience and knowledge shared with other national and international institutions.

2. Methodology: Development of the University of Sharjah Education and Business Continuity Model

2.1 Governance
The most important step in developing our response model included formulating three interlinked governing committees to oversee the response models throughout the phases of the pandemic. As shown in Figure 1, the committees were formulated to focus on one of the essential factors required to provide the framework and develop the necessary documentation, update the required policies, provide the required support and approve the recommendations for each committee.

2.1.1 Logistics Committee
The logistics committee was mandated with several key tasks that focused on the administrative and support services operations. For example, the committee prepared the remote workhours, which included attendance and reporting mechanisms. In addition, the committee established communication services e-portals that included smart workflows and document management systems. The committee was also tasked with reorganizing the student dorms, campus access and rescheduling the holidays and transportation within or outside campus. One of the important tasks for the committee was the media, which included preparing regular briefing and updates to be broadcasted on social media outlets for staff, students, and parents. In later phases of the University response plans, the committee oversaw preparing the facilities in accordance with the COVID-19 health protocols, which included sanitization, social distancing, signages, gates and checks points, and testing and vaccination.
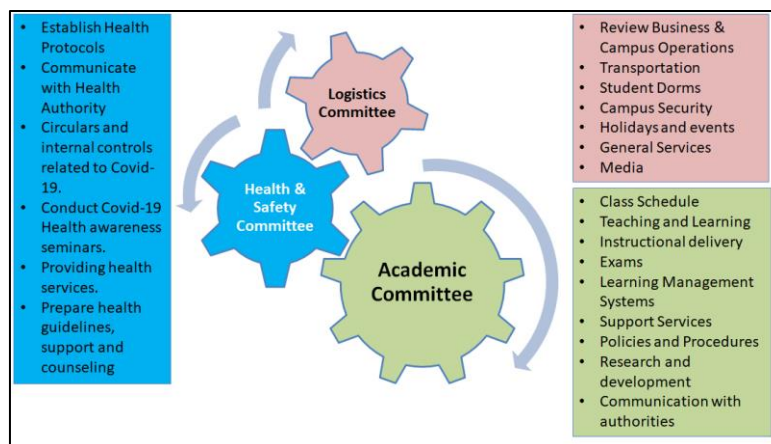
Figure 1. Three Interlinked Central Committees that were formed to oversee the COVID-19 response models through each phase.

2.1.2 Academic Committee

The central academic committee oversaw setting up the course academic calendar and classroom schedule, which took into account time zone difference and reduced class-capacity. In switching to online mode, there a number of factors that needed to be addressed. For example, male and female classes are now mixed, classes taught in the university branches were taught centrally. Another major task, which was assigned to the committee is the professional development program to instructors. The program included technical training on technological tools and applications, which was provided by the Academic Computing Section at the Information technology Centre. Professional development training on course design, instructional delivery, curriculum update was provided by the Institute of Leadership in Higher Education. The training was provided at different levels in both Arabic and English. The committee was also in charge of overseeing the summative assessment, which was conducted online till the Fall of 21/22. This included setting up the online exams policies and reformatting exams to fit the online environment. The committee has also set policies and guidelines for conducting clinical and internship training. The committee established guidelines and protocols for conducting research in the advanced research labs, which included the supporting health protocols and support. Another important task, which was done in coordination with Deanship of Quality Assurance and Institutional Effectiveness, is providing statistics and feedback on the progress of the education operations. Feedback surveys were conducted regularly to gauge the perception and satisfaction of the main stakeholders, i.e., the students and instructors. In addition, regular updates and progress reports were prepared by the committee and shared with the university administration and the local authorities.

2.1.3 Health and Safety Committee

The health and safety committee was in charge of establishing the health protocols, which included campus access, monitoring and temperature checkpoints. The committee is direct contact with the local authorities following the latest updates and circulars. The committee published regular circulars to the local UoS community to ensure that everyone is well-informed and updated. The committee also published regulation and guidelines on approach for COVID-19 infected, contact cases along with regular statistics of cases within campus. One of the important tasks of the health and safety committee is the awareness programs it ran over the period of the pandemic. Recently, the committee established testing and vaccination center at the university. In addition, the center is dedicated to provide services and statistics on COVID-19 cases on regular basis.

2.2. UOS Education and Business Response Model

Since the initial announcement by the Ministry of Education on March 5, 2020, the University initiated an emergency response team to initiate the COVID-19 response plans. Within a few weeks, the university introduced its Education and Business Continuity Model, which was designed to ensure that all business, administrative and education operations continue to function without interruption during the lockdown and beyond. The model was based on careful examination of the factors impacting the implementation of education and business operations during the pandemic. Initially the model was built as an emergency response model, however and as it became clear that COVID-19 will be around for years, the University shifted to work on long-term plans amid and beyond the global pandemic including post pandemic. The dynamic nature of the model allowed the institution to update the model based on the experience gained, lessons learned, and data collected during the implementation of model in the early phases of the pandemic. The objective was to ensure smooth transition from traditional face to face teaching and learning to remote (or virtual) teaching and later hybrid mode of teaching.

The UOS approach to education continuity was based on a quadrupole closed-loop model that is founded on four interlinked factors along with continuous dynamic evaluation and feedback from students and instructors; the main stakeholders involved in the education process in the institution. The four factors include the enabling environment and infrastructure, delivery and monitoring, documentation, support, and communication. As shown in Figure 2, the first factor focused on the enabling environment, which included ensuring education and business operations are well supported by the required infrastructure. This include both network infrastructure, connectivity, Learning Management System (LMS), communication portals, and supporting services needed for course design such as lecture capture and audiovisual technologies. Second, the committees needed to ensure that academic staff, students, and support staff are well trained on the technological tools and pedagogical approaches and transformation of teaching attributes to fit the online environment. Dedicated professional development workshops were delivered regularly as well as pre-recorded, self-administered training workshops were provided based on the need and level

of the trainees. Visual guidelines and short videos were also made available for instructors and staff, which were posted on social media for easy access. For governance, consistency and uniformity, documents were published as framework to be used by instructors in developing their teaching materials. Governing policies and procedures were also updated to account for changes accompanied the transformation of the education process, e.g., exams policies, conduct, cheating, scheduling, etc. The switch to online delivery required adequate technical support to be provided at extended hours. The University established Service Desks that operate on 24/7 basis, which proven to be one the main factors for the success of the implementation of the model. Students were provided with additional support services that enabled them to remotely access the library resources and databases, complete their entire registration process online, and communicate with staff via e-portals. General support was provided to the UOS community included counseling, awareness sessions and regular updates on the developing COVID-19 situation.
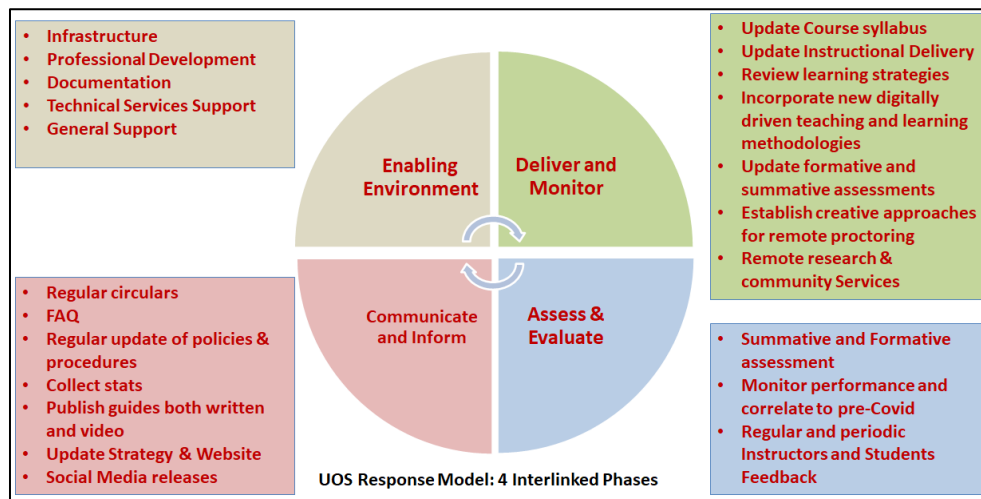

Figure 2. A schematic of the UOS Response Quadrupole Model

One of the most important actions taken by the University throughout the pandemic, is dissemination of information and keeping the UOS community up to date through frequent communications, circulars and emails. The University established Frequency Asked Questions (FAQ) website, which contained the essential questions and information about the education and business process as well as the pandemic. TV shows [6], social media outlets [7] and virtual townhall meetings [8] were the main platforms for communicating information to UOS community around the globe. The University was very active in the media writing a number of articles in the local newspapers and news forums [9].

To complete the cycle of the quadrupole model, the university established a dynamic assessment and evaluation program that contains the regular summative and formative assessments for each course. The assessment has been updated to fit the online teaching and learning approach, especially from the points of views of exam format and proctoring. Instructors were trained on transforming their exams so that they can be conducted online using the tools and applications available in the LMS environment. Assessments were structured with proper rubrics to guide students to the expectations along with automated feedback. Short, self-administered quizzes are conducted periodically including MCQ, true/false, fill-in the blanks and short assays. The quizzes allow students to apply the knowledge gained in factual scenarios. Students were fully engaged in such exercises and enjoyed them as an effective assessment tool. Feedback was provided to students in open discussion sessions or during the office hours. Written assignments, such as assays, were graded by the instructors and ample feedback was given to the students. In some cases, students were asked to write a short paper on a topic of their choice and present their work to the class over the platform. Some of the assignments require students to submit recordings in the form of a presentation in a short video (as individual or group) and submit the presentation for evaluation and feedback. Students start by introducing themselves and were given ten minutes to present their assignments, which allowed them to practice more skills such as presentation and communication. Such activities found to promote student engagement and mastery of the material [10]. In addition to course work and activities, course assessment included midterm and

final exams, both of which were scheduled centrally by the Registration Department. The format of the summative assessments were conducted using the assessment tools available on the local LMS. Question types included MCQs, calculated numerical, file response, calculated formula, ordering and matching, short answers, and reflections. MCQ, fill-in the blanks and short answers, all of which was graded and recorded automatically on the learning management system [11, 12, 13]. Finally, assessments were diversified with an increased frequency to allow continuous assessment and feedback. It should be noted that while these facilities were made available well before the pandemic. However, increased utilization of technological tools were tremendously accelerated in response to the immediate need to reduce the pandemic's impacts.

One of the major steps in building the model is the students and instructors' feedback. This is of paramount importance since this is the first-time they experience such approach, which also enabled the committee to adjust the approach as the COVID-19 situation evolved. Surveys were conducted at the end of semester and the results are discussed thoroughly at the Deans Council for improvement and updates. An example of such surveys is included in appendix I. Figure 111 highlights the responses of students to one of the questions raised in the survey conducted at the end of the Fall 20/21 session. An example of such surveys is shown in Figure 3, which highlights the responses to the following question: "*Please give your opinion on the following questions (Effectiveness)*". The results indicated that more than 65% of the students were facing technical difficulties, and more than 75% of the students were stressed out during online learning. These questions in specific prompted the institution to act by collaborating with the local network supplier to provide students with special data packages at an affordable price. In the remaining questions, students overwhelmingly appreciated lecture recordings and course organization in the LMS course page.
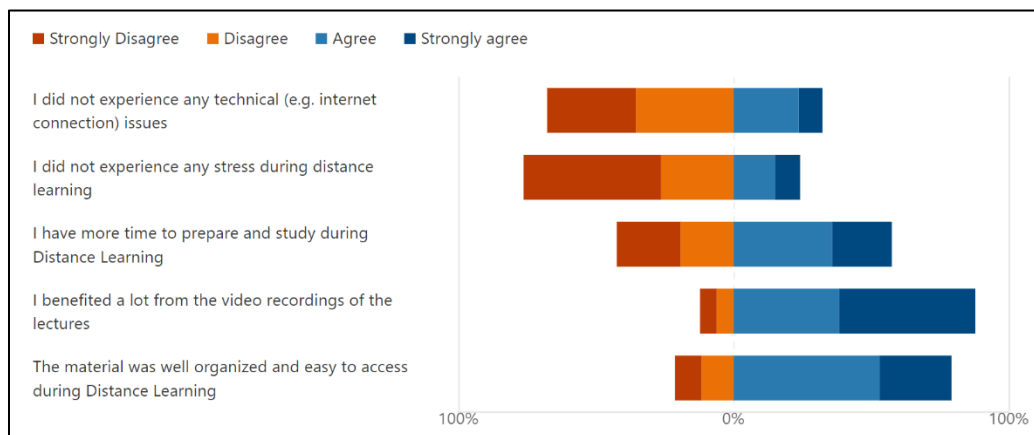

Figure 3. An example of the questions included in the regular end of semester surveys.

2.3 Implementation

The model was methodically implemented in three phases following the COVID-19 restrictions and protocols to ensure the safety and wellbeing of the UOS community, without compromising the quality of education and avoiding delays in education processes that may prolong the students' academic journey and delay their graduation. Table 1 highlights the three implementation phases, starting in March 2020 till the current semester.

Table 1 highlights the three phases of the UOS Model. The first of which was carried out as an emergency response to the sudden lockdown announcement, which came into effect on March 8, 2020. During this phase, education and business operations were conducted 100% online using e-communication tools and online platforms included in the Learning Management System (LMS) and additional communication tools such as MS Teams and Zoom. During this phase, the University provided online supporting material, with focus on interactive simulations and demonstrations to support practical laboratory sessions. Our online approach enabled us to ensure education continuity in the main campus as well as at the three university branches, which are located in different cities across the Emirate of Sharjah. Classes were scheduled concurrent to allow students from different branches additional

flexibility to register in courses irrespective of the campus they are registered in. This has proven to be effective in optimizing the schedule and reducing the overall teaching load. The main activities that took place during phase one was the professional development training, which included intensive training workshops on technological tools needed for online instructional delivery. The focus on these workshops was on transforming instructional delivery to fully online, which included creative approaches for students' engagement through interactive tools. Figure 333 shows the components and supporting technological tools that were used in typical online classes.

Table 1. Activities in each of the implementation of the three phases of the UOS Model

Item	Phase I: Emergency Response - transition to online (Spring 19/20, Summer 19/20)	Phase II: transition phase - Gradual Return to Campus (Fall, Spring and Summer 20/21)	Phase II: Flexible Hybrid (Fall 21/22 and Spring 21/22)
Course delivery (Theory)	Online	Online	Hybrid
Course delivery (Practical)	Online	On Campus	On Campus
Exams	Online	On Campus (expect general education courses)	Ob Campus
Internship Training	Online	On Site	On Site
Clinical Training	On Site	On Site	On Site
Pass/No Pass	Implemented	Implemented (max 2 courses)	Not Implemented
Graduation ceremony	Was not held (Certificates were mailed to students around the world)	Was held in person with limited attendance (no audience)	Was held in person
Libraries	Online	Online	Opened at 50% capacity
Research	Online	On campus	On campus
Training (Professional Development)	Online	Online	Hybrid
Training (Continuous Education)	Online	Hybrid	Hybrid
Conferences & Workshops	Online	Online	Hybrid
Meetings	Online	Online	Hybrid
Academic Support Services	Online	On Campus	On Campus
Administration	Online	Regular	Regular
Recreation and Sports Activities	Closed	Closed	Open at 50% capacity
Students Societies	Closed	Closed	Regular
Policies and Procedure			
Teaching and Learning Environment (classrooms)	Closed	Closed (except labs)	Flexible Hybrid
Program Accreditation Visits	Online	Online	In person

Online classes were delivered online using three main portals, Blackboard Collaborate, MS Teams and Zoom. The main online instructional delivery platform was Blackboard Collaborate; however, some instructors preferred MS Teams and Zoom because of their stability and accessibility. Figure 2 shown the utilization of each of the platforms among instructors. One of the challenges encountered during phase one is student engagement, which was mainly due to the many distractors available for the students and additional factors related to technological limitations such as the number of students that can be viewed on camera during the lecture. Some of the creative activities that were

implemented to boost interactivity and the attention of students during the lectures are highlighted in Figures 3, 4 and 5.
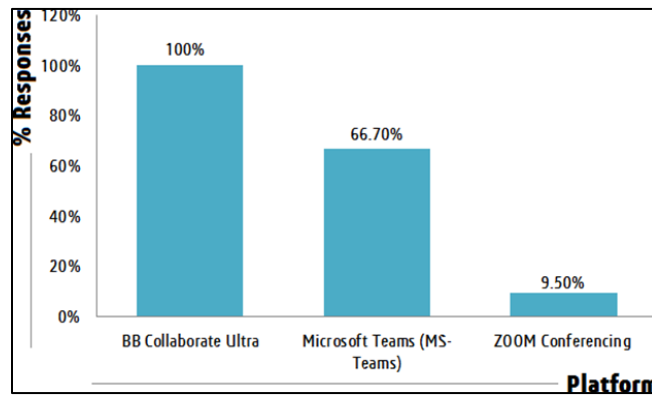

Figure 2. Methods and tools used for the creation of digital content
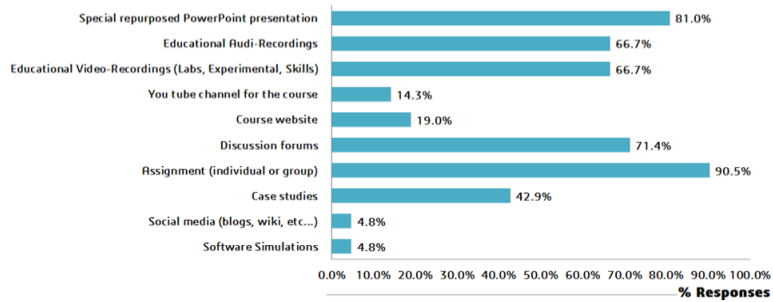

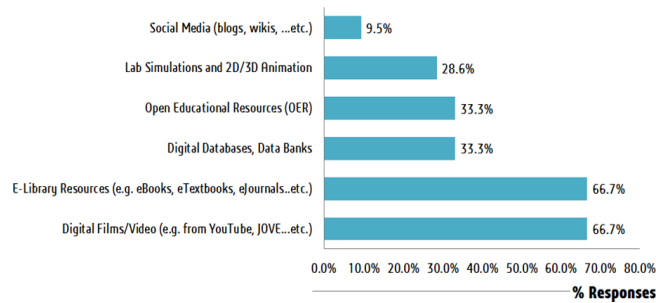Figure 3. Methods and tools used for the creation of digital content

Figure 4. Digital resources and/or digital tools used to enhance the students learning experience
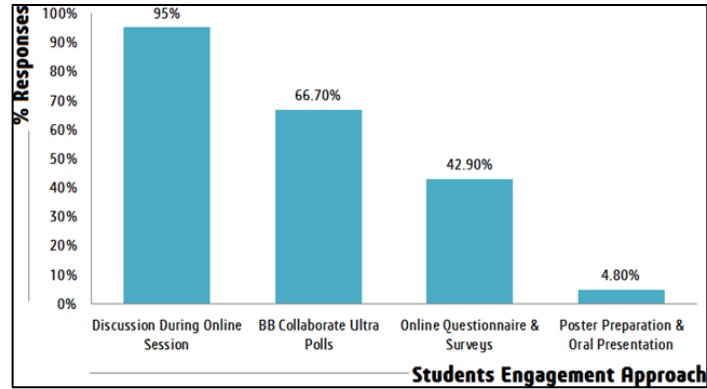
Figure 5. Digital resources and/or digital tools used to enhance the students' engagement in remote classes

One of the challenges instructors faced in Phase One is conducting exams remotely online, which included remote proctoring. Similar to institutions around the world, relying on integrated webcams proven to be ineffective [14]. Students were able to come up with creative unlawful approaches to beat the system, which included parallel login, "old school" cheating, which includes writing notes in dead points that cannot be captured by the webcam. In addition, students are using advanced technological gadgets to facilitate cheating such as screen mirroring, remote software, and login applications [15]. Realizing the fact that remote online exams are part of the education continuity plan, the Central Exams Committee had to come up with solutions to counter and prevent cheating by implementing a creative approach to reduce the risks of cheating and ensure exams are conducted in cheat-free environment to ensure exam fairness, credibility, reliability and preserve academic integrity.

To achieve that, the University developed a 360-view remote exam proctoring creative solution, which is comprised of technical as well as pedagogical components. To ensure remote exams are properly proctored, students were required to use a second camera located at an angle that enables the instructor to proctor the student live while s/he is taking the exam. Figure 6 shows the guidelines sent to students on how to setup the second camera. The approach proven to be effective not only in proctoring the students, but also provided a mean by which students can ask the instructors (or exam invigilators) on exams-related questions or seek technical help. To facilitate live proctoring, instructors create Zoom (or MS Teams) meeting link that is set at the same time as the exam. This approach allowed instructors to proctor both remote computer-based and paper-based exams. In addition to mock exams, students were provided with adequate training and guidelines to ensure their acquaintance with the system. While the system proved to be effective, there were several challenges encountered, the most important of which is invigilating/monitoring large classes. Technical limitations and manpower were also limiting factors that needed to be addressed. As it will be highlighted in Phase III, the approach was limited to small classes in advanced courses and presentation-based assessment.
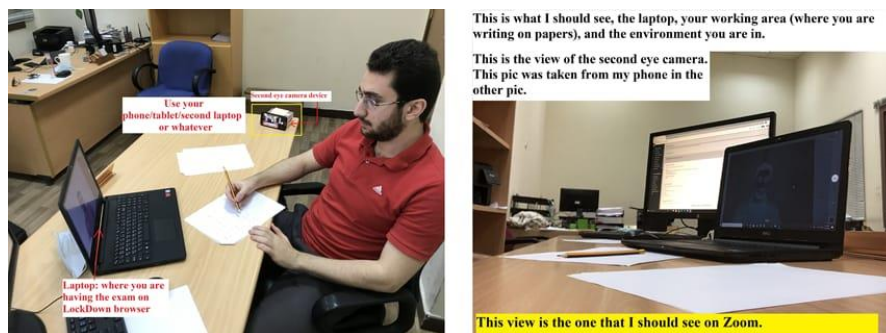

Figure 6. Guidelines for 360-view proctoring approach and instructions for setting up the second camera.

As the pandemic situation became more manageable, the University moved into Phase two, which was labeled as a "transition phase", where limited courses such as practical courses (labs), studios, internship, and clinical training sessions were conducted in person, on campus under very strict health and safety conditions, including social distancing. The latter limited the capacity of the session to less than 50% of the normal capacity, which posed additional challenges. During this phase, the University established state-of-the art online interactive labs and simulations. A list of these applications and solutions are summarized in Table 2.

Table 2. Systems and applications used to support practical sessions

System/Application	Description
LabXchange	It includes high-quality content to support online learning, which include videos, interactive simulations, online assessment. The content can be used directly or inserted into the teaching material such as PPT presentations.
MIT Open Lab Resources	The website offers a collection of videos, which are designed for chemistry practical course. It provides a step-by-step guidelines and demonstrations to standard chemistry experiments. The videos are best used as a support of laboratory experiments to help students prepare for the practical sessions.
ChemCollective	Specialized in chemistry, the website provides a set of virtual labs, assessment quizzes based on concepts, tutorials as well scenario-based interactive activities. The website also offers pre and post lab activities, homework problems, reference textbooks to support learning paths.
Phet Simulations	Developed by the University of Colorado, this is one of the amazing open-source websites that provides interactive simulations that supports standard laboratory experiments in applied sciences and engineering. The simulations allow students to interact with all phases of the experiment, including experimental setup, connection, changing parameters, collect data and analyze it for reports.
eScience Labs	The site provides hands-on experiments in the fields of basic sciences and engineering. The experiments designed to support online learning. The site offers subject kits that contain digital tools to support experiments included in basic sciences and engineering curriculum.
Jove	The Journal of Visualized Experiments (JoVE) publishes procedure to conduct practical standard experiments in the form of videos in applied sciences, engineering and life sciences.
PraxiLabs	The site offers lab interactive lab simulations in basic sciences and engineering, which can be viewed in 3D. The labs are designed to provide a real-life experience that allow students to interactively setup experiments in a user-friendly interface. The simulations are easily integrated into the Learning Management System.
VR Lab Academy	Is an educational website that supports laboratory experiments in applied sciences and engineering as well as medical and health sciences, which is carried out using virtual reality technologies in support of experiments in undergraduate courses.
Merlot Materials	It provides access to curated online learning and support materials and content creation tools.
Labster	A collection of lab simulations designed to support online learning through a well-designed experiment that allow learners to visualize the experiments and help them connect theory to practical sessions. It extends to molecular level in advanced topics such as DNA sequencing, examination of chemical reactions, cancer treatment responses, etc. The experiments to provide a gamified interactive experience that allow students to understand abstract theories.

The University invested on true VR/AR/MR facilities to provide students with interactivity experience. In addition, instructors made use of Microsoft 3D HoloLens for example, for interactive teaching and laboratory applications. The Information Technology Center ensured that all necessary software is accessible via a dedicated server rather currently all associated software's are downloaded on individual PC which prohibit students from accessing the necessary software for course work or exams at traditional or online education.

In Phase three, which started in the Fall of 2020/2022, the University started the gradual return of students to campus following a Flexible Hybrid Model (HyFlex), where selected courses were held face-to-face allowing lectures to be concurrently live streamed to students who could not attend classes on campus. HyFlex is an acronym for hybrid and flexible combined. As shown in Figure 7, the HyFlex model integrates face-to-face with online activities using appropriate educational technology. It offers students the opportunity to learn on all the platforms in synchronous and asynchronous formats. On the other hand, the flexible elements of hyflex allow students to simultaneously attend classes in a form suitable for them and their colleagues, including online or face-to-face classes. During this phase, midterm and final exams were held in person, on campus.

Figure 7. HyFlex model, definition and technology block diagram

Table 3 summarizes the distribution of the courses according to the developed protocol, which was mainly driven by the physical limitations, classroom capacity, in accordance with COVID-19 protocols.

Table 3. The categorization of courses among the mixed modes of teaching approaches.

Courses	Teaching Mode
• General Education Courses • Level 1&2 Courses • Courses with sections in Branches • Law, Arts & Hum & Sharia • Selected Courses	Online (100%)
• Medicine, Dentistry & Fine Arts and Design • Labs & studios • Selected Courses HS Courses	On Campus (100%)
• Level 3, 4 and PG and Labs • Courses were selected on criteria based on nature of course and room capacity determined by social distancing protocols	Flexible Hybrid*

*Comprised about 51% of the offered courses

3. Results and Discussion: Assessing students' feedback, perception, and academic performance during the implementation of the model

To assess the effectiveness of our model, we have conducted a mixed-mode approach analysis, which relies on quantitative and qualitative assessment. Our focus was on two aspects: 1. students experience and 2. Student academic performance. Student experience was gauged using online survey conducted at the end of the semester to gauge student satisfaction, experience and feedback on the teaching and learning attributes, activities, communication, support, systems, etc., at the end of each phase of the model. For example, at the end of phase 1, a survey was conducted to all students across campus, with focus on preference, satisfaction, effectiveness with additional questions on support, assessment and exams and general feedback. Figure 8 shows the responses of students to the question "*Please give your opinion on the following questions (preference)*". It should be noted that during this phase (lockdown), teaching was conducted entirely online. Except for practical sessions, which students were not in favor of teaching labs online, students' opinion on other teaching attributes were in favor of online teaching and learning. Figure 9 show the students responses to a follow up question on the students' opinion

(preference) on the effectiveness of the online approach. It is evident that technical difficulties and stress experienced over the lockdown were among the top concerns of the students. Students though that video recording and the organization of the material in the Learning Management System was very effective and appreciated by students.
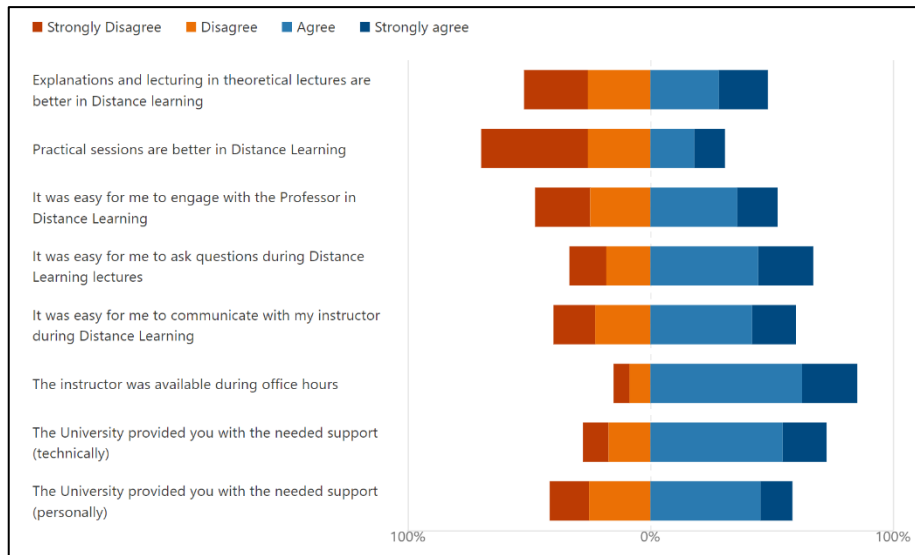

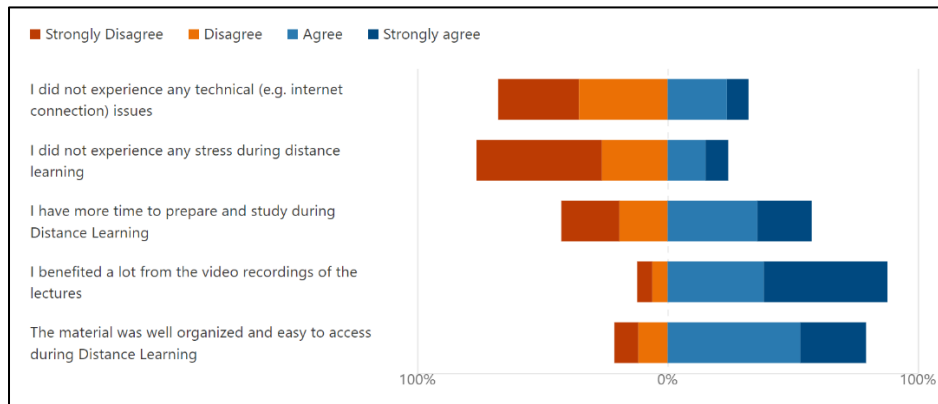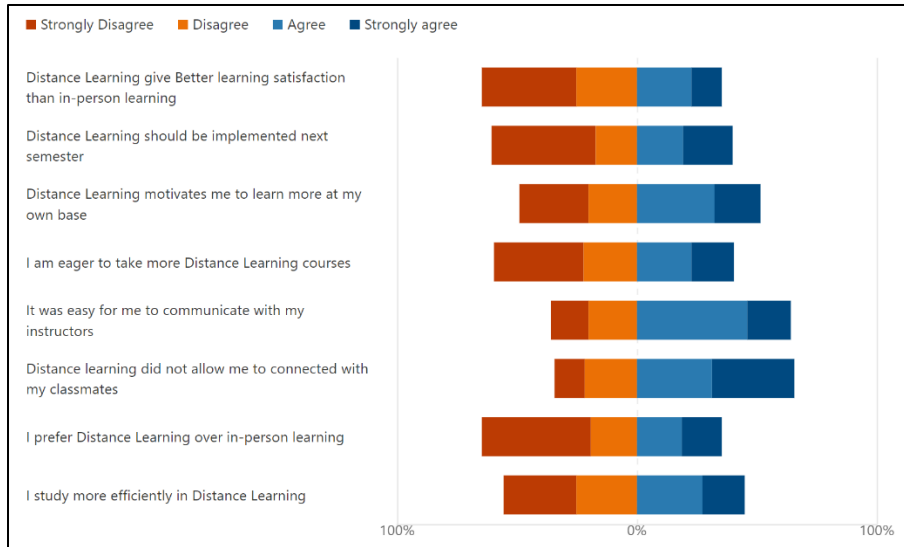Figure 8. Students responses to the question "*Please give your opinion on the following questions (preference) on:…*"
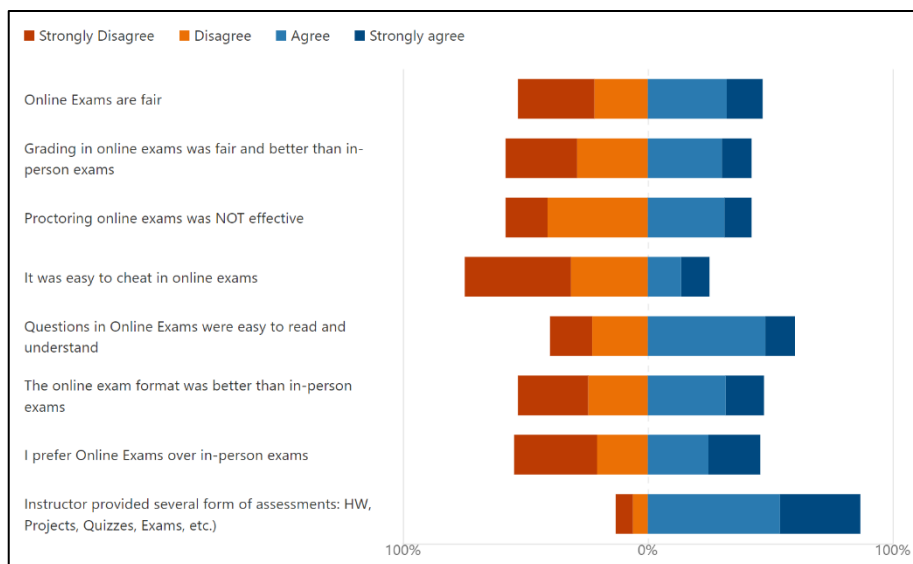

Figure 9. Students' responses to question on students' opinion on the effectiveness of the online approach

Students' satisfaction (preference) at the end of the first phase was investigated using six questions. The results are shown in Figure 10. It is clear from the response; students were not fully satisfied with the online learning approach except for communication with their instructors. More than 65% of the students prefer face-to-face learning than online.

Figure 10. Students' responses to question on students' opinion on the effectiveness of the online approach.

The next set of questions focused on online exams. It should be noted that during the first phase, exams were conducted remotely using the exam tools provided by the Learning Management System (LMS) including lockdown browser and webcam live monitoring (Respondus Monitor). The responses are summarized in Figure 11 below. Students were split on their preference between remote vs. in-person exams (49 to 51% respectively).
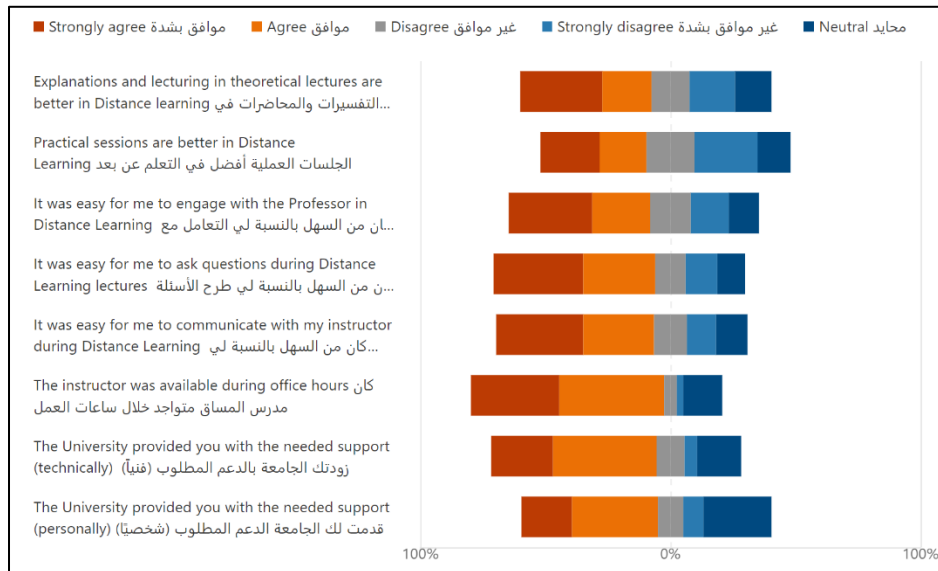

Figure 11. Students' responses to question on students' opinion on exams, assessment, and proctoring.

The collected data was used as feedback to improve our model in the next phase, which included on-campus practical session, clinical and on-campus exams.

For comparison purposes and follow up, the surveys were repeated at the end of each phase. For example, Figure 12, shows the student responses after phase two to the same questions raised in Figure 8 in the previous paragraph. The responses were very similar, with the exception of the question on practical sessions, i.e. "practical sessions are

better in distance learning", where the responses have improved from 39% to 70% strongly agree and agree. The reason for the improvement is mainly due to the fact that in phase 2, labs and practical session were held in hybrid format. Lab sessions were reformatted so that students' physical presence in the labs were limited to experimental setup and data collection. Pre- and post-lab activities, including data analysis, writeup and presentation were conducted online. This was necessary to comply with COVID-19 protocols and social distancing guidelines.

Figure 12. Students responses to the question "*Please give your opinion on the following questions (preference) on:…*" repeated at the end of Phase 2.

The results presented in the above Figures provided positive overall positive feedback that reveals positive experience with the implemented learning models, which supports the continuity of the education process during the different phases. The data was analyzed to gain deep insights and concerns that may arise for the purpose of improvements to ensure business and education continuity throughout and beyond the pandemic. The analysis led to a number of findings in the main teaching and learning attributes such as education continuity, learning experience, gained skills, career readiness, effectiveness of technology-based teaching and learning.

The main concern for students and parents during the pandemic is the continuity of the education process. At the University Students As far as academic continuity was concerned, interesting feedback was reflected by a student, who appreciated the university efforts and plans to ensure education operations continuity. Students highlighted the fact that classes and educational activities were not interrupted during the pandemic. Student responses are summarized in the following paragraph:

"*We are very appreciative of the effort and dedication of the university to ensure that our classes did not stop during the pandemic; it enabled students from around the world to join online classes together at the same time; the teaching and learning tools in the Blackboard were very helpful; we saved time on commuting, transferring among classrooms and buildings; training guideline and mock exams were very helpful and helped us prepare for online exams; were able to take classes at home to ensure our safety and wellbeing; it was easy to attend classes and access the material online*".

The students' feedback revealed the effectiveness of the University of Sharjah education continuity plan. These comments were pleasing, especially since they are coming from the main stakeholders and the focal point of the education operations, i.e., the students. Researchers have highlighted that response plans to crises such as the global pandemic is challenging and complex [16]. It requires a holistic plan that considers factors such as scalability, interdisciplinary and coordination among the various interlinked operations. Response plans must also consider the

risks encountered during the implementation phases. Students feedback also highlighted the challenges faced by students during the implantation, which were focused on the following points:

1. Internet connection and coverage, especially in rural and remote areas and in poor or underdeveloped countries.
2. Student engagement during online lectures.
3. Communication and face-to-face interactivity with peers and instructors.
4. Attendance, attention span, and in-class discipline.

One of the important aspects examined is the students' feedback and perception on their learning experience during the three phases of the model, which was based on their experience in pre COVID-19, including their level of understanding, comprehension, knowledge, and skills gained, and attitudes towards the learner's needs and expectations [17]. There is an overall satisfaction among the students, which indicated a positive learning experience during the period of the pandemic. Most of the responses indicated the effectiveness of the university continuity plan, which was shared by parents. This was mainly because UOS Students were able to finish their courses on time according to their study plans without disruption and senior students were able to graduate without delays. The above-mentioned points are in line with the findings of researchers in other international institutions. For example, Jacob et al [18], emphasized that technological tools and systems enabled institutions to successfully continue the education process and operations during the pandemic. The authors highlighted that the challenges encountered during the implantation of the online plans are natural given the fact that it is the first time for institutions and students to experience with these approaches. The students feedback gave excellent insights on how well and effective the online teaching and learning is, which was utilized for future plans to integrate technological tools in post COVID-19. Additional feedback on the learning experience highlighted by the students includes the gained technical skills, which enhance their employment readiness. The positive feedback on the learning experience of the students agrees with the findings of similar studies [19, 20].

To gain further insights on the learning experience, students were asked to reflect on the learning experience with focus on lecture delivery, instructors' ability to communicate with the students and availability of the instructors outside the class time. The responses of the students were generally positive about the competency and readiness of the instructors in delivering the material during the phases of the pandemic. Nevertheless, there were a few comments on instructors who seem to struggle with technologies and were not as effective, which included mainly older professors in colleges of humanities, law and Islamic studies. This is a very important finding that highlights the importance of providing instructors with structured professional development training to ensure they have the required technological skills needed to teach in online environment. The University has developed a certified professional development training workshops conducted regularly on topics such as course design, assessment, student engagement, collaborative tools and advanced simulations used to deliver interactive sessions. Studies on instructors' role in online learning have emphasized the importance of professional development in the success of implementation of new teaching and learning paradigms [21, 22]. It is argued that when instructors are ready, it reflects positively on their attitude towards the success of online learning experience of the students, which are the central focus of the e-learning eco-system [24, 25]. Educators are considered the catalyst and engine that transforms the education process from the traditional face-to-face to virtual environment, and work to inspire the students to accept and buy into digital transformation of education attributes [26]. Furthermore, in an online setting, some skills are difficult to develop and improve. For example, in traditional face-to-face classes, instructors can monitor and promote skills such as communication skills, mastery of the language, and thinking skills [27]. These skills are difficult to develop in an online setting, especially in large classes dur to the limitation of the number of students that can be viewed on the screen. In addition, some students do not turn your cameras on, which adds to the problem and limits the instructors' ability to monitor and develop such skills. It is evident from the students' response that instructors at the University of Sharjah were in general ready and managed to utilize technological tools and applications to promote student engagement through collaborative exercises and breakout sessions and much more. The above is consistent with recently published articles, which highlights the importance of removing barriers and obstacles presented by technologies and attitudes of some instructors who were not able to adopt new online teaching methodologies, especially those related to utilization of technological tools [26, 27]. Similarly, some students were not fully engaged in online classes and were not able to adjust to the new online environment [28], which are attributed to poor internet connection, student attitude and self-discipline [29].

Lastly, we examined the students' academic performance throughout the implementation phases. While it was not feasible to examine the student performance across all academic programs, we have selected a sample programs to

compare and monitor the performance during the different phases. For example, in the College of Engineering, the overall GPA for the students was a little higher in the first COVID-19 semester, i.e., Spring 2019/2020, Figure 13(a). In later semesters, i.e., Fall 2020/2021, the GPA averages in the College of Engineering were consistent with pre-Covid-19, averages (Figure 13b).

Department	Spring 2019/20 GPA	Spring 2018/19 GPA	Spring 2017/18 GPA	Spring 2016/17 GPA
AED	3.05	2.88	2.77	2.96
CEE	2.81	2.66	2.68	2.65
EE	2.67	2.61	2.53	2.65
IEEM	2.91	2.68	2.9	2.73
MNE	2.81	2.72	2.46	2.41
SREE	2.74	2.73	2.52	2.46

Figure 13 (a)

Department	Fall 2020-2021 GPA	Fall 2019-2020 GPA
AED	2.9	2.9
CEE	2.7	2.7
EE	2.5	2.6
IEEM	2.8	2.7
MNE	2.6	2.8
SREE	2.8	2.7

Figure 13 (b)

Figure 13. (a) Students GPA for the College of Engineering, at the end of the first COVID-19 semester, i.e., Spring 2019/2020, (b), in later semesters i.e., Fall 2020/2021.

A more in-depth analysis was conducted at the College of Sciences, which looked at the grade distributions across each department. For example, in the Department of Chemistry (Figure 13), there was an overall increase of 3% in the in the GPA of the students (2.44 in pre COVID-19 to 2.51 in Phase 1, i.e., Fall 2020/2021). Similar reports were also found in other departments at the College of Sciences.
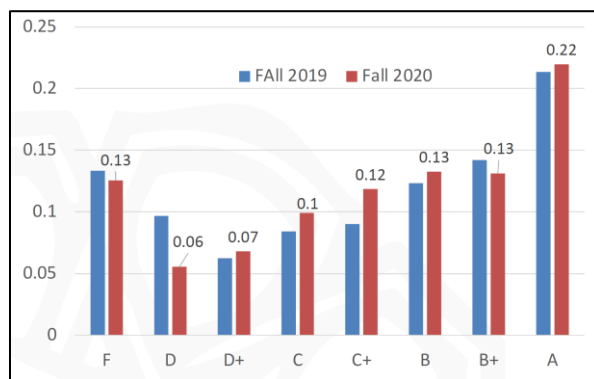
Figure 13. Students GPA for the College of Sciences, at the end of the first COVID-19 semester, i.e., Spring 2019/2020, and at the end of Fall 2020/2021.

Similar results were reported by the College of Pharmacy, Figure 14. It is evident that there are no significant differences in overall student performance. It was reported that there is a general decrease in the number of incomplete cases, which is mainly due to the convenience and acquaintance with the online environment. The latter is mainly due to extensive professional development training offered to students and instructors.
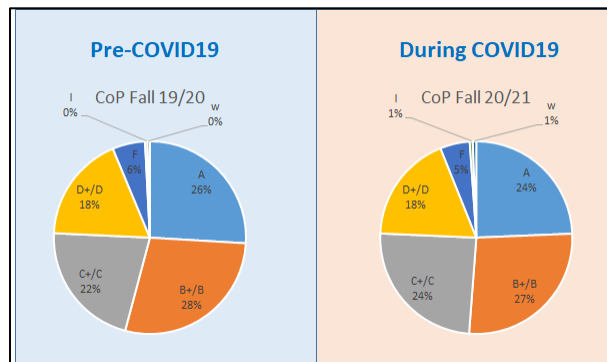
Figure 14. Overall performance of students at CoP pre-COVID-19 and during the COVID-19, Fall semesters

4. Conclusions

The report details the University of Sharjah Education and Business Continuity quadrupole model that was implemented in phases during the past two years, starting with Phase 1, which is highlighted by the total lockdown to the Phase 2 (gradual return to campus) to Phase 3 looking beyond the pandemic with the Flexible Hybrid Model that is currently implemented. In addition, our study provided qualitative and quantitative evaluation of the model at the different phases, which included insights and students' perception of the effectiveness of the plans at the various phases. Students were overall positively satisfied with the learning experience, which enabled them to continue without interruption. It was apparent that students at the University of Sharjah consider themselves among the lucky ones considering the fact that some students were not able to continue their education for the first part of the pandemic.

The crisis raised concerns about the readiness of higher education institutions to face challenges presented by online education. These challenges include proper infrastructure, professional development training, policies and documentations needed to govern the transition to the new teaching and learning environment. The dynamic model also revealed the importance of students' feedback, insights and reflections in planning and evaluating the effectiveness of the transition plans [30]. The conclusions of our report can be summarized the following key takeaways:

1. The success of the implementation of Education and Business Continuity Model/Plan depends on factors such as proper infrastructure, professional development training, supporting documentation and required support. The plan also needs to be consistent with the strategic direction of the institution and in line with the policies and instructions of the local authorities.

2. Institution readiness is key factor in the success of the continuity plans. This includes structured professional development training for stakeholders with emphasis on training on technological tools that contribute to smooth transition of the education operations. The transition includes the entire education eco-system, which require dedication and proper planning. Additional support services, such as systems, resources, extracurricular activities, etc., cannot be overlooked.

3. Successful continuity plans need to take into consideration supporting students, which should not be limited to casual academic advising and regular follow-up sessions. Supporting students in a remote environment may be challenging, especially in crisis such as the global pandemic during which students and families face additional circumstances. Instructors should be ready to go the extra mile to support and help the students during the challenging times. Educators have great influence on their students, and they inspire them to succeed [31]. Some instructors focus on their role as teachers limiting their contribution to teaching and learning attributes such as course design, instruction and facilitating the learning process [32]. However, they fail to realize their personal contribution, which are known to have great impact on their students. Instructor personality, thought, emotions, enthusiasm, attitude, and values are recognized by students and impact students' perception and motivation to embrace online education [33]. Instructors are

encouraged to be engaging, passionate and approachable, qualities that have been identified to enhance students' engagement, appreciation, and love for the subject matter.

4. One of the most important factors for successful implementation of education continuity plan in any of the phases is inclusion and recognizing the diversity of the student population within the class. In an online environment, instructors need to realize that students with special needs or those with special circumstances need special attention, which may be easier to deal with in face-to-face teaching and learning environment. Additional technological and personal challenges presented by the online learning environment should be taken into account when setting up education continuity plans in academic institutions. Instructors need to show empathy and compassion to students in general with the understanding that some students have different learning abilities, which may be influenced by noncognitive attributes such socioeconomic, cultural or impairment.

5. After two years since the start of the global pandemic, the world is looking forward to post COVID-19, which is unanimously expected to be different that pre COVID-19 in many wats. Academic institutions have gained valuable experience with online education, which need to be utilized. Resources, training, and time invested during the past two years need to pave the way to education reform that is technologically driven. Education continuity plans need to consider the "new normal", which is highlighted by high student expectation, globalizations, and education without boundaries.

In conclusion, COVID-19 provided educational institutions around the world with an eye-opening experience and opened the door for calls for reforming the education process. In addition to accelerating the incorporation of technological tools into teaching and learning, the pandemic helped realized additional advantages such as tools to facilitate communication, e-portals, and social media outlets. These tools are considered excellent platforms for facilitating instructional delivery as well as extracurricular activities and events including conferences and scholarly activities. The implementation of three phases of the UOS model during the pandemic proved to be effective in in ensuring education continuity under the circumstances, regulations, and health protocols. The effort and dedication of leadership, instructors, students, and support staff during the three phases provided the institution with exceptional opportunities to manage class schedules and explore cost-effective solutions, which had a great impact on students experience and expectations. The University was able to capitalize on the advantages and opportunities during the implementation phases. While the model was effectives in ensuring the continuity of the education and business operations at the University of Sharjah, more work needs to be done as we start the post COVID-19 era. The ever-changing job market, newly introduced jobs, required skills, employment readiness, student expectations, and inclusivity are among the critical factors that need to be considered to move forward.

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