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An agile educational framework: A response for the covid-19 pandemic

Hana Y. Al-Sholi[1], Ola R. Shadid[1], Khaled A. Alshare[2] and Mike Lane[3]*

Abstract: The COVID-19 pandemic has caused an emergent move in all countries across the world. All education institutions were forced to shut down until further notice and were forced to come up with creative solutions to continue with the learning process. Based on existing literature, students and faculty feedback, and interview responses obtained from top management of higher education institutions in several countries, this paper proposes an agile educational framework for higher education institutions to be better prepared for teaching/learning in the digital age for the long term, and for the upcoming academic years in the short term. The proposed framework encompasses the major components that contribute to the effectiveness and efficiency of online, hybrid or traditional face-to-face instruction mode.

Subjects: Strategic Management; Management of Technology & Innovation; Management of Technology

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PUBLIC INTEREST STATEMENT

The recent global pandemic provided significant challenges and opportunities to institutions of higher education around the world. This unprecedented situation demonstrated the responsiveness of many institutions while exposing some weaknesses in others. Most importantly, the pandemic has provided an opportunity to examine how well institutions of higher education respond to unprecedented challenges and how this experience has impacted the decision makers for future planning. The experiences of several institutions provided an opportunity to assess the responsiveness of these institutions and to provide a flexible framework for effective education in three primary modalities, face-to-face, Hybrid, and online). Institutions of higher education had to move programs online to protect the physical safety of faculty staff and students. Senior leaders reassessed long-term plans to include IT infrastructure, program viability, and pedagogical approaches to teaching and learning. To assist in some of these planning activities, we have proposed a framework which can be used at a variety of levels from strategic opportunities to day-to-day program implementation.

1. Introduction

It has been estimated that COVID-19 pandemic forced school closures in 185 countries, UNESCO estimates that during the months of March-May 2020 over 89% of students were out of school because of COVID-19 closures. This represents 1.54 billion children and youth enrolled in school or university (UNESCO, 2020). Additionally, during April and May, there were 10.3 million enrolments in courses on Coursera, which is an increase of 644% from the same period last year (DeVaney et al., 2020).

As reported by the World Bank Group, universities and other tertiary education institutions are closed in 175 countries and communities as of 8 April 2020 (World Bank Group Education, 2020). Around 220 million post-secondary students (13% of the total number of students affected globally) have had their studies ended or significantly disrupted due to COVID-19. Accordingly, many countries implemented an immediate response to the need to close the physical campuses of their institutions and shift into distance learning. One form of distance learning was through online learning. As the institutions in some countries were not prepared to implement this teaching/learning environment, they have encountered significant implementation issues. Issues include equity, infrastructure, broadband capacity, pedagogic capacity, and students' and instructors' readiness. Other forms of distance learning were through email delivery/return of assignments, TV channels, radio, phones and mobile applications (Pevneva & Edmunds, 2020; World Bank Group Education, 2020). The extraordinary commitment of faculty members, professional staff, responsible students and administrators have made this rapid transition less stressful. Nevertheless, there were certainly challenges that higher education institutions have faced during this sudden shift. The objective of this study is to propose an effective and practical educational continuum framework to help higher education institutions plan for the future academic years.

1.1. An overview of the Problem

As is the case with all the aspects of our lives, higher education institutions have faced the same problem with the interruption of traditional mode of delivering education (Face-to-Face) due to the COVID-19 pandemic. The universities had to discontinue traditional education formats and quickly find an alternative. This unprecedented situation raised many questions such as what were the available alternatives to universities and how were they feasible and practical? What were the challenges facing these institutions? What were the lessons learned and themes emerged from this universal case? How could higher education institutions be better prepared to respond to future changes? In other words, what is the framework that enables higher education institutions to effectively respond to new challenges? Therefore, this paper will examine the situation that higher education institutions faced during 2020 and provide them with a framework that helps them in handling the current situation and be better prepared for another unexpected interruption. The paper is organized as follows: the first section provides an overview of related literature. The second describes the methodology in developing the proposed framework. The last section discusses the implications and conclusions.

2. Background perspective

The popularity of online learning continues to increase. In these days, online learning has expanded quickly especially with the existence of different technologies and devices to access learning resources, such as computers, laptops, tablets, and smartphones. In a traditional learning environment, learning materials are accessible to few individuals and communication is restricted to students in the classroom. However, with the emergence of recent technology in education, different learning resources are offered on the Internet fostering self-paced learning and mitigating geographical boundaries. The meaning of face-to-face learning (F2F) derives from the traditional and instructional format that involves a physical classroom and the synchronous physical

attendance of all participants (faculty members, students and staff) (Nortvig et al., 2018). One important point to mention is that even if computers and other educational technologies are used in class, this does not affect the definition of the F2F format although it may become blended learning (Bernard et al., 2014). On the other hand, the most notable feature of online learning is the absence of the physical classroom, which is substituted by the use of web-based technologies offering opportunities for out-of-class learners to receive their education (Bernard et al., 2014) . Ryan et al. (2016, p. 286) stated that "in the context of higher education, the phrase online learning is often interpreted as referencing courses that are offered completely online."

Online learning can be performed synchronously or asynchronously. Each online learning model has its own characteristics. For example, in asynchronous mode lecture notes and/or videos could be posted on the web and the main communication mean between the students and instructors is often email. On the other hand, in the synchronous mode there can be live interaction between students and instructors during live lectures over the internet using technologies like Microsoft Teams or Zoom. Whereas hybrid learning can be defined as "the combination of instruction from two historically separate models of teaching and learning: traditional F2F learning systems and distributed learning systems" (Bernard et al., 2014, p. 91). According to Ryan et al. (2016) the terms blended learning and hybrid learning sometimes seem to be used interchangeably. Allen and Seaman (2010, p. 4) define blended/hybrid as a course where a "Substantial proportion of the content is delivered online, typically using online discussions, and typically has a significantly reduced number of face-to-face meetings". Although online learning is becoming more popular, still some educators as well as learners and parents believe that nothing can really replace the physical presence and traditional face-to-face contact between faculty members and their students. In a study conducted by Chingos et al. (2017) in which they compared students' performance in hybrid courses and traditional courses, the findings suggested that students' performance was about the same in both learning settings. However, students were less satisfied with the hybrid experience.

According to the World Bank Group, many universities have faced short-term and long-term challenges because of the COVID-19 pandemic. The immediate challenges included extensive institutional disruption, shift of numerous students, loss of essential campus services and support, technical "debt" due to the outdated technology platforms, continuing instructional operations in terms of coursework, assessments, and degree awarding, retaining or closing research operations, layoffs of faculty and staff. As for the long term challenges, they included but were not limited to increased students at risk, permanent closures of programs, permanent shift of some programs to an on-line environment, socio-emotional impacts on students (and academic staff), loss of research, including research collaborations across institutions (World Bank Group Education, 2020). However, institutions may still be forced to extend online learning, as there is a second wave of COVID-19 (Iglesias-Pradas et al., 2021). Teaching will be changed for sure even when the pandemic is over. Institutions should recognize that there is a difference between emergency remote teaching and a real transform to online or hybrid learning.

A study conducted by Mok et al. (2021) that evaluates online learning experiences of students in higher education institutions in Hong Kong during the pandemic, found that students were dissatisfied with emergency online learning. So addressing the challenges of emergency online learning, higher education institutes management should find a mixed-mode of delivery for enhancing teaching and learning. Based on that we proposed the agile educational framework that addresses such limitations and challenges in an Emergency Remote Learning.

3. Methodology
In developing the proposed framework, there were three stages as shown in Figure 1. In the first stage, which is assessing the current situation, gap analysis was performed. This stage includes discussion of the levels of readiness of higher education institutions with respect to online teaching/learning capability, examples of successful stories in handling, and students and faculty

Figure 1. Methodology of developing an agile educational framework.
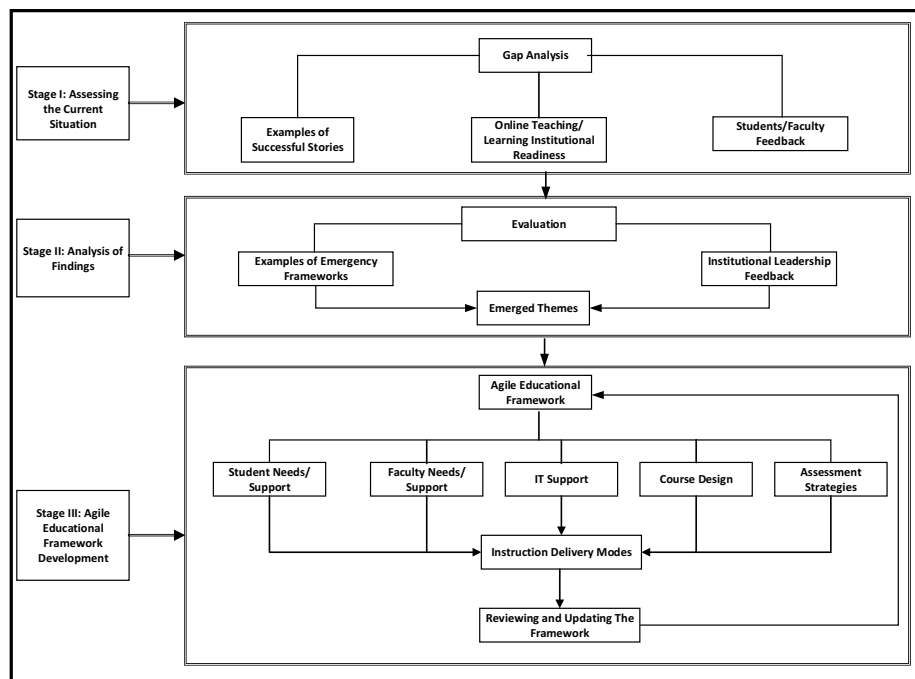
feedback on their experience during early stage of the pandemic. The second stage describes the analysis of collected data. More specifically, we discuss examples of emergency assessment frameworks and the results of semi-structured interviews with higher education institutions top management from different countries. This stage is concluded by identifying common themes which emerged from discussion of the two stages. The third stage describes the process of developing the proposed agile educational framework. The framework includes student and faculty needs and support, IT support, course design, and assessment methods for the three instruction delivery modes (online, hybrid, and face-to-face). The framework is a living process, which needs to be updated based on conducting continuous reviewing.

4. Stage I-assessing the current situation (gap analysis)

4.1. Online learning readiness before and during the pandemic
Most of the higher educational institutions suspended all on campus educational activities for a week or so during the month of March as an implementation of recommendation by the healthcare professionals in order to limit the spread of the COVID-19. Following the sudden suspension, many universities have undertaken tremendous efforts and have made remarkable arrangements to shift from the regular face-to-face classes to virtual learning platforms. Universities used different learning management systems to ensure the continuity of educational process and to achieve the learning outcomes and academic plans (Hodges et al., 2020). All departments have responded quickly and have implemented a range of measures to facilitate remote learning and have conducted many workshops related to distance education provided by academic units and Information Technology (IT) services.

It is essential to start the analysis with the level of online education maturity that the institution had before the pandemic occurred. Many universities, if not all, offered more online courses during the pandemic than they had planned to offer. According to DeVaney et al. (2020), universities, based on their digital readiness, could be classified into three categories. The advanced level, which describes those universities with advanced robust IT infrastructure with excellent online

education experience. Additionally, at this level, universities typically have a Center of Academic Excellence that drives their digital strategies. The second level describes universities with an emerging online education. These universities have reasonable digital infrastructure with good online education experience. They have utilized online courses in packages for a few programs and their faculty have the experience and are ready to take the full capacity. The last level of universities describes the late adopters of online education. They have about 3 percent of their courses available online and their instructors have little or no experience in teaching online. Additionally, students and faculty have limited access to software, hardware, and internet. However, with advancements in technology and decreasing costs, universities can start developing and building online education capabilities more easily.

4.2. Examples Institutions-Successful Stories

In this section, we will provide examples of universities from different countries that adopted an agile education approach during the COVID-19 pandemic. These examples were selected because they represent different countries, cultures and categories (pure online, teaching, or research oriented).

Zhejiang University (ZJU) is a comprehensive research university having seven sites in east China's Zhejiang province. As indicated by its president, Wu Zhuhai: "ZJU has proactively joined what might be the world's largest remote learning experiment."(Zhaohui, 2020). ZJU is one of the universities, which built a wide range of smart classrooms, equipped with audio recognition and simultaneous interpreting. Within two weeks of the transition experiment, ZJU was offering more than 5,000 courses to both undergraduate and graduate students. "Learning at ZJU", a course hub, attracted 570,000 visits, and the live streaming app co-developed by Alibaba: "DingTalk ZJU," recorded 300,000 audience members. During March and April 2020, almost 200 classrooms have been put in place for teachers to shoot video courses or live stream their lectures. In order to assure quality in the sudden shift to the online process, ZJU delivered a number of training sessions in mid-February for 3,670 faculty members. To assure that students who had internet connections problems could succeed, the university provided them with lecture playbacks and courseware packages. ZJU believes that it is a strategic priority for research universities to transform into innovation-driven institutions. Therefore, it announced the one-stop "Research at ZJU" platform for scientists and students to collaborate online during this epidemic (Zhaohui, 2020).

Arizona State University (ASU) is one of the largest public universities by enrolment in the U.S. As of fall 2019, the university had nearly 90,000 students attending classes across its metro campuses and more than 38,000 students attending online. The 2019 university ratings by U.S. News & World Report rank ASU No. 1 among the most innovative schools in America for the fourth year in a row. Arizona State University (ASU) was one of the universities that rapidly responded to the COVID-19 pandemic and transitioned all their courses online. ASU has been able to move roughly 55,000 on-campus students successfully to their digital learning platforms, which already served tens of thousands of daily online learners from 170 countries. ASU stated on April 18th, 2020 that it has conducted more than 136,000 remote teaching sessions for full-immersion on-campus students (nearly 75,000 learners) via Zoom since March 16th. Additionally, ASU organized a two-day online conference in which more than 80 live sessions attended by 25,000 participants from different countries covered different topics related to online teaching/learning environment to have better preparation for the coming academic year and beyond (Arizona State University, 2020).

Qatar University (QU) predominantly uses the face-to-face method of teaching and it has advanced technical support for students and faculty. QU conducted a pilot experience by offering a few online courses in 2014. However, the experience was not further extended, although it is part of the QU strategic Plan 2018–2022. Following the sudden suspension in all educational institutions in Qatar on 9 March 2020 due to COVID-19 pandemic, Qatar University has undertaken tremendous efforts and have made remarkable progress to shift the regular face-to-face classes to a virtual learning platform in a very short period. All departments at QU have responded quickly and have implemented a range

of measures to facilitate remote learning and have conducted many workshops through the "Centre for Excellence in Teaching and Learning" on various LMS to be adopted for online education. Workshops and tutoring videos that were organized during March-May for faculty related to online education numbered around 90 workshops and 53 videos and reports. Additionally, all student support centers shifted their services to online and they offer many workshops and services to students such as stress management and virtual study challenges, therapeutic sessions, psychological advises, stress and anxiety during pandemic (Qatar University, 2020).

4.3. Student and faculty feedback on their online experience during the pandemic

This section provides student and faculty feedback on their experience with online education during the COVID-19 pandemic. A comparison of students' academic performance before and after the start of online education is also discussed. Many universities attempted to evaluate their online experience during the pandemic by seeking feedback from their students, faculty and staff. For example, one university conducted two surveys for both faculty and students during spring 2020 in order to gauge their satisfaction and to seek their feedback. The surveys were conducted at the beginning of the period when the university went online (about mid of March) and the second round of surveys were conducted toward the end of the spring semester.

We can categorize the students' feedback and concerns into three main categories. The first category is related to IT used during the pandemic (technical issues), which includes connectivity, compatibility, and accessibility of specific applications. The second category is related to the interaction and communication between students on one side and faculty and IT support from the other side. The third category is related to students' readiness and understanding of the course content delivered over the online platform. Students' main concerns were their efficacy of the use of distance learning systems, continuous support from ITS, the assessment methods, practical courses, using different LMS by faculty, and the interaction between students and faculty and their colleagues. On the positive sides, students reported that lectures can easily be followed and watched at different times, an easy sharing of content with faculty and other students. It should be noted that there were some differences in students' feedback between the two surveys that were conducted in late of March and at the end of May. Overall, the students' feedback was more positive in the second survey. For example, students felt that the instructions provided by the instructors were more useful at the end of the semester. Additionally, their satisfaction on all statements improved in the second survey. For example, their satisfaction increased from 56% to 76% when they were asked, "in general I am satisfied about the effectiveness of distance learning". This should be expected since by that time students and instructors felt more comfortable with the new learning environment. For example, 57 percent of students in the first survey, compared to 79% in the second, indicated that they are prepared to continue with online learning.

On the other hand, the main challenges reported by the faculty members include the lack of student's interaction in the class discussion, student absence, integrity of the assessment, technical issues, and difficulty in delivering practical courses and labs. The faculty suggested that improvement of the network capacity is needed, providing more workshops for students and faculty on how to use the learning management systems and related technologies would also help. Working on changing the mindset of the students with respect to online learning environment was also mentioned. It should be noted that instructors' feedback did not change between the first survey and the second one. They felt in both surveys that the traditional classrooms education is better than online learning in many educational aspects like students' interaction and engagement, achieving learning outcomes, and utilizing lecture time.

Similarly, a recent study conducted by Allo (2020) during the COVID-19 pandemic, reported that learners perceived online learning is very good and helpful in the middle of the pandemic. However, because of financial constraints, they hope that lecturers make use of facilities such as free Messenger application in the online learning system. Also, they recommended having group tasks in addition to individual tasks. They believed that this is important to help colleagues who do not have internet

access. Comparing the results from the two universities studies, the common concerns were internet connectivity, lack of interaction between instructors and students, and technical support(Allo, 2020). Likewise, results of a Survey Monkey asked 955 students across the United States how faculty and staff can best support them during the shift to online learning due to COVID-19 pandemic and what they need to be successful in an online learning environment(SurveyMonkey, 2020). The results indicated that about 36 percent of participants felt that they were very prepared for online learning environment. Additionally, about 50 percent of students felt that the interaction among students is extremely important in online learning. Moreover, about 53 percent felt that having virtual office hours is very beneficial. Students reported that their biggest concerns, as their university shifts to an online learning environment, were keeping up with coursework, losing contact with instructors, being physically isolated from classmates, and juggling other priorities (e.g., child care, family care, etc.). In a study conducted by Shin and Hickey (2020) to explore students' experience during the COVID-19 pandemic, students reported several challenges such as difficulties to stay motivated, the distraction in learning, insufficient communication and feedback from instructors, and the challenge in fostering creativity.

5. Stage II: analysis of the findings

5.1. Examples of emergency assessment frameworks
In this section, examples of existing emergency assessment frameworks developed by some institutions will be introduced. The first example is the one developed by Birmingham University. The main objective of the framework was to support the university's resilience and deliver a sustainable curriculum during and post COVID-19 pandemic (Armour, 2020). The framework consists of the following conditions:

- Having resilient staff to deliver each course
- Having resilient modules to reduce content duplication across programs
- Designing courses for both online and face-to-face modes.
- Having additional support for students
- Having resilient assessment methods

The other framework was introduced by the UNICEF team (UNICEF, 2020), which was based on four main steps including assessing, planning, implementing, and evaluating the process. The framework focusses mainly on children schools. The first step deals with evaluation of the accessibility and learning conditions, and well-being and safety for children. The second step includes planning on activities that focus on schools that are in a great need for support. The third step is focusing on documenting the process and results of the implementation of action plans. The last step includes monitoring and modifying the process as needed. Another framework that guides educational institutions response to the COVID-19 Pandemic of 2020 was developed by the Organisation for Economic Co-operation and Development (OECD). The framework was developed based on the results of a rapid assessment conducted between March 18 and March 27 of 2020. The report offered a checklist for educational institutions response to the COVID-19 Pandemic, which includes the following main steps (OECD, 2020):

- Defining the principles that will control the strategy during the pandemic.
- Coordinating with public health authorities so that education actions are in line with public health goals and strategies.
- Prioritizing the curriculum goals to define what to be learned during the pandemic.
- Developing alternative means of education delivery.
- Defining appropriate mechanisms of student assessment during the emergency.

The Arizona State University (2020) introduced a framework that focuses on how policymakers and educators can support equitable, effective teaching and learning irrespective of the medium through which learning takes place. For example, closing the digital divide, strengthen distance and blended learning, assessing what students need, and ensuring supports for social and emotional learning (Darling-Hammond et al., 2020). In the same line of emphasis, (Bresnick, 2021) suggested key areas of focus to support teaching and learning in the future. These areas include offering the support to faculty in implementing evidence-based instructional practices, selecting affordable digital learning tools, providing digital learning support and faculty professional development, and ensuring accessibility of students to equipment, internet and skills so that they will prepare to use digital tools.

5.2. Higher educational institutions top management feedback

The COVID-19 pandemic has changed the learning/teaching environment for a while and possibly forever. Each institution of higher education has learned its own lessons from this unprecedented situation. The one lesson that all institutions might have learned is revealing the hidden institutions' capabilities and their swift response to such pandemic. As stated by the president of Ohio State University Dr. Johnson "academics can be nimble agile and make fast decisions." The other lesson learned is the realization of the power of IT in facilitating the delivering of instruction. The president of University of Maryland—Baltimore County, Dr. Hrabowski said, "we have to be willing to take risks and think out of the box and that technology will be more important than ever." (The Remote Summit, 2021). The third lesson learned by many institutions is the change in the perception of the quality of online learning. The COVID-19 pandemic brought challenges, at the same time it opened many doors for opportunities.

To get insights on the pandemic's impact on higher education institutions from a senior management perspective, we conducted several semi-structured interviews with members of higher education institutions top management in different countries such as USA, Chile, Malaysia, Jordan, and Qatar. The interview questions address the impact of pandemic on the higher education institutions. These questions include the long-term impact of the pandemic on higher education in general, the impact of the pandemic on institutions' strategic initiatives and priorities, the evaluation of online learning during the pandemic, the impact on institutional policies and guidelines, and students and faculty readiness for the online education environment. Additionally, the interviewees shared their lessons learned from this unprecedented situation. A key point emerged from the interviews, related to the long-term impact of the COVID-19, is that hybrid learning will continue to be part of higher education, as a result, they will make sure that digital transformation will be, if it has not been yet, part of their strategic initiatives and priorities. There were other long-term impacts such as more adoption of open sources, changing the way higher education institutions have been managed, and highlighting the inequity in education accessibility. There was a mixed feedback with respect to the evaluation of the online learning experience during the pandemic. While some universities did compare students' performance, others did not. Varied results were reported with respect to students' performance, in some universities students performed better, compared to performance in prior semesters, while in other universities students performed worse. However, the interviewees agreed on the need for continuous evaluation of the experience by seeking feedback from students and faculty. The other key point emerged is the fact that all universities had to develop or alter certain policies related to grading scheme and attendance. With respect to the readiness of the students and faculty, universities varied in their responses. Some universities were ready since they were offering online courses and even online programs, while others had to offer training sessions for their students and faculty because they had limited experience in online education. The common lessons learned were increase in offering online and hybrid courses, paying more attention to the integrity and quality of online learning, and having a response plan for future unprecedented situations since this pandemic reveals the fact that many higher education institutions did not have a contingency plan. Among the lessons learned from the pandemic is the need for assessing the inclusion and the accessibility to education, which leads to consider implementing personalized education. One university president stated, "Without doubt, the pandemic is a great disruption to higher education. It forced everyone

Figure 2. Emerged themes for higher education from the COVID-19 pandemic.

Themes emerged at the beginning of the pandemic

- The need for having a contingency plan and activate it if there is one.
- Crisis management within the education and the healthcare context.
- Emotional responses including confusion and anxiety.
- Implementing alternatives to the traditional education system (face-to-face).
- A greater need for continuous training of faculty members on the uses of technology in the educational environment.

Themes emerged during the pandemic and during implementing online learning

- Setting priorities, which include the safety of the university community and continuing the teaching/learning process.
- The available choices for the universities during COVID-19 pandemic crisis depend significantly on how well prepared, with respect to digital transforming, these universities were before the pandemic. For example, had universities not been prepared and ready to deliver online courses, they would find themselves with very limited options of delivering online classes.
- Training for designing online courses. At the beginning, the priority was to convert the content of the F-2-F courses into online environment.
- Understanding the needs and the challenges faced by students and faculty during the transition period enabled the administrators to provide the needed support and be ready for the following semesters.

Future Themes

- Online learning will be a major part of higher education in the future and thus universities need to prepare for the transition period in the short term and for a comprehensive transforming in the long term (DeVaney, et al., 2020). As discussed in the proposed framework, the hybrid model could be the middle ground between the pure online learning and F-2-F traditional education.
- The COVID-19 pandemic opened opportunities for higher education institutions in terms of utilizing efficient and effective technology not only for delivering online courses, but also for a comprehensive digital transformation across all units. This may provide an opportunity to significantly change internal processes and create operational efficiencies.
- Digital maturity will evolve faster than expected and it will enable universities to offer high quality online/hybrid learning.
- Building a resilient and agile digital transformation system to deal with any future crisis.
- Initiating the discussion about offering personalized education.
- Developing new educational modules based on students' competencies and marketing needs.
- Advanced AI and machine learning usage in higher education to augment student's social experience on campus.
- Redefining the vision and mission of the higher education institutions. Will it continue to be just graduating employees? Or graduating good citizens, or both?
- Using Data analytics to better serve students and staff
- Providing better care for students and staff by using CRM technology
- Reforming programs curriculum and assessment policies.

to sit back and think through what higher education is supposed to be about—is it about being on campus and going to class? Is it sitting for exams and getting the grades? Is it about character building? If yes, then how would you do so when you are not in frequent physical contact—make that when one cannot even leave one's home? Is it about employment upon graduation—then how do you prepare the students for jobs that might not be there as the economy shrinks? These are just some of the questions those in higher education have to ask themselves, and whatever the answer is, one thing is clear—there have to be major changes in the way we have been managing higher education, and it goes beyond e-learning."

Building on the discussion reported in stages I and II, this section summarizes the major themes that emerged from this pandemic. As shown in Figure 2, the main themes emerged at the beginning of the pandemic the need to have an emergency plan in case of any unprecedented situation. At the early stage of the pandemic institutions were concerned about the health of their staff and students at the same time considering options on how to complete the spring semester. Thus, crisis management principles guided them in handling the case. The vast majority of institutions adopted, in a reasonable time, online teaching mode. However, many institutions were not ready and did not have the appropriate IT infrastructure. Moreover, many students were not ready for online learning. Once each institution has made the decision, the main themes during the pandemic were setting the priorities, which mainly include protecting the university community and continue the teaching and learning process. Of course, there were more options available for those institutions with strong and advanced IT infrastructure and had experience with

online teaching. During the pandemic many institutions tried to understand the challenges that their students and staff faced and provided the needed support.

With respect to the future themes that emerged, online learning will be part of higher education, especially for those institutions that were not involved in it before the pandemic. The hybrid mode of learning will be the most attractive method in many cases, especially with the advanced technology such as AI and machine learning technologies. The pandemic has accelerated the digital transformation for higher education institutions, which leads to the institutional evolution. Personalized (individualized) education is coming soon and the focus will be on what students do not know and less focus on what they know. The term "just-in-time learning" or "On demand learning" will be part of the higher education institutions agenda (The Remote Summit, 2021).

6. Stage III: an agile educational framework development

As shown in Figure 1, the process of developing an integrated agile educational framework includes students and faculty needs and support, IT infrastructure, course design and assessment methods. It should be noted that these components are discussed for each one of the three instruction delivery modes (online, hybrid (blended), and face-to-face). Then, after implementing the appropriate components of the framework, there is a need for reviewing and monitoring the results of the framework. The following sections will discuss this framework in detail.

6.1. Students Traits and Needs

In this section, we will consider students' traits that are essential to succeed in an online learning environment such as student culture, learning style, and student engagement. This unique experience magnifies the need not just for technological transformation, but also cultural transformation. There is a need for higher education administrators to establish "virtual culture ecosystems centers" in order to smooth students and instructors' transfer from the traditional classroom setting to the online education modality.

The first step in this direction should be understanding the impact of students' culture on their learning process. According to Hofstede, cultural dominations influence the way students interact with their teachers (Hofstede, 2008). For example, students who espouse large power distance (e.g., China and Arab countries) depend on their teachers because teachers are considered to be the source of wisdom. Students who espouse strong uncertainty avoidance cultural dimension (e.g., Russia, Japan, and Arab countries) want to know the right answers, expect teachers to have all answers, feel the pressure to conform to the class rules. The focus of education in a collectivism society (e.g., China, Chile, and Qatar) is more on "learning how to do" and less on "learning how to learn". Students associate according to in-groups. In masculine culture (e.g., Japan, USA, China), students admire brilliant teachers, and competition in the class among students is common. Students from long-term oriented culture (Japan, and China) often attribute both success and failure to luck and occult forces. It is essential to provide resources and training to help change the mindset of both students and faculty to adapt to this new teaching/learning environment.

When designing an online course, students' learning style should be considered. As defined by Grasha, learning styles are "personal qualities that influence a learner's ability to acquire information, to interact with peers and the instructor and otherwise to participate in learning experiences" (Grasha, 2002, p. 41). One of the most common models used for analyzing the individual's learning style for online learning systems is Felder-Silverman framework (Dag & Gecer, 2009; Hasibuan & Nugroho, 2016; Kouis et al., 2020; Shamsuddin & Kaur, 2020). Felder and Silverman (1988) identified four categories: Active (learners prefer teamwork)/Reflective (learners prefer to work on their own), Sensitive (learners prefer concrete thinking)/Intuitive (learners prefer conceptual thinking), Visual (learners prefer visual activities)/Verbal (learners prefer written and oral explanations), and Sequential (learners prefer segmented processes)/Global (learners prefer holistic thinking) (Dantas & Cunha, 2020; Kouis et al., 2020).

Table 1. Mapping learning styles, teaching styles, and learning activities to instructional modes			
Instructional Mode	**Learning Styles**	**Teaching Styles**	**Learning Activities**
Online	Reflective, verbal, intuitive and sequential	Demonstrator, facilitator, delegator or blended.	Discussions, self-assessment tests, chatting, real-life applications, videos, animations and exercises, Theories and concepts.
Hybrid	Active-Reflective, Visual-Verbal, Sensing- Intuitive and Sequential-Global	Authority, demonstrator, facilitator, delegator or blended.	Flipped hands-on, labs, discussions, self-assessment tests, real-life applications, lectures with summaries, reflection quizzes, additional reading materials, films, theories, concepts and relate lectures to previous learning.
Face to Face	Active, visual, sensing and Global	Authority, demonstrator or blended.	Hands-on, labs, discussions, lectures with summaries, reflection quizzes, field trips and guest speakers, additional reading materials,

Kouis et al. (2020) employed the learning styles of Felder-Silverman questionnaire; the results showed that in one online course in which the majority of its content was based on text files would be more appropriate for students who prefer reflective and verbal learning styles. Additionally, the authors suggested that instructors could design the content of online courses in such a way that matches the learning styles of each student. For example, the course that has theories and labs would fit better the intuitive and active learning styles. Another finding by a study conducted by Battalio (2009) was that reflective learners (prefer work on their own) have shown to be successful in learning through online courses. As there are different learning style preferences, instructors should consider various teaching materials, teaching methods, and class activities. It is very important to consider student engagement, especially in the online environment, as students are often isolated and disconnected. Instructors should focus on their interaction with students through online discussion, group work and instructive feedback.

Although online students demand many of the same services as their traditional peers, such as registration, financial aid, and academic advising; the virtual environment shifts the impact of these service roles. In an online learning environment, students might be isolated and may come from different backgrounds. Different student support services should be offered. An example of student support in this environment includes reaching out to those students who are not engaged in the online class discussion and providing the needed academic support. Another example is implementing a coaching program, where students are directed to various specialized departments to help them and guide them to the best resources. Virtual meetings with students might include discussions about different students' concerns such as academic behaviours, financial matters, and social integration. It is also possible to create a learning community that provides the opportunity for students in the same major and their instructor to connect.

6.2. Faculty Traits and Needs
With the anticipation of rapid development of online teaching and the large number of faculty in need of support, faculty development and support teams must find ways to meet the institutional

need to provide instructional continuity while helping faculty develop skills to teach in an online environment. Faculty needs during the pandemic include an attendance policy that motivates students to participate in distance learning activities, training workshops on effective use of e-learning systems.

Online learning is most successful when individuals are enthusiastic about teaching and learning on the virtual platform. Grasha (2002) suggests that a teaching style represents a through-way that the faculty present themselves to the students, deliver information, engage with students, supervise tasks and socialize with the students. Hence, faculty members usually select the teaching styles with which they are most comfortable allowing them to revert to comfortable processes in turbulent circumstances (Vaughn & Baker, 2008). According to Gill (2018) and Pachina (2019), there are five teaching styles that are mostly used in the classroom. These styles include 1) Formal authority (Lecturer) style, where the instructor presents the information and students just listen; 2) Demonstrator (Coaching) style, where the instructor is somehow like a lecturer but he/she use some teaching aids like multimedia and class activities; 3) Facilitator (Activity) style, where the instructor supports students' participation in the process of learning; 4) Delegator (Group) style-the instructor acts as observer and respond to students' questions; instructors give students some complex tasks that require their initiative; and 5) Hybrid (Blended) style-the instructor acts as a conductor where he/she blends the type of instructor's personality into students' interests and needs.

In an attempt to draw attention to the most important components to create an effective instructional mode, we propose a taxonomy that maps three key elements to each instructional mode respectively as shown in Table 1. The taxonomy defines distinctive learning styles, teaching styles and learning activities that are essential to be implemented based on the different instructional mode adopted. For instance, in an online mode, students usually prefer individual work, facts and practical real-life scenarios, verbal activities and they favour segmented processes and linear thinking. They prefer hands-on activities, discussions, self-assessment tests, real-life applications and all forms of animations. Therefore, the most appropriate teaching styles are demonstrator, facilitator, delegator or blended (Awla, 2014; Phavadee, 2020). Whereas in a face-to-face mode, most students prefer group work. In addition, as they can interact with the instructor, they tend to prefer visual activities that include concrete thinking. This type of students favour formative assessment, additional resources, theories, field trips and guest speakers. Regarding the teaching styles, the most appropriate ones are authority, as it is suitable for large number of students in a class, demonstrator or blended (Awla, 2014; Phavadee, 2020). As for the hybrid mode, it will combine the different styles and preferred learning activities covered in the other two teaching modes (online and face-to-face).

6.3. Course content and design

Universities need to create a matrix of courses for each program identifying the courses that can be totally taught online and the courses that can be taught in a hybrid mode, and the courses that need to be taught in the traditional face-to-face modality. Some universities focus on transforming the courses content into a format that is more appropriate for an online environment using for example, virtualizing, games, and simulation (DeVaney et al., 2020). Many universities have made their experience and digital content resources available to other institutions. For example, Harvard Business Publishing Education has made their resources available to educators at (https://hbsp.harvard.edu/educator/). Additionally, Coursera created a platform that enables universities to use courses available on Coursera that fit their curriculum (https://www.coursera.org/campus-coursematch).

Universities need to reform their program curriculum and assessment policies to accommodate the new teaching/learning environment (UNICEF, 2020). For example, there is a need for innovative pedagogical design and new learning support strategies. Effective online learning results from careful instructional design and planning by using a systematic model for design and development (Branch & Dousay, 2015; Nayar & Koul, 2020). Effective design for any course will enable the achievement of desired learning outcomes for students of varying learning styles. Diaz and Entonado (2009) have suggested that while preparing an online course, the instructor needs to

build the content based on the online channel so that it can be learned independently. During the preparation of the content and the assessment of student performance, the faculty member must also put significant effort in developing student's interest, encouragement and capability of learning in the virtual environment. Furthermore, faculty members are required to give continuous feedback, or provide any form of response whenever required since the virtual classroom environment is not defined by space or time. This creates a new demand on faculty members' time.

The content of courses could be redesigned to fit online education by focusing more on the upper levels of Bloom's taxonomy such as analyzing, evaluating, and creating capability. This will help enhance students' critical thinking skills. Instructors need access to a greater selection of online content and flexible online resources to reduce the amount of work required to prepare the online materials for their courses and to improve student experience (Chingos et al., 2017). Kumar et al. (2019) identified significant components for online course design which include authentic and relevant course materials (connect concepts to practice), the use of multimedia resources, student creation of digital content individually and collaboratively, students' reflection on learning activities, and the instructor's explanation of the purpose of activities. On the other hand, Martin et al. (2019) identified online course design practices from the perspectives of award-winning online instructors. These best practices include systematic approach to content design (starting with the course description and objectives, and identify weekly topics), backwards design (identifying learning objectives, course topics, and resources, and then design learning activities), course organization (organizing the online courses according to modules, weeks), and meeting learner needs (providing a variety of instructional materials to encompass different learning styles). Nayar and Koul (2020) reported that students showed more engagement with the use of hybrid-learning tools (e.g., flipped classrooms, simulations) and liked the experience. They recommend hybrid-learning tools for instructors who transform the traditional classrooms to more interactive and engaging learning environment. The flipped classroom approach allows students to use most of the lecture time to enhance their interactions and transferable skills, including critical thinking, problem solving, communication skills and group discussion (Klegeris, 2021). With respect to the class size, it has been reported that even though the online mode can handle large class size, 50 students in the class was the target for many institutions (The Remote Summit, 2021).

6.4. IT infrastructure support

With respect to the IT infrastructure support, there are two sides of this issue. The university IT infrastructure and the IT infrastructure of the students. The university has control over its equipment and infrastructure including software, course shells, etc. Often, students have little control over significant components of their infrastructure due to resource availability and physical location. This leads us to mention the inclusivity and accessibility for online education; knowing that many students in many countries might not have access to the appropriate internet connection. Even if they do have access, the internet speed and reliability might not be sufficient for students to meet the online courses requirement. With respect to instructors' technological literacy and competency challenges, some studies point out that some instructors lack confidence, experience with online teaching environment, and knowledge of online course content creation, and resist using new technology for teaching (Rasheed et al., 2020). IT service departments and Centers for Effective Teaching and Learning can assist instructors in performing their tasks effectively and can enhance their performance and productivity. ITS department provides instructors with a wide range of electronic channels to interact with students in the online learning environment. As reported by Prasad et al. (2018) students complain about the complexity of technologies for online activities installed by their institutions. As an example, students spend significantly more time learning how to use these technologies and they become distracted with the technology rather than focusing on learning the course content. Universities should make concerted efforts to ensure a single platform for all classes as differing platforms will require students to learn to use multiple platforms further exacerbating technology distractions. Higher education institutions requiring online or hybrid learning must provide support to faculty and students to meet the requirements of high-quality digital literacy. Those institutions should show a maturity in using IT tools and

techniques as technology is changing fast. Technical staff need to spend more time on developing training programs for instructors and students. The main success factor for online learning environment is dependent on the quality of technical support provided to users.

6.5. Assessment strategies

Assessment is one main challenge in the transition process from face to face to distance learning during COVID-19 pandemic (Rapanta et al., 2020). The pandemic situation required universities to rethink assessment practices. For example, the new approach should not rely on traditional formal exams like closed-book examinations with more than 50% of total course points, further they should decrease the focus on memorization learning (Armour, 2020). More focus should be on critical thinking and problem solving skills through for example, open-book exams. However, both on campus traditional exams and online exams should be prepared in case of emergency. The main challenge of online assessments is to ensure students engagement in authentic assessments with responsive feedback. There are many online assessment alternatives to the traditional closed-book exams. These alternatives include games, puzzles, contest among teams, for example, providing best design, best story, or best solution. Other alternatives assessment methods include writing reports on arguments for/against a particular topic (debate), writing on student's experiences (reflections), designing posters, using "what if analysis" scenarios, interpreting results of analysis of a problem (asking "so what"), and having a case study and then ask what concepts from the course they can apply to analyze it. A crucial point to consider is self-regulation as part of the assessment, which means that students manage their learning processes. This could be happened through self-reflections or portfolios as well as including asynchronous activities into the learning process (Rapanta et al., 2020). This will help in shifting the focus onto students to be responsible for their learning and will help instructors to allocate more time to design online learning activities and distribute them over time. Furthermore, continuous assessment is a fundamental component in an online education model. Gathering information through all learning process is vital and needs to be supported by proof of evidence by using different form of instruments. One of the strategies that is highly recommended for an online education is the use of E-Portfolios (Rapanta et al., 2020). It should be noted that there is no one method that fits all. Determine your main goal of the assessment; is it to test their knowledge or apply their knowledge or both? The assessment requirement must be clear to students. Additionally, assessment methods should be flexible to enhance students' learning experience.

7. Reviewing and updating the framework

The final step is to monitor and evaluate the effectiveness of the framework. As part of a continuous improvement of the framework is to measure the effectiveness of the process, diagnose its success, increase accountability and to make necessary modifications (Brereton, 2021). This steps starts with collecting reliable and valid data from different sources including feedback from students, faculty, and staff. Additionally, data regarding students' performance should be collected and scrutinised for each instruction delivery mode. As depicted in Figure 1, the monitoring and evaluation process is across the components of the framework. Recording lessons learned and understanding "what went right' and "what went wrong" are essential step in planning for corrective actions.

8. Conclusion

The main objective of this study was to propose an agile educational framework for higher education institutions to be better prepared for unprecedented situations such as the COVID-19 pandemic. The proposed framework will enable higher education institutions to have a comprehensive approach to consider the most relevant factors that affect the success of delivering high-quality education regardless of the delivery mode of instruction. The framework identifies student and instructor characteristics that are most appropriate for each type of learning environment (Online, hybrid, or face-to-face). Moreover, the identified themes serve as guidelines for higher education institution management to be better prepared for unseen situations. To restate, the proposed framework is resilient in the sense it has practical ideas based on various inputs sources such as existing literature, students and faculty feedback, and interviews with top management of higher education institutions. Additionally, the

framework considers the so called "new normal" educational setting by addressing the main components of educational system which include students, faculty, course design, assessment strategies, and IT (digital) support for each of the three instruction delivery modes. It enables higher education institutions to accommodate different students' needs in different modules. For example, institutions will be able to support students who, for some reasons, might not be able to be on campus by offering pure online courses. On the other hand, other students might prefer face-to-face education setting. Regardless of the situation, the framework provides the appropriate strategy to handle future challenges. Plausible future research endeavours could include extending the framework by including the future role of higher education institutes and testing the proposed framework by collecting data on each components from a few institutions.

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Ethical approval
This study received approval by the Qatar University Institutional Review Board (QU-IRB 1358-EA/20).

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The authors have no relevant financial or non-financial interests to disclose.

Short summary of key research activities
The research team includes four researchers whom cumulative years as educators exceed 75 years. Two of them had administrative experience as a president and as an associate dean for research and graduate studies. Thus, this research project was a continuation of team's interest in higher education issues in general and during the pandemic in particular. The teams has participated in many research projects related to higher education future trends, distance education, class management, and students assessment through publications in academic journals, professional seminars and panel discussion at international conferences. In this project, we intended to provide an agile educational framework that would help higher education institutions in responding to the new challenges that have been raised as a result of the COVID-19 pandemic.

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