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New Priorities in the Post COVID-19 Era

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Introduction

Adnan Badran, Elias Baydoun, and Joelle Mesmar

Abstract The impact of the novel coronavirus (COVID-19) was felt worldwide and has been a growing topic of discussion. Specifically, this book explores the challenges and costs that have hit the higher education sector due to COVID-19 pandemic. As such, 31 eminent authors from a wide range of disciplinary backgrounds from public and private higher education institutions in the Arab world and Europe address how to mitigate these challenges and build a resilient higher education system; a system that should be well prepared not only to face emergencies in the future, but also one that fits the needs of a growingly diverse student body and an ever-changing labor market. Even before COVID-19, the higher education sector was facing significant challenges. This book provides an opportunity for higher education stakeholders to reimagine the higher education system, re-think the purpose of a university education and pedagogy, re-design the students' experiences, and evaluate business models.

Keywords Higher education · Arab universities · COVID-19 · Virtual learning · New normal · Innovation · Communication

As the outbreak of the most recently discovered type of coronaviruses COVID-19 evolved from Wuhan, China in December 2019, forcing many Chinese cities into lockdown, it was impossible to foresee the crisis that would ravage the rest of the world, sending shockwaves through communities, societies, and governments. No sector was spared, no field was left unaffected, and everyone witnessed sudden changes to their daily lives. The COVID-19 pandemic took the world by surprise, causing an unprecedented health crisis, shaking the global economy, and exposing the vulnerability of the higher education sector globally.

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With COVID-19 infections spiraling out of control, higher education institutions had to shift abruptly to emergency remote teaching, which served initially as the panacea for this crisis, forcing faculty, staff, and students to adjust to the new digital normal. In order to ensure continuity, universities have been forced to be innovative, show agility, and transform digitally. However, COVID-19 highlighted the inefficiency of digital learning, particularly in the Arab region, due to not only inadequate infrastructures in universities and poor governance structures, but also to the reluctance of faculty to change their traditional pedagogical approaches. Does this mean that the impact of COVID-19 is all doom and gloom? With over 1100 public and private universities in 22 countries, comprising 13 million students and 183,000 faculty members, the Arab region should have been in the vanguard of research and innovation. However, many universities have not kept pace with the needs of local industry and society. COVID-19 must therefore be regarded as a catalyst for much needed change, and a pivotal moment for higher education institutions to address deeply rooted weaknesses and challenges.

As part of its focus on the future of Arab universities, the Arab Academy of Sciences has been producing a series of books in collaboration with international experts, starting with *"Universities in Arab Countries: An Urgent Need for Change"* (ISBN 978-3-319-73,110-0) published by Springer in 2018, followed by *"Major Challenges Facing Higher Education in the Arab World: Quality Assurance and Relevance"* (ISBN 978-3-030-03,773-4), "Higher Education in the Arab World: Building a Culture of Innovation and Entrepreneurship" (ISBN 978-3-030-37,834-9), "Higher Education in the Arab World: Government and Governance" (ISBN 978-3-030-58,153-4), and "Higher Education in the Arab World: Research and Development" (ISBN 978-3-030-80,121-2). In this volume of 16 chapters, 31 authors from a wide range of disciplinary backgrounds explore the effect of the pandemic on institutions of higher education in the delivery of education and research, analyzing lessons learned, addressing priorities, and arguing the negative and positive impacts. Proposals and constructive recommendations on how to build agility and ensure the success of the Arab higher education sector post COVID-19, are also presented, focusing on the changes that must be adopted by institutions and governments. Topics covered include technology, E-learning and distance education, innovative curriculum approaches, research and knowledge delivery, financial models, the importance of partnerships with the industry and society, among others.

The book starts with Chapter "The Post-COVID Classroom: Lessons from a Pandemic" (*Mesmar* and *Badran*), which gives an overview on the purpose, value, and functions of higher education and how it evolved over time. The authors then describe the COVID-19 educational response around the world and in Arab countries, highlighting immediate measures, effects, and challenges. More specifically, the impact of the pandemic on educational delivery in different fields is reviewed including: (a) academic research, (b) medical and nursing education, (c) pharmacy education, (d) engineering education and skills, (e) business education, (f) legal education, (g) creative disciplines, and (h) adult education. The COVID-19 pandemic has undoubtedly shaken things up. However, it surely provides an opportunity to reflect on the way things were done, the status quo, and address possible solutions.

Indeed, the pandemic has accelerated the transformation of education as new learning methodologies were introduced, putting a new perspective on twenty-first century skills. It has also been a source of opportunities, inspiration, and innovation. As such, a myriad of initiatives in teaching technologies emerged around the world. Innovations from the Arab world are described in this chapter. While planning for recovery, it is important to look at the challenges facing higher education institutions by examining for instance the student pool, reassessing academic programs and jobs, and reviewing the value of the real estate.

Disruptive events, whether natural or man-made, have been shown to trigger significant change. In recent history, the COVID-19 pandemic has been described as the highest disruptive event with complex and tremendous impact. While it is still early to predict whether the COVID-19 pandemic has left a transient or permanent mark on the higher education sector, there is an opportunity here to imagine the new normal. In Chapter Do Disruptive Events Favor the Bold or the Old? (*Galbraith*) discusses the opportunities and challenges in an age of disruption, and how these can force change. The author draws on lessons from the pandemic, that can give universities in the Arab world a competitive advantage in a rapidly changing region. He explains how these universities can learn and what they can learn to improve and resist the temptation to return to business as usual, by setting a new normal. Although mostly conservative, universities are ideal grounds for experimentation, and the pandemic has highlighted several points of significance: the culture towards virtual learning, the infrastructure, the students' experience and expectations, and a massive demographic challenge. The events of the past two years have highlighted the radical need for innovation in how education is delivered and given an insight into the future of higher education.

In Chapter "How to Prevent a Crisis Becoming a Catastrophe" (*McKellar*), the author describes how the University of Hertfordshire in the UK has responded to the COVID-19 pandemic, testing its resilience and responsiveness. He addresses three elements that are key to the preparedness of universities to the pandemic: (1) institutional resources (financial and human), (2) previous planning and preparation and (3) how fast the university responded to the crisis. To this end, the response of the University of Hertfordshire to the pandemic is reviewed and the structures of groups and committees formed, as well as their roles and modes of operation are described. Communication is an important aspect in emergency situations. The timely dissemination of effectively planned messages ensures not only the safety and protection of the community, but also instills a sense of security and confidence. Therefore, the communication strategy for staff and students is also presented, highlighting its importance in times of crisis. The author then describes how the pandemic impacted the main functions of the University such as the delivery of education, advancement of research, recruitment of overseas students, and engagement with business and industry. There is no doubt that the pandemic has had major disruptive effects on the higher education sector, with positive and negative outcomes, and which will require a longer-term adaptation. However, it is important to underline the human impact of the pandemic, validating that the university is more than just an academic education.

In Chapter "Access to Resources for Learning and Assessment in the Time of Pandemic—What Happens When Things Misalign and When the Teacher is not There?" (*Askey*), the author reflects on how the pandemic has affected access to resources for learning and assessment, drawing on the case of the Undergraduate Laws (UG Laws) program of the University of London. The author highlights the significance of such program in terms of a large student body and worldwide outreach. Indeed, it is a flexible low-cost access model, which is normally delivered through Recognized Teaching Centers (RTCs) and provides Virtual Learning Environment (VLE) resources and interactive online Module Guides to those who prefer to study alone. However, challenges arose in the delivery of assessment during the pandemic, given the dispersed and diverse nature of the student body. The author describes the process in moving the examinations online and selecting the assessment method, a project that normally takes weeks to years of preparation. He discusses legal complexities in the UK, privacy impact assessments, IT requirements, and security testing. In the remaining part of the chapter, the author reflects on "something we did not see directly in 2020", that is the teacher as a particular resource for learning and how access to this resource impacts learning. This chapter provides an opportunity for all educators to reflect on the type of learning that is required from the students and the assessments tasks required to achieve the desired learning outcomes, stressing on embracing change and acting on it.

While teaching and research are still considered the main functions of a university, additional activities that add more practical value to the knowledge created have been gaining increasing attention. Such activities are labelled as the third mission (TM) of universities and add an entrepreneurial approach that drives development and bridges the gap between academia and industry. In Chapter "Bridging the Gap Between Academia and Business" (*Parry*), the author discusses how the COVID-19 pandemic has accelerated the need for universities to adopt TM programs and increase the value of universities in society, in addition to providing an additional source of income. The introduction of the TM function requires a strong entrepreneurial environment and knowledge transfer capacity. Here, the author gives examples of TM programs and the organizational and management structures required for the implementation of such programs. He also emphasized on the importance of increasing the understanding between universities in the MENA region and businesses in order to influence and implement innovation.

The future of business education in a post COVID world is addressed in Chapter "The 'New' Normal of Business Education in a Post COVID Era: The CDIO Approach" (*Zabalawi* et al.). The authors start by redefining business education and placing it in a context that is vital to the economic growth and development of any nation. The COVID-19 pandemic has highlighted the major problems facing business schools and the challenges that must be addressed in order to prepare graduates for an increasingly complex workplace. These are centered around: (1) a shifting student demography, (2) business school facilities, (3) a university strategy and governance model, (4) pedagogical approaches with innovation at their core, (5) relevant academic research, (6) faculty readiness and adaptability, (7) the importance of innovative partnerships, (8) the competition between university degrees and professional

certificates, (9) disruptive technologies, and (10) the emergence of diverse forms of learning. The pandemic has emphasized on the importance of embracing change and encouraging innovation. This Chapter provides a guide for the design of an innovative business curriculum, addressing its intent, implementation, and impact. It is based on the Conceive-Design-Implement-Operate (CDIO) initiative, which is centered around active and experiential learning experiences for students, and which was initially applied to engineering programs. A detailed roadmap is outlined, including a CDIO syllabus adapted for business education, showcasing the Australian College of Kuwait's (ACK) School of Business experience as a case study, and which could be used by business schools to reform their programs of study.

Lessons learned from the pandemic towards achieving economic resilience are addressed in Chapter "Leveraging Research and Innovation for the Post COVID-19 Era: Lessons Learned and Future Plans Towards Economic Resilience" (*Thaer* et al.). The authors discuss the immediate impact of the pandemic, particularly on energy consumption. They also provide recommendations for research priorities that Arab countries could benefit from, emphasizing on the importance of scientific research and innovation. Such research and development priorities are centered around: (1) the health and medical sector, encouraging initiatives supporting decision-making and investments in the healthcare systems; (2) the agricultural sector to ensure food security; (3) the industrial and IT to maintain and enhance collaboration with academia, and (4) the educational sector to ensure the continuity of the educational process.

Even though the recession began in 2007, affecting both developed and developing countries worldwide by a series of overlapping crises, the Arab countries in particular had to deal with regional crises driven by the Arab Spring and now the COVID-19 pandemic, adding to an already high debt burden. In Chapter "Implications of the Recent Financial and Health Crises on Institutions of Higher Education in Arab Countries: Revisiting Existing Financial Models" (*Neaime* and *Saghir*), the authors briefly overview the current Arab macroeconomic situation, before placing it in the context of higher education. For this, they describe the effects of the global financial crisis on US universities and provide short- and long-term mitigation measures. An analysis of the impact of the financial and sanitary crises in the Arab region is then provided by taking the American University in Cairo, Egypt and the American University of Beirut in Lebanon as examples, highlighting lessons learned. The future of higher education relies on robust and solid operational and financial schemes that ensure growth and preparedness for future shocks. The pandemic provides here an opportunity to revisit current university financial models. As such, it is essential to safeguard education spending by ensuring cost-efficiency and developing innovative funding approaches that drive sustainable growth. The authors conclude the chapter by giving some policy recommendations.

In Chapter "Shaping the Future: North African Universities After COVID-19" (*Benjelloun*), the author documents the response of North African countries to the COVID-19 pandemic. He starts with a general account of how the pandemic affected several North African countries, including Morocco, Algeria, Egypt, Mauritania, Tunisia, and Libya. He then focuses on the impact of the pandemic on the higher education sector in those countries. The pandemic has emphasized on the ever

increasing need to embrace technology and digitalization by universities in order to face the future and avoid being left behind. Although this has been an ongoing effort, the pandemic has clearly accelerated the process. This entails upgrading internet infrastructures and access, in addition to facing the skills gap. The author then looks at the future of North African universities, post COVID-19, drawing on examples from several initiatives and measures taken to enhance information and communication technologies and encourage innovation. Finally, he highlights the lack of research in health and related disciplines in North African universities and calls for action through public–private partnerships and regional cooperation.

Online learning can be advantageous in many ways, namely for the convenience and flexibility it offers. However, it is not without its challenges. In Chapter "E-Learning Quality Requirements for the Post COVID-19 Era in the Arab World" (*Helal* and *Sharaf*), the authors surveyed 354 faculty members and administrative staff from various countries in the MENA region and the GCC, drawing on their experiences with e-learning as a mechanism that ensured the continuity of education in times of crisis. They also reviewed academic articles voicing the students' experience with e-learning, highlighting their opinions. Both quantitative and qualitative analyses were conducted to highlight the requirements for an e-learning mode of higher education in the Arab world. These are summarized in proposed framework centered around three main themes: culture, pedagogy, and technology.

Chapter "Opportunities in Disruption: Higher Education in the Post COVID-19 Era" (*Shanableh* et al.) analyses the impact of the COVID-19 pandemic on higher education institutions in general, and in the United Arab Emirates (UAE) in particular. The authors address the different modes of learning adopted during the pandemic and their evolution, as lockdown measures were being lifted. They also describe the impact of disruptions caused by the pandemic educational delivery and learning on instructors and students, highlighting their preferences based on feedback from an ad-hoc survey in the UAE. The COVID-19 pandemic has provided an opportunity for higher education institutions and their stakeholders to experiment educational technologies and reflect on the future of education. They need to realize that the education landscape is fluid, constantly changing, and more technology-focused. It also needs to be flexible and innovative. In order to survive, higher education institutions should keep an eye on global educational developments and the needs of the future generations, rather than dwell on their past successful experiences.

The University of Petra in Jordan also carried out an assessment on its experience with the sudden shift to online learning. In chapter "The COVID-19 Teaching Experience: The University of Petra as a Case Study" (*Muwalla*), the author describes the survey that was rolled out across the campus targeting members of staff, instructors, and students, almost two years after the start of the pandemic, and with the purpose to assess the measures taken by the university to ensure the continuity of education. Topics addressed included the infrastructure and technical support available and the effectiveness of the learning managing system adopted. The opinions of instructors and students on the assessment methods used was addressed, exposing their integrity and credibility. The instructors' knowledge of the rules and regulations pertaining to online learning was evaluated, in addition to their readiness for adopting online

learning in their future plans. Finally, the author reflects on the delivery of education at the Unviersity of Petra, post COVID-19, highlighting the areas that need to be addressed to overcome the limitations of online learning.

Whilst massification of the higher education system has been observed worldwide, there was no clear alignment with the changing socio-economic needs of communities. Moreover, the pandemic has placed emphasis on the benefits of digital technologies and highlighted the diversity and complexity of the student body. In order to survive, leaders of higher education institutions need to make the right decisions now. In Chapter "Effective Partnerships with Multinational Organizations—A Case Study from Sohar University" (*Al Fazari*), the author focuses on the importance of partnerships and collaborations to ride the wave of new higher education development trends. He discusses the reasons for higher education institutions to enter into strategic partnerships, drawing on the example of the University of Sohar in Oman, namely how the COVID-19 pandemic has affected these partnerships the past two years and moving forward.

The challenges and opportunities in the Syrian higher education sector post war and pandemic are presented in Chapter "Higher Education in Syria Post-War and Pandemic, Challenges and Opportunities" (*Mualla* and *Mualla*). The authors start with a background on the shape and composition of the higher education sector in Syria, describing the various public, private, and vocational institutes in addition to the reforms that took place in the sector since 2000. The impact of the ten-year old war in Syria on the higher education sector is also addressed before delving into the impact of the COVID-19 pandemic, focusing on: (1) teaching and learning, (2) access and student recruitment, (3) student mobility, (4) academic staff, and (5) non-teaching staff. The chapter also deals present case studies from various Syrian higher education institutions (public and private) on how they coped with the pandemic and the various strategies they undertook to ensure the continuity of teaching and learning. For comparison purposes, the authors describe how the University of Leicester in the UK has responded to the COVID-19 pandemic. The authors emphasize on the need of higher education institutions to be prepared to shift to remote learning, should the necessity arise. It is important that they embed the many technologies that allowed the sustainability of education during such emergencies in the institutions' educational methods, in addition to incorporating blended learning approaches.

COVID-19 has been a new and disruptive experience in modern education, affecting all stakeholders from students, faculty, staff, and administration. Two years after the start of the pandemic, getting feedback on the experience of educators during this period is important to reflect on the educational process and outcomes, determine areas of improvements, and more importantly give insight into the future of higher education. In Chapter "Through a Glass Darkly: Oral Histories of Teaching During the Pandemic" (*Smith*), the author interviewed professors from the American University of Beirut in Lebanon about their online teaching experience during the COVID-19 pandemic lockdown. For the past few years, Lebanon has been going through unprecedented turmoil and crises that have affected higher education in many complex ways. However, now that lockdowns have been lifted and nations are moving

into the "next normal", it is fascinating how quickly one can forget. The author therefore saw an opportunity to document the stories of these professors, who came from different backgrounds and disciplines and with at least eight years of experiences, and reflect on their online teaching experiences. They discussed methodologies used, best and worst experiences, feedback from students, and areas of improvement. Their opinions on whether they would still use any of the new approaches adopted during online teaching, or hire and recruit students with an online education background were also registered.

How the Kuwait Institute for Scientific Research (KISR) responded to the government of the State of Kuwait's call to action to face the pandemic is presented in Chapter "Flagship Projects for Accelerating R&D During the COVID-19 Period in Kuwait" (*Omar* and *Al-Momen*). In this context, KISR initiated a flagship project to identify emerging issues, carry out response assessments, and propose innovative solutions to tackle the pandemic through scientific approaches. The governance and mode of operation of such projects are presented, in addition to examples of results and outcomes to date. KISR's initiative is supported by the Kuwait Foundation for the Advancement Sciences as the funding body and implemented in collaboration with the Ministry of Health, Kuwait University, and other public and private sectors.

Two years into the pandemic, and as we are entering a relatively stable phase with some kind of normalcy, it is time to reflect on what we have learned. The past two years have been a disruptive phase that has changed us all. Also, a phase that has transformed higher education. Technology proved to be an essential part of the learning process, as distance education and e-learning have gained momentum during the pandemic. It proved to have many advantages, but not without its challenges. So could technology be the future of higher education. While it is one thing to embrace e-learning and distance education as an essential part of the future of higher education; it is quite another to implement them. If these are to be successful, critical success factors need to be identified and policy makers in the higher education institutions need to be well informed for the education process to be implemented effectively. Now is the moment to reset our thinking and build on our experiences to reimagine the higher education landscape; one that meets the needs of a workforce in an ever-changing world. Now is the time to reinvent higher education.

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The Post-COVID Classroom: Lessons from a Pandemic

Joelle Mesmar and Adnan Badran

Abstract In December 2019, an outbreak of pneumonia cases with unknown etiology was reported in Wuhan, China. It had then quickly spread to other provinces with more and more patients having fever and cough symptoms. Within a few weeks, a novel coronavirus was identified by the Chinese Centre for Disease Control and Prevention and named as severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). The World Health Organization called the illness associated with this infection as "coronavirus infectious disease 2019 (COVID-19) and on 11 March 2020, it was declared a pandemic, as the virus spread across the globe, reaching 217 countries and territories with 17 million confirmed cases and over 668 deaths. By April 2020, the number of students staying at home due to lockdown measures implemented by their educational institutions reached 1.598 billion in 194 countries. Such lockdown has forced these institutions to switch to online pedagogy. In developing countries, and among them the Arab world, this has exposed inequalities and challenges, such as uneven distribution of internet connectivity between urban and rural areas, with some poor areas not able to afford even the price of the hardware. Students and teachers were not well trained and equipped for online and virtual education. And schooling and campus social life was missed and the student's psychology under these circumstances may have changed human behavior, which needs to be studied further by social scientists. As for academic conferences, these were postponed, cancelled or carried out online using various platforms. There is no doubt that online learning has saved the educational sector from disaster. However, after the pandemic, the style of educational pedagogy will be changed, and will not be business as usual. This chapter presents an overview of the effect of the pandemic on higher education, starting with an introduction that includes a description of the higher education sector pre-COVID-19 and a background on COVID-19. The immediate measures taken by higher-education institutions and the immediate challenges they faced will be presented, focusing on the impact of COVID-19 on various educational fields and

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the different stakeholders. Finally, the challenges of recovery beyond the pandemic are addressed and recommendations for future trends and possibilities for the Arab world are considered, for a more sustainable future.

Keywords COVID-19 · Pandemic · Disruption · Online learning · Lockdown · Higher education · Universities · Arab world

1 Introduction

What it is the purpose of higher education? What is the value of higher education? What is the core mission of higher education? These are questions that today's students, faculty, staff, policy makers, and stakeholders in the higher education sector are most likely asking themselves.

Although the higher education sector is often described as rigid and resistant to change, the history of higher education points to continuous transformation. At different points of time, the purpose of higher education has taken on a variety of angles. Higher education institutions first targeted a single stratum of society: the elite and the privileged, focusing primarily on religious and theological education, literature and philosophy, mainly designed to nurture the mind as well as preparing students for leading roles in government and learned professions, such as divinity, law, and medicine. Then as the number of students increased and higher education institutions expanded, accompanied by a massification in enrollments, staff and faculty recruitments, and institutional infrastructure and disciplines, higher education started its transformation into mass higher education, in order to be able to cater for a broader range of students with a broader age group and range of functions. With this growth, the purpose of higher education shifted from mainly the shaping of character to the preparation of technical elite roles through the transmission of technical knowledge. Today, the higher education sector entered a third phase, described as the universal phase and designed for universal access, which was facilitated by technology, consequently breaking the boundaries of institutions, and increasing diversity and collaborations [1, 2].

While the higher education sector transformed from the diffusion of bookish knowledge and training to the advancement of knowledge through critical thinking and research, Newman argued that teaching and research should be separated, and that higher education should be about liberal education for "the achievement of a particular expansion of outlook, turn of mind, habit of thought, and capacity for social and civic interaction" [3]. Clearly, the purpose and functions of higher education have been long debated, and one cannot deny that the higher education sector witnessed great transformation. *"This great transformation is regretted by some, accepted by many, gloried in, as yet, by few. But it should be understood by all"* [4].

Nowadays, the definition of the purpose of higher education is a non-compulsory learning stage that occurs beyond high school, with the main aim to prepare students

to become professionals and effective citizens. At the core of higher education institutions there are three major missions: (1) to educate, (2) to generate new knowledge through research, and (3) to engage with the community and contribute to the development of society by providing public service [5]. In other words, higher education institutions aim to prepare students to join the workforce by teaching subjects that are required to tackle the society's needs and challenges, ultimately contributing to social mobility and economic growth.

From the student's perspective, enrolling into university is often seen as the next obvious step and a means to enter the labor market. This vocational orientation towards learning places the student as the customer of a service provided by the university. The downside of such orientation is that the students become passive and tend of focus on having a degree regardless of learning or their responsibilities towards society. However, with a growing number of students seeking higher education and the addition of non-traditional cohorts such as full-time working adults and part-time students who have different characteristics and educational needs, the student body has become increasingly diverse with consequently diverse needs and purposes. Yet the reality is different. With higher education institutions still mostly geared towards the traditional type students as a "one-size-fits-all" model, offering overcrowded and fragmented curriculum that remiss about the vocational and personal development of students, there is a pressing need to adjust the purpose of higher education to meet the requirements of a growing and diverse student body. A student body that is still seen as a customer, rather than a learner, of an institution-centered provider.

As from the society's perspective, the lack of investment in higher education can have dire consequences, negatively impacting the country's economic growth and participation in the global knowledge economy, mainly due to lack of investment in the country's human capital resulting in loss of talent through brain drain, poor research activity because of limited access to facilities and capacity for solving local problems.

Over the last 50 years, the Arab countries of the Middle East and North Region (MENA), have made great progress in improving enrollment rates and gender parity at all education levels. Until 1953, there were only 14 public and private Arab universities in the Arab world, most of them as very old or foreign institutions. Today there are over 800 universities, associated with an expansion in student enrollments, mainly fueled by an exponentially growing population with a high youth composition and the recognition of the importance of higher education for social and economic development [6, 7]. However, the gap between the educational output and labor market demands and development needs is still growing. Young citizens in the region feel that higher education only serves them to get credentials without offering links or relevance to the labor market. While Arab countries vary in the political, economic and social challenges they face, they all suffer from this disconnect and are not conducive of critical thinking. Years of conflict and instability in many countries of the region have further exacerbated this situation, failing to meet the demands of a large growing young population and leading to more and more isolation of the Arab countries from global knowledge and progress. Although the region has

witnessed many advances, their education system remains the same and is in dire need to transform in order to be able to create the required change [8–10].

A higher education sector in crisis is not breaking news. Articles, issues, and books on higher education in crisis have been calling repeatedly for change. Looking at a past with various challenges, and having survived with relatively little institutional change, will the higher education sector's response to the COVID-19 crisis by any different? During an interview with Forbes magazine in 1997 discussing the escalating cost of education and the rise of the "internet mania", management guru Peter Drucker had said that the current setup for higher education is "doomed" and predicted that "thirty years from now the big university campuses will be relics. Universities won't survive. It's as large a change as when we first got the printed book". Will higher education institutions embrace this opportunity and respond accordingly by making the necessary adjustments and adopting sensible reforms for building an effective educational system that actually meets the needs of students and society? Will higher education embrace change in its purpose to become relevant? Will these changes be coupled with a transformation at the institutional level and improvements in governance structures, curriculum, pedagogical delivery, educational technologies, and interactions between the various stakeholders involved?

Only time will tell.

2 The COVID-19 Pandemic

The 2019 novel coronavirus (2019-nCoV) is the most recently discovered type of coronaviruses which causes respiratory infections. When first detected in December 2019 in Wuhan, the capital of the Hubei province in China, it was described as "pneumonia of unknown cause". On 11 February 2020, the World Health Organization (WHO) announced "COVID-19" as the name of the disease caused by the 2019-nCoV virus and the International Committee on Taxonomy of Viruses renamed it as severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). By the first week of March 2020, the virus had reached over 100 countries with over 100,000 cases, causing a global outbreak and becoming a major public health issue [11]. A year later, there were 115 million confirmed cases and over 2.5 million deaths globally [12].

Outbreaks occur when the number of disease cases in a community rises suddenly above the expected occurrence in a defined community, geographic area or season. While epidemics consist of outbreaks in specific geographical areas without necessarily being contagious, pandemics occur when the disease grows exponentially, crossing geographical boundaries and affecting several populations. The disease is then declared a pandemic by the WHO, regardless of its severity and population immunity, but rather based on its rate of spread and transmission [13].

The COVID-19 outbreak is not the first disease that shook the world. The Black Death (1346–1353) was a highly contagious disease that was caused by the bacillus

Yersina Pestis in the Afro-Eurasia region, and which claimed over 20 million lives in a period of about five years before running its course in the early 1350s, with some estimates reaching 200 million [14]. Symptoms included sever aches, fever, vomiting, swelling of the lymph nodes, and black pustules on the skin, causing death within three days. The Black Death (also known as the Plague) caused major terror and uncertainty around the world leading to social and religious upheavals, with many describing the pandemic as "God's punishment". The Plague also had profound economic consequences. This may have given incentives for innovation, such as the shift of labor-intensive grain farming to animal husbandry, mainly fueled by lack of cheap labor due to the death of countless workers. Efforts to contain the disease included social distancing and isolation of sailors on their ships for initially a period of 30 days, which was then increased to 40 days (hence the origin of the term "quarantine"); practices that are still applied today. Later during the modern industrial age, the expansion of new transportation routes facilitated the spread of influenza viruses causing the Flu Pandemic (1889–1990); within a few months the earlier cases reported in Russia had wreaked havoc worldwide, killing around 1 million people. The Spanish Flu (1918–1920), also referred to as the 1918 influenza pandemic, was caused by the H1N1influenza virus. It was considered the most severe in recent history, infecting over 500 million people, equivalent to one third of the world's population at the time, and killing at least 50 million sparing no age group, especially the youth. Then came the Asian Flu (1957–1958), another influenza pandemic, which started in China and claimed over 1 million lives worldwide due to infections with avian flu viruses [15]. The cousin of the H1N1 virus resurfaced again in 2009 announcing the swine flu pandemic, which has touched over 60 million people in the United Sates alone and caused an estimated 151,700–575,400 deaths worldwide [16]. Some pandemics such as HIV/AIDS, which has claimed over 35 million lives so far since the first infections by the human immunodeficiency virus (HIV) virus were discovered in 1981 virus, are still ongoing today. Although a cure has not been found yet, the disease is no longer as deadly and infected people can have normal life expectancies because of new medications developed in addition to prevention and treatment strategies [17].

Looking at such a history of pandemics, one cannot deny that the warning signs were there. The number of infectious diseases and outbreaks have been increasing with time, in line with a growing population, global trade networks, travel, and globalization [18]. The era of the Anthropocene, our newest present day geological epoch during which human activity is significantly impacting the Earth's ecosystems, climate and geology, is becoming the "pandemic era" [19, 20]. The Global Preparedness Monitoring Board had issued in September 2019 its first annual report, "A World at Risk", with the aim to accelerate the preparedness of the world for health emergencies and threats focusing first on biological risks, and drawing on lessons learned from previous outbreaks such as the 2009 swine flu pandemic and the Ebola virus disease [21]. The report warned that "there is a very real threat of a rapidly moving, highly lethal pandemic of a respiratory pathogen killing 50 to 80 million people and wiping out nearly 5% of the world's economy", stressing that the world would be unprepared for a global pandemic. As a matter of fact, the COVID-19

pandemic highlighted even more how interconnected the world has become, how quickly a contagious disease could spread, and how fast an outbreak could turn into a catastrophe. This pandemic proved that not only the world was clearly unprepared for such an environmental threat but that it was also divided and politicized in its response strategies. Leaders around the world have responded differently to the threat, and the "Prozac leadership" type emerged, which encourages leaders and their administrations to be positive, all the while denying the bad news, ending up with a distorted picture of the reality, impinging on the actions and responses taken towards public health policy. It states that "excessive positivity constitutes a significant barrier to reflection and learning. By silencing critical voices, Prozac leadership has hindered our leaders' response to the pandemic" [22].

This is where the relationship between science and politics has been severely strained and where the value of science and expert advice have often been decried, from the initial stages of the pandemic to vaccine development [23, 24]. Around the world, scientific advisers and committees have been attacked, questioned, criticized, and held responsible for creating an economic crisis, and increasing poverty and unemployment. Following science to set policy is not a straightforward matter, but rather a breeding ground for bias and conspiracies. Where science and politics intersect, it is the idea that fits best or that suits certain purposes that survives. For example in the UK, as COVID-19 was declared a high consequence infectious disease (HCID), it was later downgraded without prior expert consultation, until it was eventually removed from the HCID list [25]. The reason for such political decisions takes its origin in the unpreparedness of the government and its underestimation of the situation and medical requirements, which was translated into a shortage of protective personal equipment such as medical gowns, visors, respiratory masks, and even swabs for testing the ill and body bags for the dead, not to mention the saturation of hospitals and the need for ventilators. Countries in the Arab world were of course not spared from such situations.

COVID-19 had covered all the Arab world by April 2020. While the countries in the region differed in their response strategies, most adopted strict lockdown measures in an effort to curb infection spread and prevent overwhelming the medical systems. These measures included: applying social distancing protocols; closing schools and universities; shutting down malls, shops, restaurants and cafes; suspending employee attendance; closing ports, airports and restricting travel; and banning enclosed prayer places and gatherings. Other countries went for the herd immunity strategy, putting priority on saving a collapsing economy. In fact, the socioeconomic fallout of the pandemic in the region is very heavy. A loss of USD 420 billion in market capital was reported by April 2020, equivalent to 8% of the region's total wealth [26]. And Arab youth unemployment peaked to 23%, the highest in the world [27]. Until mid-2020, containment efforts in the region were successful compared to the rest of the world and death rates were low, mainly due to a relatively young population. However, as lockdown measures were lifted, infection rates started rising exponentially, with more than 2.2 million cases by the end of the same year [28]. The health sector in the various Arab countries has also been put under tremendous strain. In Syria for example, a decade of war has left the sector crippled with

only 64% of hospitals and 52% of primary health care centers fully functional. Other conflict-affected countries such as Iraq, Libya, Yemen and the Palestinian Authority follow suit [29].

However, this pandemic is not all foreboding. It could be an opportunity for Arab leaders and stakeholders to tackle indelible issues such as updating an outdated and weak healthcare infrastructure, investing in science and technology, and promoting innovation. Additionally, revisiting the education system and investing in research and development should be an important long-term strategic goal for the region to reduce inequalities and provide opportunities for the Arab young population.

3 The COVID-19 Educational Response: Maslow Before Bloom

The COVID-19 pandemic has left no one spared and touched all domains of life. Education is of course one that has been hit hard, forcing higher education institutions to confront problems and issues they have long shirked. Experts and critics claim this is the crisis the higher education sector needs, hoping the disruption this pandemic has caused to education will be more than just a blip on the long run, but rather an opportunity to reset and to re-imagine the purpose and operations of the whole sector.

3.1 Immediate Measures

The pandemic came as an unexpected storm. With cases skyrocketing all over the globe, just a few months after the virus had taken over China, higher education had to react swiftly. With fear, anxiety and uncertainty in the air, it is "Maslow before Bloom" when it comes to learning and academic success; in other words, the students' needs and well-being come first and are essential for educational attainment [30]. So first came the decision to close higher education institutions, a measure that was part of the social distancing and confinement protocols adopted by China and recommended by the WHO to contain the virus. According to UNESCO by 1 April 2020, 89.4% of enrolled students were affected by the closure of schools and higher education institutions, amounting to 1.5 billion learners worldwide. Generally institutions closed completely for a short break, suspending all campus-activities and announcing extra holidays and vacations, in order to prepare the necessary measures for remote learning. Such measures included changes to the curricula, setting up technical infrastructures, platforms and educational tools. Learners and educators had no choice but to transition and adapt quickly from traditional face-to-face teaching to virtual education. In Europe for example, most universities closed their campuses as of March 2020 and 95% of universities shifted to distance learning [31].

All countries in the Arab world initially applied the same measures. However the impact of the pandemic on education was more negative than other parts of the world and showed how badly the sector is in need for reforms. The absence of proper technical infrastructure and platforms for delivering classes online, over and above the reluctance and unreadiness of faculty to teach online, not to mention limited access to internet and often a non-conducive environment at home, meant that teaching had to be cancelled in many higher education institutions in the Arab countries and that students had to rely on self-study means. Such situation of course is not ideal; it is associated with negative impact on learning and shouldn't last long. As a matter of fact, institutions who were unable to deliver distance learning either shifted their academic year, postponed graduation, adopted a blended learning approach or had no choice but to re-open their campuses [32].

3.2 Immediate Effects

The current pandemic impacted the enrollment of international students who had to be brought back home, mainly due to imposed travel bans in many areas and closure of dormitories and halls of residence at universities. Those institutions relying on international enrollment for revenue have been heavily affected. Some countries in the region have taken initiatives to retain and attract international students. For example the United Arab Emirates (UAE) issued a new policy that allows new students to sponsor their relatives during the time of their studies [33]. And several Egyptian universities are establishing new branches in other countries in Africa, such as Ain Shams University in Cairo and Tanta University which have signed agreements with Tanzania and Djibouti, respectively [34].

The pandemic-induced recession also caused a decrease in the enrollment rates of local students, particularly underserved and low-income students as well as non-traditional part-time and working students, which would eventually impact their educational attainment and consequently their future. In the United States, first-year enrollments dropped by 13% in fall 2020 compared to the previous year, with two-year institutions hit the most, accounting for an 18.9% drop. The latter cater mostly for low-income students and nontraditional students. Reasons for dropping out are mainly related to higher education affordability and that the cost of virtual education is not worth the cost. Experts worry that when these students leave higher education, it is very unlikely that they will return [35]. Additionally, during a recession, what is usually observed is an increase in higher education enrollments because the newly unemployed often decide to study again until the economy improves. However this was not the case during the COVID-19 recession. In fact, student enrollment was already on the decline due to rising education cost. Similar trends were observed in the Arab world, where the majority of households have seen a decline in living standards and purchasing power, as has been reported in Egypt, Lebanon and Morocco, with many families unable to pay tuition fees. Financial constraints have also caused students to shift from private universities to public universities in an attempt to lower

tuition costs [32]. As for prospective students, admission deadlines were extended in many universities and admission tests were waived. While for new students, their visits and orientations had to be carried out virtually, and graduating students saw their ceremonies cancelled.

The disruption of education and closure of campus have also caused a drop in the auxiliary fees, such as housing, parking, dining, sports facilities, events, and other activities. Refunds of fees were also asked for, leaving a gaping hole in the operating revenue. Also, universities relying on their hospitals for revenue were also affected as non-essential and selective procedures and visits had to be postponed in order to care for COVID-19 infected patients.

The decrease in government funding has also put a strain on higher education institutions, having its roots in the health crisis and drop in oil prices that the Arab region has been witnessing. This reduction in higher education public funding is also expected to last for the coming few years. As a consequence, financial assistance to students was strongly affected, as government spending had to be re-directed to pressing health needs. Institutional budget cuts were also implemented and translated into a reduction in staff salaries, early retirements, contract freeze and even suspension, elimination of tenure, as well trimming benefits, closing programs, merging departments, and decreasing research funds. In Lebanon, the American University of Beirut, one of the most prestigious and prominent universities in the region, announced it would lay off around 25% of its staff in mid-2020, mostly in administrative positions as it is facing "its greatest crisis since its foundation in 1866", according to its President [36].

3.3 Immediate Challenges

COVID-19 has directly and heavily impacted the teaching and learning processes. Shifting to online modes of education seemed like the immediate panacea to ensure continuity in teaching and learning. Although digitally enhanced learning and teaching has been on the table for higher education reform for years and many education technology tools have been developed or are under development and are slowly being integrated in educational practices, it is COVID-19 that really acted as the catalyst for distance learning. However, such sudden change is not without challenging consequences. Stating that online learning is the only way forward would be a dicey prediction.

Although the shift to online teaching and learning has rescued the academic year at the beginning of the pandemic, it has revealed several challenges: the first one on the list is the internet. With this comes not only poor internet connection and penetration, but also access to digital devices and acceptance towards online education, especially in developing countries. In fact, many Arab countries have showed skepticism towards online education pre-COVID-19 and suffer from digital illiteracy, which is observed among both educators and students [37]. Based on International Telecommunication Union (ITU) estimates for 2020, only 54.6% of individuals use

the internet and more than half of households don't have internet at home in the MENA region, with the exception of the Gulf Cooperation Council (GCC) countries (scoring over 90%) [38]. There is therefore a great digital divide between countries in the region, which explains the variety of educational strategies adopted in light of the pandemic. Some countries such as Lebanon, Syria and Iraq had to face even more challenges such as electricity cuts, which severely disrupted online sessions and access to educational material, making distance learning difficult. Also in terms of digital divide, a significant gap exists between rural and urban areas, as well as public and private universities, which is likely to exacerbate inequalities between students within the same country and region [39, 40].

Another challenge students and teachers had to face was online evaluation and examinations, creating a lot of stress and confusion for everyone involved in the process. Examinations are a critical and important part of the learning process, and therefore cancelling them was not an option. Teachers had to create and design proper assessment tools, which were associated with trial-and-error approaches, to counteract cheating. For this, several universities adopted tools for the detection of any fraudulent activity during an exam, such as ProctorU or Respondus. Of course, this is not without its drawbacks, including weak internet connections—a prevalent issue in the Arab region—and privacy concerns among students. Yet, this experience could be seen as an opportunity to re-think traditional approaches as these are still based on twentith-century mindsets, emphasizing on compliance and conformity rather than critical-thinking and creativity, as well as enhancing collaboration and knowledge transfer. Besides, in-person examination is a tedious and costly process with often human error problems [41, 42].

Knowledge sharing, mobilization and production through networking and collaboration is an essential purpose of academic conferences. By February 2020, in-person conferences around the world were cancelled and shifted online. To replicate the conference experience online is for sure challenging. Though the main purpose people chose to participate in conferences is to create networks, which is an essential characteristic of on-site gatherings, it is often costly and time-consuming. And under-resourced less privileged institutions or academics often miss out on such opportunities. Going online is therefore not without benefits, especially when it comes to convenience, accessibility, visibility and inclusion, which would allow to cater to the needs of a larger and diverse group of academics and researchers [43, 44]. Creating a hybrid format for conferences in the future could be the way forward. Oftentimes, in-person academic conferences are more of a routine than a necessity. In his article on academic conferences after the pandemic, Dr. Joshua Kim envisions that "in the future, we may see smaller but more resource-intensive (lavish) in-person events. Academics will not travel to an in-person conference unless that event offers benefits far and above what can be gained virtually. This will maybe mean better conferences, with less boring panels and passive talks, and more in the way of opportunities for collaboration and conversation" [45]. An opinion shared by many.

Clearly the pandemic has accelerated the digital transformation of societies, and with it higher education. It underscored the importance of technology and the need for reforms to improve the digital infrastructure and digital literacy among both students

and educators. Having faced so many challenges and undertaken a lot of changes in the way education is delivered, the higher education community is now ready to exit the crisis stage, re-think the pre-COVID-19 status, assess the implemented solutions, and invest in remote learning in order to plan for a future with quality education, as new challenges will continue to emerge. This will not only mean developing or learning new tools, but working in collaboration internationally to find joint solutions. It will also necessitate a shift in mindset in seeing challenges as opportunities and focusing on change, progress, and growth.

4 The Impact of the Pandemic on Various Educational Fields and Activities

The impact of COVID-19 on education differs from one field of study to another. While distance learning was efficient in some areas, it often had many limitations in others. This section provides examples of how the pandemic has affected the educational delivery in different fields, recognizing gaps and reflecting on possible solutions.

4.1 The Academic Research Enterprise

As institutional lockdowns were instigated, eerily empty classrooms together with labs going quiet was a typical scene on campuses in 2020. Apart from essential research including COVID-19-related research, many research programs were suspended worldwide, being a campus-based activity, with laboratories and fieldwork at their core. While educators and staff were given instructions and advice on how to carry on their work remotely, this was not the case when it came to scientific research, especially research requiring heavy equipment in the lab, fieldwork and clinical trials. Having to pause their work, researchers were left confused on how to safeguard their research activities and uncertain about their future. Many have changed their priorities and are assessing new directions [46]. Graduate students were also put in difficult situations, often finding themselves unable to complete their projects due to lab access constraints and funding shortages, consequently having to rethink their degree timelines. Post-docs and young researchers were the most vulnerable among the research cohort, as their career progression was put at stake [47, 48].

As labs had to be closed for some time and access was limited to carry out only critical activities such as maintaining cell lines and looking after animals, many scholars shifted their priorities to COVID-19-related research; all the while "non-essential" research has slowed down. A bibliometric analysis of the COVID-19 global research output showed that from December 2019 to March 2021, there were over 140,000

publications worldwide [49]. The Arab world's contribution during that period constituted only 4.26%, with mostly original journal articles and reviews related to: "public health and epidemiology; immunological and pharmaceutical research; signs, symptoms and clinical diagnosis; and virus detection". Saudi Arabia (35.65%) was in the top of the list followed by Egypt (20.78%) and the UAE (11.73%). When taking into consideration population size and GPD, Saudi Arabi, the UAE and Lebanon were placed in the lead. These publications were the result of collaborative work with mostly the United Sates and the United Kingdom [50].

The impact of the pandemic on academic research is without any doubt challenging. However the virus created a state of urgency and a matter of survival that catalyzed collaborations and accelerated the pace of research and innovation. The development of the COVID-19 vaccine is an example of unprecedented and fruitful international collaboration in scientific research, putting aside secrecy and personal agendas [51, 52]. Scholarly communication is an essential element in the process and much has changed during this pandemic. Preprints, such as the medRxiv and bioRxiv servers, saw a surge in submissions, facilitating the early sharing of information publicly. Many peer-reviewed journals and publishers also accelerated their submission-to-publication procedures and made coronavirus-related research openly available and free to read. Whether this improvement in efficiency will persist or not is unclear. Stefano Bertuzzi, chief executive of the American Society for Microbiology, thinks that "this is just the emergency situation that we're dealing with" [53]. It might be too early to predict what academic research will look like post-COVID-19. Nevertheless, research agendas will certainly be affected, and revenue generation will most likely be the main concern.

4.2 Medical and Nursing Education

The COVID-19 crisis has severely disrupted medical education and the lives of medical and nursing students. At the onset of the pandemic, lectures were moved online and clinical clerkships were halted based on recommendations from the Association of American Medical Colleges, measures that were adopted in many countries worldwide [54]. In order to protect patients and the healthcare workforce and limit the risk of transmission, many hospitals suspended regular clinical care in an attempt to minimize non-essential staffing and reduce the number of patients seeking non-COVID-19 related care. The shortage of protective personal equipment was also an additional obstacle preventing medical and nursing students from interacting with patients, fulfilling their required patient care hours, and practicing bedside medicine training. This contrasts with other disasters, such as earthquakes, fires, or other outbreaks, where students were able to be involved in emergency responses, while continuing their education [55, 56].

Pre-clinical students may not have been affected as much as their senior counterparts as their main educational activities were lecture-based and the virtual move was not a disadvantage, especially for the tech-savvy universities. However, an essential

element in a physician's learning and training journey is the development of communication skills and empathy with patients, further limiting the students' overall educational experience. Such changes and disruptions in medical education are large losses in learning opportunities. However, in some institutions, final year medical students have been put in the frontline in the fight against COVID-19; an issue that has been highly debated [56–58].

In order to keep students on track for graduation and enter the workforce, many schools around the world have developed strategies to help them finish their degrees such as introducing emergency waivers to reduce the number of required clinical hours for nursing students or showing flexibility using virtual simulations [59, 60]. This relaxation of requirements comes at a time where many countries have been suffering from overstretched healthcare systems and having to face a crisis-level shortage of medical and nursing staff.

In the Arab world, surveys were conducted in Saudi Arabia [61], Jordan [62], Egypt [63] and Libya [64] to assess the medical students' circumstances and the impact of the pandemic on their education, given that many countries in the region suffer from instability and a poor digital infrastructure, necessary for conducting virtual learning. Online learning also raised the issue of inequity in terms of access to devices and the internet. Another common issue was the readiness of the educators to embrace online learning, as the majority are considered "digital immigrants", often unwilling to adapt and not able to reap the benefits of technology. During the lockdown period, students had taken on different approaches to education. While some got accommodated to online learning, others relied on self-study, and some undertook research activities or participated in volunteering efforts part of the COVID-19 response [65]. Suggestions to encourage academic coaching were also made to enhance the communication between educators and students so they stay motivated. In fact, the pandemic has had severe psychological effects on students worldwide, with many suffering from anxiety and depression, which could eventually impact their career plans [66].

Although the pandemic was a source of uncertainty, disruption, and chaos for medical students, it has provided them with an opportunity to view firsthand medicine as a dynamic field. It demonstrated the qualities required from a twenty-first-century physician and the importance of cross-disciplinary interactions to solve complex issues in healthcare and respond rapidly and efficiently to threats. This crisis will surely change the way physicians are educated. "There may be no better time in history to learn what it means to be a physician" [67].

4.3 Pharmacy Education

The COVID-19 pandemic has challenged healthcare providers and workers as they had to stand in the frontline and fight a disease in an uncertain and unpredictable environment with little scientific evidence on its management. Pharmacists were no exception. They quickly had to respond and assume prominent roles in health

promotion by informing and enabling the public in an effort to control the outbreak, while putting their safety aside [68–70]. Pharmacists also saw their roles expanding during the pandemic and their responsibilities growing as pharmacies became sites for testing and vaccinations [71].

Such responsiveness requires a robust educational background and special sets of skills. In fact, curricular changes in the pharmacy program have been taking place since the 1960s, resulting in profound transformations, and making pharmacy a patient-centered career [71]. The COVID-19 pandemic has highlighted the important role of pharmacists in health crisis and management, and pharmacy education needs to keep evolving to further advance the role of pharmacists.

An analysis of the academic pharmacy's response during the pandemic [72] and surveys from Jordan [68] and Saudi Arabia [73] summarize the status of pharmacy education and the challenges faced during the pandemic, while reflecting on opportunities for improvement. The suspension of on-site laboratory teaching and experiential training were a major challenge although virtual alternatives were provided. Nonetheless, the pandemic has surely provided a learning opportunity for pharmacy faculty, staff and students, highlighting the important role of pharmacists in the management of pandemic and health crises, as well giving them a drive for becoming agents of change [74].

4.4 Engineering Education and Skills

Engineering education, a usually hands-on, content-centered and design-oriented type of education, is a challenging domain when having to face the pandemic-induced social distancing measures. These are more or less similar to the challenges described in the previous sections and mostly related to online delivery and technological obstacles such as poor internet connection, absence of software licenses, lack of devices, or even space in the house, in addition to exhaustion and lack of focus during virtual sessions. Educators also had their own challenges, many being unprepared for online class delivery, digitally incompetent and having difficulty adapting the syllabus for online and hybrid teaching. They often had to resort to sharing handwritten notes and virtual videos of labs with their students [75, 76].

Several projects and initiatives were undertaken during the pandemic to serve the global health efforts in the fight against the virus. For example, the Department of Electrical and Computer Engineering's high voltage lab at Mississippi State University in the United States quickly converted battery-operated ventilators, originally designed for temporary and emergency responses, to AC power so that they can be used for longer periods of time [77]. Another example is an interactive map by the Johns Hopkins Center for Systems Science and Engineering to track the spread of the virus in real-time [78]. From the Arab world, the American University of Beirut developed "Ma3an—Together Against Corona", a contact tracing and exposure notification mobile app for Lebanon, a partnership between the university's Humanitarian

Engineering Initiative and the Ministry of Public Health [79]. The American University of Beirut also launched a series of projects and initiatives for the development of medical and personal equipment involving collaborations between the faculties engineering and medicine, such as designing a self-disinfecting robot for hospital use, developing environmentally friendly biodegradable masks as alternatives to the N95 mask, among others [80]. In Tunisia, a team of engineering students from the Sousse National School of Engineering developed 3D-printed protected masks, a project that was officially supported by the President of the republic [81].

Clearly COVID-19 has put educators and students out of their comfort zones, forcing them to think what learning should be about and to embrace change.

4.5 Business Education

Business schools had to ensure instructional continuity during the pandemic through emergency remote teaching as in other fields. Business as usual. However business education has long been questioned regarding its lack of relevance, public value and general impact on society [82, 83]. The COVID-19 pandemic has re-ignited this long debate, creating a pressing need to re-think in the long-run the purpose and meaning of the business school in order to secure its future to fit in a business world that is changing faster than ever [84].

The missions of business schools have been centered around the understanding of management and the preparation and training of men and women to become leaders that are mainly oriented towards the pursuit of profit or profit maximization in a competitive environment where the strongest survives. Instead of producing graduates that look at the needs of the wider society, we have "unethical graduates" that lack moral reasoning [85]. However, the post-COVID-19 world will be different than the one we know. The nature of the workplace is changing, which will demand not only a new set of skills and services but also new insights and perspectives. Business schools have already started overhauling their curricula and reshaping educational services and programs that would be relevant to the student's needs and closer to the changing reality. For instance, shortly after the early months of the pandemic, business schools started introducing courses and workshops on leadership in a time of crisis [86, 87], and saw the resurgence of financial technology (Fintech) programs, which is "the design and delivery of financial products and services using disruptive technologies in order to reduce cost, improve efficiency and provide better personalized service" [88]. The meaning of the MBA is also changing; once a "must have" despite soaring costs and having to leave the workforce for two years for a full time degree, it is no longer considered a high return on investment [83, 89]. As the lure of the business school with a huge reliance on international students, COVID-19 has significantly impacted the MBA's cash cow status, forcing business schools to reconsider their business model.

COVID-19 has also accelerated the change in admission requirements. For instance, early during the pandemic, undergraduate business programs made the SAT or ACT scores optional and the GMAT was waived for graduate programs [90].

However, will this adaptation period be enough for the needed transformation of the business school?

4.6 Legal Education

The typical traditionalist law school had no choice but to adapt to the COVID-19-imposed remote learning methodologies. Law schools have been long facing criticism related to their business model and pedagogy, creating graduates drowning in debts due to the ever-escalating costs of their studies.

Looking at the job market, COVID-19 has created a "boom" for the law industry despite a plunging economy. In fact, the pandemic has highlighted the complexity and vulnerability of a rapidly changing business world. Lawyers will be needed more than ever to protect and promote the rule of law [91, 92].

A re-imagined legal education will consist of training students "to think like a lawyer" not only in the traditional sense of learning legal basics and thinking critically, but also learning soft skills such as emotional intelligence, collaboration, and communication abilities in addition to competencies required by legal professionals in the post-COVID-19 era. Referred to as augmented skills, these include project management, data analytics, crisis management, and the use of technology in legal delivery, to name a few [91, 93]. The law degree will no longer be the end goal but rather the start of the legal learning process.

4.7 Arts and Design (Creative Disciplines)

Online learning proved to be successful in various disciplines. However in the case of creative education such as graphic design, architecture and fashion, it raises question marks. A blended or hybrid approach has mainly been adopted in institutions around world and consists of a combination of both online and face-to-face teaching [94]. To mitigate some of the limitations of online learning in the arts, Adobe provided free access to many of its applications during the pandemic, which are usually used during design classes on campus [95]. Several companies have also come up with resources for teachers and students, in an effort to enhance their learning experience [96]. However with limited access to design studios, students found themselves missing out on a special kind of learning experience, one that embraces the interaction and intimacy that develops between students and faculty, encouraging the exchange of thoughts and ideas. To overcome this, educators have had to resort to making time for digital feedback. But it is not enough, and something is lost in the process. Online

teaching in arts requires a lot more work than in-person teaching and a lot of flexibility from all parts.

4.8 Adult Education

Adult education, also referred to as continuing education, is an educational activity undertaken by adults beyond traditional schooling. It recognizes education as a life-long process that shall "enable all persons to participate effectively in a free society" [97]. Adult education comprises diverse modes of study to fill various purposes such as: (1) advancing vocational and professional skills; this is the most common type and aims at preparing adults for the job market, improving skills required for a profession, and adapt to a changing workplace; (2) promoting personal development and contributing to self-fulfillment and leisure, which is mostly learning for the sake of learning; (3) acquiring literacy and numeracy skills as well as remedying neglected primary or secondary education; and (4) participating fully in democratic and civic processes. Adult learning is essential to reduce social inequalities related, but not limited to gender, social status, disability, and race.

However adult education is inadequately funded, and even underfunded, as very few governments have been dedicating the recommended 3% of their educational budget [98]. According to the Fourth Global Report on Adult Learning and Education, the major focus of adult learning goes to the workplace and serving economic needs [99]. Often it is the employed, often high-waged staff that benefit the most from this type of education, leading to a Matthew effect, where the rich get richer and the poor get poorer [100]. In fact, cost of participation is the main barrier for accessing adult education, putting vulnerable and underprivileged members in the society such as women, refugees, and adults with low literacy, at a major disadvantage, and even more marginalized, further widening inequalities.

While governments and education authorities have taken measures to respond to the educational emergency triggered by the pandemic and ensure the continuity of education, adult learning was more or less neglected. Besides, adult learners had to face many barriers. As online learning was the most suitable way to resume education in schools and universities, many adult education programs lack the technological resources and rely on face-to-face teaching, plus adult learners often suffer from poor digital literacy skills, suddenly finding themselves having to upskill their digital capabilities, adding more to their stress and anxiety. Many of these learners also lost their jobs during the pandemic or were given pay cuts, and so had to prioritize earning over learning.

It was estimated that 773 million adults lacked basic literacy skills before the pandemic, a number that will most likely increase in the near future. With a global economy in its worst recession since World War II, this crisis is forcing education providers to re-think how adult learning opportunities are provided, focusing on the development of new skills for a changing market. Aside from the vocational aspect, there is also a need to look into the other purposes of adult learning, such as "basic

health and citizenship education to safeguard a future society that is sustainable and cohesive" [101]. In a report prepared by the UNESCO Institute for Lifelong Learning, different programs and best practices from different countries are presented as examples of promising approaches for adult learning education for the post-COVID-19 period [101]. Among the countries represented are Algeria and Egypt from the Arab region, showcasing programs on the empowerment women and young community members from disadvantaged areas respectively, while highlighting the importance of building strong partnerships for the delivery of initiatives.

5 Beyond the Pandemic: The Challenges of Recovery

Faced with exceptional challenges, higher education institutions had to be proactive in confronting the COVID-19-induced change. They proved to be responsive and responsible. Leaders showed speed and agility in decision-making, educators changed their delivery methods, and students adapted to digital learning. However, there is no doubt we are facing an era of uncertainty and unprecedented complexity. Even before the pandemic, questions around the value, the relevance, and the need of higher education were arising, as students seemed unprepared for the job market. In other words, the higher education sector seemed disconnected from the real world. Now is the time for higher education institutions to re-think their operating models, their purpose, and their mission if they want to survive and create a sustainable model. "When a wave of challenges hit, speed gives more control over destiny and agility increases your options. It is important to take advantage of the opportunities that arise" [102].

5.1 The Student Pool

The recruitment of prospect students and the retention of current ones was a major challenge during the first few months of the pandemic in 2020. Although domestic student recruitment has not been majorly affected, it is the international students that posed a problem, especially that universities rely on them in their operating models.

The ability to connect and communicate with students, current and prospective, has never been more important. Higher education institutions have been working hard on setting-up communication and marketing strategies for the recruitment of students. With open-days on hold and in-person interactions with an institution's community being still very limited, they had to develop and expand their digital outreach. The institutions' response and operations during these challenging times may have also impacted current students, leaving them concerned about their study plans and future. Higher education institutions will have to face competition not only among each other, based on their responsiveness to challenging situations and the treatment given to their community, but also with online-only providers, which have been recently

put in the spotlight. Besides, these institutions need to take into consideration that the pandemic may have changed the students' attitudes and perspectives towards education in general, their developmental needs and eventually their perception on the importance of the degree. Now more than ever, the higher education sector has to face issues of affordability, relevance and equity in education, issues that have long been sidelined. They have to keep up with the student's changing expectations and they have to differentiate themselves from an increasingly diverse and attractive pool of education providers. For this, it is important to look at the students' perspective and provide answers to where, how and why they want to learn.

5.2 The Academic Programs

While the world is planning to return to some kind of "pre-COVID normal", there is no going back for higher education institutions. Uncertainty around student enrollments and the decline in public funding, re-assessing the portfolio of courses seems like the next obvious step in order to manage balance sheets and ensure financial sustainability in the long run. This involves redefining the value proposition of the institution, reviewing academic programs by assessing those that are essential to its mission, and reconsidering those that are non-essential from the student's standpoint. For so long, higher education institutions have been designing curricula and pedagogies around the interest of departments, away from the students' expectations and needs, and many are considered impractical and disengaging. This would entail closing certain programs as well as investing in new ones to attract an ever-more conscious and diverse pool of students.

There is also a need to determine the appropriate balance between face-to-face and online teaching. While tuitions from the first type usually cover fixed administrative, faculty and estate costs, the latter will not necessarily be enough. Moreover, there is general apprehension towards paying for online classes, even doubting if it is worth it [103]. Just like a digital book costs less compared to the physical version, students expect to pay less for online course offerings.

Implementing blended learning programs should not affect the quality of education and the reputation of the institution. However, while online programs can fulfill a course learning outcomes, certain skills such as promoting problem-solving, encouraging critical thinking, enhancing social skills, and even motivating and inspiring students cannot easily be attained online. Delivery models should be responsive and innovative. And academic programs should aim at closing the gap between learning and the real world by embracing "learning by doing" and engaging students in real life experiences to develop knowledge and skills through collaborations, internships, or other hands-on experiences as part of the learning cycle. This is where experiential learning comes into play. And this is at risk today. The process of learning through experience has significant advantages such as actively involving the learner

in the learning process, encouraging reflection and analysis, and improving decision-making effectiveness and problem-solving skills. It is and must remain a crucial part in the evolution of education [104].

5.3 The Real Estate

The rise of online learning, accompanied by flexible working models and arrangements, has impacted the demand on estate and campus footprint, causing higher education institutions to re-visit their space management strategies. Over recent years, there has been a drive to expand campus construction and build new facilities to attract prospective students. This "academic building boom" was often described as irrational [105, 106]. Today, re-purposing the higher education estate is on the agenda of policymakers and leaders. For example, it is projected that personal office space used by academic and administrative staff, which typically consists of over a third of the institution's property, will be altered and even reduced. The emphasis will shift to investing in the digital IT infrastructure and digital learning environments as well as providing communal areas for the students' learning and recreational use and lecture theaters, in an effort to overcome the challenges of providing socially-distanced teaching space [106]. In other words, "COVID-19 has underscored the burden of physical campus infrastructure and the need for technical infrastructure improvements" [107].

The COVID-19 crisis has surely put to the test the financial resilience and strength of higher education institutions. Depending on each institution's type and circumstances, re-structuring will be essential in order to survive for some or expand for others. It is important to recognize the benefits of collaboration and the timely potential for merger and acquisitions. "While higher education has stood the test of a thousand years, many individual schools will simply not survive the next five" [108].

5.4 The Academic Jobs

Technology-supported work flexibility and outsourcing are new major employment trends in the labor market, which have seemingly started to impact the higher education staff. Higher education institutions have long been advocates of fixed staffing costs, as exemplified by a tenure-track faculty workforce. However, the COVID-19 pandemic has changed the operating dynamics of these institutions by accelerating the financial strain. Budget cuts, hiring freezes, layoffs were all common topics, making higher education employment not as desirable and secure as it used to be. The young, non-tenured, and part-time professors are of course the ones hit the most, having to suffer furloughs and layoffs. Virtual learning was also a challenge many older tenured professors had to face, whereas tenure-track professors found themselves in career limbo and an uncertain future. In addition, the loss of job opportunities

in academe is driving graduates and PhDs to seek non-academic careers. However is the grass really greener on the other side? [109]. According to a survey by The Chronicles of Higher Education in the United States, over half of faculty of all ranks consider leaving teaching by changing their careers or retiring [110] and experts are warning of a "coming exodus of academics" [111].

Moreover, outsourcing services usually provided in-house instead of hiring permanent staff for these jobs have been on the rise, allowing the institution not only to increase efficiency but also to control costs, save money on job security, compensation and benefits [112]. Such services can include core activities (certain administrative functions, cleaning, and security) as well as non-core functions (housing, bookstores, and dining facilities). This kind of arrangements needs robust partnerships and does not come without its own challenges and disadvantages, including but not limited to loss of managerial control, reputational risk due to inefficiencies by the provider and quality issues, lack of flexibility, instability and hidden costs.

6 Future Trends and Possibilities

The COVID-19 pandemic has accelerated the transformation of education. The phase of global experimentation with virtual learning has changed the learning experience and the higher education sector can start looking now beyond immediate demands. While it is still difficult to predict what the higher education landscape will look like once the COVID-19 threat has dissipated, it has undoubtedly instilled a new mindset and methodologies.

"In 1665, Cambridge University closed because of the plague. Isaac Newton decided to work from home. He discovered calculus and the laws of motion. Just saying.", said Paddy Cosgrave, chief executive of Web Summit.

6.1 A New Perspective on Twenty-First Century Skills and Learning Methodologies

COVID-19 has transformed the way we live and work and consequently highlighted the skills and key competencies that are needed for the student's development. Communication, collaboration, critical thinking creativity, agility and ability to solve complex problems are key components of twenty-first century skills [113]. Educators have to play an important role in developing and promoting these skills to produce graduates who can thrive and succeed in these changing times and difficult circumstances. This requires a shift in instructional approaches, assessment methods and training; a shift from a mostly "lecture-based learning" approach to "problem-based learning", centered around the belief that students learn through active collaboration and interaction with others [114].

Digital literacy and information and communications technology (ICT) skills have also drawn major attention as a core element of twenty-first century skills. The digital transformation of education however is not a new phenomenon. It is COVID-19 that induced a "paradigm shift" for higher education institutions and hastened virtual teaching and remote working [115]. This global pandemic has also put the spotlight again on Massive online open classes (MOOCs), a term coined in 2008 for open-access online course providers, available to anyone with internet connection, anywhere in the world. Back then, George Siemens and Stephen Downes decided to experiment the concept of connectivism by teaching a course called "Connectivism and Connective Knowledge" to a small cohort of traditional students at the University of Manitoba in Canada, while providing open access to anyone who wished to attend online. The 25 students at the university were joined by 2200 people from around the world. The purpose of MOOCs was to "democratize higher education" by providing affordable or free education accessible to anyone [116]. MOOCs were mainly attractive to learners seeking professional advancement to close a skills gap not provided by traditional education in a rapidly evolving marketplace as well as for those looking for personal growth. After a successful start, by 2015 academics thought MOOCs were "almost dead" [117]. Five years later, they were booming: enrolments at the online platform Coursera was up 640% compared to the year before and Udemy saw a surge of 400% between February and March 2020 [116].

Digital education requires appropriate and robust technological infrastructures and platforms to support virtual teaching and learning. This was accompanied by a surge in the use and types of learning management systems (Blackboard, Moodle, Edmodo, Microsoft teams) and software applications (Zoom, Skype, Google Hangouts, Google Meet, Cisco WebEx, GoToMeeting, Loom, OBS) to facilitate the management and delivery of online courses.

Now that technology advances are progressing exponentially, focus is switching to methodologies for generating dynamic, proactive and collaborative sessions. To improve the learning experience through the use of educational technology, various methodologies resurfaced such as the "flipped classroom" pedagogical model, which is a blended learning model whereby students use technology resources to prepare for their classes in advance and use the actual session for fruitful interactions among each other and the educator in order to promote deeper understanding and knowledge of the subject.

However, technologies are still widely criticized for separating the learner from the educator and creating a weak sense of community. This debate is as old as the beginning of civilization. Socrates was a strong advocate of face-to-face interactions and was critical of using writing to transmit knowledge. Nonetheless, he hadn't thought that the written word or books, the hot technology of the time, would provide a richer learning experience [118]. In today's world, the fear of digital education is well-founded, however it is no longer a matter of whether we should use technology or not, but rather how to use it and how to create a sense of community.

6.2 *Innovations in Teaching Technologies from the Arab World*

The inconveniences and negative effects caused by the COVID-19 pandemic were also sources of opportunities, inspiration, and innovation. The pandemic has triggered the capacity of people to come together and created an innovation ecosystem. In these challenging times, a myriad of initiatives in the delivery of education emerged around the world. This section sheds the light on some of the technological innovations from various Arab countries, addressing structural weaknesses in the education sector in the region.

The rise of online platforms hosting digital learning resources has been remarkable in the Arab region, whether it is granting access to educational content or providing online courses. In Morocco, the MOOC platform Maroc Université Numérique (MUN) uploaded digital educational resources from various universities of Morocco to serve university students [119].

The Skilling Up Mashreq (SUM) initiative, which was launched in Amman, Jordan in 2019 during the Digital Mashreq Forum is part of the World Bank's commitment to prepare young women and men from the Mashreq region (Lebanon, Jordan, and Iraq) for the digital workspace by addressing the digital skills gap. SUM serves as a platform to boost initiatives in digital skills training through collaborations between the government, private sector and universities. It also aims at attracting digital technology players to invest in the region. So far, this initiative has established partnerships with major international and regional players. For example, in Jordan, the partnership between Edraak—an MOOC platform established by the Queen Rania Foundation—and Code.org—an international nonprofit organization that aims to encourage people to learn computer science, especially students from underrepresented groups—resulted in the localization of computer science education resources. This included t. In Lebanon, Code.org partnered with the Beirut Digital District—a hub for the digital and creative industries—in April 2020 under SUM's World Bank umbrella, to provide free online Arabic coding lessons. Another SUM initiative stems from the collaboration with Microsoft, LinkedIn and GitHub, and aims to offer free digital skills courses and certifications to young people in partnership with the Beirut Digital District in Lebanon and Injaz in Jordan—a non-profit organization in Jordan which aims at providing vocational training and skills to young people [120].

The UAE's largest applied higher education institution, Higher Colleges of Technology (HCT), led the digital transformation of education as soon as classes were suspended at the beginning of the pandemic by launching first a two-day virtual learning pilot program to test its digital infrastructure in delivering its curriculum fully online at the regularly scheduled times. The online platforms were set up in partnership with Etisalat, Zoom and Blackboard. HCT then sought to establish a service-on-demand "uber-like" virtual classroom model, which then evolved into DIGI Campus, an online learning platform that aims at keeping students engaged and providing them with virtual off-campus activities such as E-counselling, life

skills, E-sports and health activities, an E-reading space with book review sessions, and E-volunteering [121].

In Bahrain, the Ministry of Education and the Bahrain Information and eGovernment Authority were also quick to set up an electronic online portal for students, in collaboration with Amazon Web Services, completed with an additional online service using Microsoft Teams and Office 365 programs that connects students to teachers and a specialized support staff [122].

Educational television was another solution used in Arab countries to overcome the obstacles of remote learning, especially with regards to internet penetration challenges. In Morocco for example, the state television broadcasted live sessions and educational material across the nation, in partnership with the Ministry of National Education, Vocational Training, Higher Education and Scientific Research [123].

7 Conclusion

COVID-19 is a virus that has turned into a pandemic. It is a virus that has brought our lives and the world as we know it to a halt, taking us out of our comfort zones, causing a rupture with the past, and forcing us to think about the future. Epidemiologists and health risk analysists have repeatedly warned of coming pandemics with huge social and economic impacts. It was no longer a matter of if but rather when. The world was warned, and the world was unprepared. Now that vaccinations are underway to achieve herd immunity and limit the spread of the virus, a sense of normality is gradually being restored and populations around the world are embracing the pre-COVID-19 status quo. With systemic risks likely to increase in the future, has this pandemic taught us a lesson in setting global public health policy, the importance of international collaborations, and realizing the need for the adoption of the Sustainable Development Goals and the Paris Agreement. COVID-19 could be a once-in-a-generation opportunity.

However, will we ever learn from our mistakes? Will the voices of experts be ever heard? Form history and experience, it seems we learned nothing. German philosopher Georg Hegel once famously said: “The only thing that we learn from history is that we learn nothing?”. Will this time be any different?

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Do Disruptive Events Favor the Bold or the Old?

Graham Galbraith

Lessons from the pandemic that can give universities in the Arab World a competitive advantage in a rapidly changing region.

Abstract Disruptive events can bring about significant change and, if we can put aside the terrible human consequences of the COVID-19 pandemic, and focus on higher education, we can without doubt state that the sector globally has navigated one of the most disruptive periods, quite possibly, ever. Unlike other historical major disruptions that have often revolved around the substance of what universities teach, the pandemic has challenged conventional models of how higher education operates. Universities have had to pivot rapidly to adopt new technologies supporting novel approaches to pedagogy. It is quite remarkable that many have done this successfully, achieving what would previously have been thought impossible or something that could only happen with a great deal of preparation and time for implementation. As we emerge from this experience the key questions now are (i) which of the changes we have experienced will be permanent? and, (ii) which universities will act first to realize the benefits of these changes? Will it be the old universities—those with prestige, and with a greater weight of tradition—or the bold—the agile institutions, less hidebound by their past, and more prepared to change? Other changes—in particular the demographic transition and the fourth industrial revolution—emphasize the need for higher education to prepare for and embrace change. This paper shows that the next few years will offer significant opportunities for higher education institutions in the Arab world to challenge the existing global hierarchy of universities through offering new and innovative approaches to learning that challenge the old ways. The universities that realize this and embrace change could reap huge benefits. Those that don't will face risks and an uncertain future.

Keywords Covid-19 · Higher education · Education technology · Democratic transition · Student experience

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1 Introduction

The COVID-19 pandemic has been the biggest global crisis of my lifetime and the largest peace-time crisis many countries have ever experienced. One cannot think of it without reflecting on the appalling loss of life, livelihood, and psychological dislocation that it has imposed on people in every part of the world. But, if we can also learn from the experiences of the last two years, we should. In this essay, I explain how I think universities can learn and what they can learn.

Crises tend to increase the speed of change that is already underway and, in the pandemic's case, in forcing universities to deliver education virtually, the last two years have given universities an insight into what our future might be like, the problems we must address, and how technology can and cannot enhance students' educational experience. In an important sense, it has been a rehearsal for the changes the twenty-first century will increasingly bring. Universities, particularly those in the Arab region—most of whom cannot rely on history or prestige for future success—must remember and learn these lessons and resist the strong temptation to return as quickly as possible to how we operated before 2020.

In this paper I argue that the key lessons to learn are that we should expect the formal aspects of learning to be delivered increasingly online and virtually, through the increased support of education technology. We should expect the informal parts of learning—those that occur outside the classroom—to be far harder to deliver virtually, at least while maintaining quality. High-quality pastoral and wellbeing support for students will also continue to be delivered in person.

The universities that learn these lessons and act on them boldly and with agility will have a competitive advantage over other universities, particularly the elite, traditional universities in meeting the challenges that the twenty-first century will bring. These challenges include the fourth industrial revolution and the demographic transition (as more people want and need more education) that many parts of the world, particularly the Arab region, will experience.

I proceed as follows. In Sects. 2–4, I explain what my institution learned in the pandemic, and what conclusions can be drawn from this about which parts of the student academic experience are better-suited to virtual delivery. In Sects. 5–7, I articulate the significance of this for universities, particularly most universities in the Arab region, which find themselves outside the traditional global elite of universities. Then in the conclusion, I turn more specifically to list some of the issues on which universities in the Arab region should focus on now, and the questions they must ask if they are to take advantage of the insights that the last two years have accidentally offered us all.

2 The Pandemic

The pandemic hit different parts of the world at different times but when it hit, we all experienced the same juddering realization that we were entering a new way of living for an indefinite period. Much of normal life stopped or was radically altered but—rightly—there was a determination that education should continue as best it could.

It is hard to remember the chaos and uncertainty that accompanied the first full lockdown which, in the UK's case, was March 2020. It was a period fraught with uncertainty, in which everything changed overnight, and we had little experience to rely on. I remember saying to colleagues that we would see each other back in the office in a month or two. Little did I know that only in February 2022 would COVID-restrictions be lifted in England, and that by that point, globally, 5.9 million people would have died [1].

We must use the last two years as a way to learn and improve. Two things I learned from the pandemic demonstrate this. First, I noticed that within my own institution the pandemic exposed problems we knew already existed. Crises do this. They stress-test individuals, organizations, and states. If there are latent problems, they will be exposed. Second, the pandemic sped up the pace of change latent in the English university sector. Since the English higher education sector has been 'marketized' some parts of the sector have benefited more than others and, in some cases, at the expense of others. With the pandemic leading to the cancellation of school exams, novel approaches to school assessment were necessary. As a result, universities had a less reliable guide to the grades students were likely to obtain (In England, universities routinely make offers to students before they have their examination results). All of this led to slightly chaotic and uncertain admissions processes. As a result, some universities whose long-term trend was successful expansion, recruited far more students than they expected in any one year. In some cases, this led them to offer students five figure sums to defer their entry. This states the point I am making: these universities were saying to some students 'we want you but didn't expect you this soon—can you wait?'.

Speeding up the pace of latent change is fairly typical of crises too. The second world war (1939–45) hastened the changing role of Britain as a global power. Britain's influence was reset, and international politics became dominated by the USA and the Soviet Union until the latter's dissolution in 1991. But Britain's global role was already changing. Nothing could have altered that course of history. The second world war simply sped things up.

The pandemic brought the future closer and gave us some insight into what it will look like. What did we learn and how can we—both institutions in the UK and the Arab region—use this in the future?

3 Lessons from the Pandemic

The pandemic had a devastating effect on education. To illustrate the scale of the issue, during the peak of school closures (April 2020), 1.6 billion learners worldwide were affected; this is more than 90% of total learners [2]. I will come back to the longer-term significance of this below when I discuss the future. For now, I want to focus on what my institution learned and then turn to make some general points.

One of my first reactions was to marvel at how quickly we could change to keep things going day-to-day while we worked out what we might have to do longer-term. People sat in a home office or in any space they could find and joined virtual meetings of 20 plus people and hammered out vital issues. How do we change examination regulations? How do we replace face-to-face engagement with meaningful teaching? And so on.

There are two general points of significance here: culture and infrastructure. The need to keep things going destroyed any cultural resistance most people had felt to working virtually. It seems bizarre now but before the pandemic vital meetings could be delayed for weeks and sometimes months because key people could not be in the same place at the same time. This was hopelessly inefficient, delayed important decisions, and only happened because of assumptions about how things must work.

The second point is that we could move online so quickly because the infrastructure existed and most of it was embedded in the way our institution worked (even if, for the cultural reasons just explained, we hadn't quite noticed this). To put the point more directly: imagine if the pandemic had happened in 2000, before so much education technology? It would have been impossible to carry on. Not all universities across the world, and in the Arab region, are at the same point in embracing and benefiting from education technology as are universities in the UK, but the general point remains. While culture is important, so is the supporting infrastructure; it must exist. Still, I think over time culture will be a more significant factor. If cultural norms within universities mean that people don't notice the benefits of technology, they will not use the infrastructure no matter how good it might be.

There is a connected point best considered through a question. If institutions like mine can be culturally averse to embracing technology, why did the infrastructure exist in such advanced form when we needed it? First, and prosaically, because my point about culture is a generalization and so admits exceptions. Second, and connected, universities are not top-down hierarchical organizations in the way that most private businesses are—which is why people moving from conventional businesses to the university sector can be so disoriented. The separate units, faculties, departments etc. within universities have a reasonable degree of autonomy. Non-hierarchical organizations with reasonable degrees of internal autonomy create the ideal conditions for experimentation. Universities are full of individuals—'mavericks', trailblazers, call them what you will—who operate outside the mainstream norm. In the pandemic, we found these people invaluable and turned to them increasingly when we needed them most. As we, for example, wrestled with questions about how to preserve high-quality assessment online or virtually, someone would pipe up

'I have been doing this for X years, let me explain how'. The conclusion is that universities need to ensure we don't accidentally squash the space in which people can experiment with new ideas, even when it is unclear whether any of those ideas will ever be used. We will need such people more in the future—a point to which I will return.

As my institution got used to the new normal mode of working, other issues emerged. Traditional large group teaching was impossible but, on the whole, was not missed. This kind of teaching—in which content is delivered usually for around one hour and one way to a largely passive audience—is not necessarily the best approach. Well-designed shorter 'lectures' recorded once and consumed by students at any time can be far more beneficial. A second point is that once lectures are reconceived online in this way, there is no requirement that the lecturer be in one particular part of the world or even be employed by the institution to which the students belong. This is a key point for any institutions who lack the resources to recruit world-class academics or who find it hard to attract world-class academics for other reasons. As Prof. Souvik Bhattacharyya, Vice-Chancellor of Birla Institute of Technology and Science, Pilani, India recently put it:

> If you ask someone from Sloan School or Kellogg to spend seven days in India, it could be very difficult. They cannot afford that sort of time. But now, if you ask them 'could you have two hours per day, three days a week?', it is a reality and people are doing it. [3]

At the other end of the spectrum, small group teaching and seminars, which are far more interactive than the traditional lecture, are sometimes difficult to replicate on-line. The key inference for me is that virtual education can work less well where group dynamics play an important role in learning. Of course, some group dynamics can be negative and inhibit collective discussion and learning, so the picture is far from clear. It is also very much subject dependent—as well as being related to the maturity and expectations of the learner. This final point is important. Over the coming decades as the need for people to retrain, reskill etc. through their working lives becomes more important, we should expect to work with and support a greater diversity of learners.

One area that you would expect real problems is in practical education. Nursing, dentistry, medicine, engineering, and so on. But even here, the barriers are not as pronounced as one might expect. Universities are increasingly using virtual resources. The University of Portsmouth has a virtual cadaver for our nursing students and, like others, we are using more virtual reality to support learning. Two caveats are important. The infrastructure to support these kinds of things is less well-advanced than other educational technology infrastructure and it is expensive, at least at the moment, so one should not push this point too far. More generally, one should be careful not to dismiss some of the practical problems that have arisen in the last two years. For example, research on how educationalists experienced the pandemic in the United Arab Emirates found that:

> The four main challenges reported were those of: pedagogy and unsuitable course design for online education; student engagement; monitoring of online exams; and the unsuitability of online education for practice-based subjects. [4]

These are significant practical problems but, over time, the infrastructure to address these problems will improve. The last two years have given universities an insight and a confidence about how they might get better at addressing these problems. The general conclusion—that we found it was less difficult than we might have thought to virtualize the academic side of the student experience—remains valid.

The other big lesson from the last two years is that the academic side of the student experience is only one part of the whole. We did experience many issues and problems. These fell into two categories. The parts of the student experience that happen outside the formal learning settings—sports societies, friendship development, being thrown together in a new place with new people—and the people bit. To put the second point another way: one can virtualize relatively well a lot of the formal learning parts of university life, but that leaves the learner isolated. How they feel, think, and engage is a critical part of learning, with active peer interaction important. A brilliant online lecture from a world-leading academic will have very little value if a student is depressed, demotivated or distracted—or just not switching on.

This leads to the important question around the kinds of experience students want from their learning and it is clear that we can no longer make assumptions even for groups of learners, as needs and expectations do vary. A full-time learner on a degree program straight from school may want and value face-to-face interaction much more than a mature learner who is learning part-time, where learning at times that suit them is more important. It is also the case that for less mature learners, the discipline of attending a lecture and being present in the room is part of the learning experience. However, even within such broad groups of individuals there will be differences, and this poses a very significant question around learner choice and how this can be efficiently accommodated at the kinds of scale that mass higher education systems entail.

The way I understand these points is that universities are places of education *for humans* and humans are complex creatures, and complex in different ways. Attempts to educate them in ways that ignore this will fail. A small example illustrates this point. The pandemic meant that universities had to adapt our examination and assessment regulations. Apart from anything else, there would be no in-person examinations. Like other universities, Portsmouth made changes quickly, and we did this well and told our students what we had done. We aimed to reassure, but we failed. We communicated the changes we had made in dry, technical, and bureaucratic language to a group of young people who were deeply worried, anxious, and whose life had just changed completely. We just confused them, exacerbating their existing worries.

This is just a single illustration of a much bigger problem. Some students lost friends and family during the pandemic; others had to study in their bedrooms, sometimes in small houses with similar aged siblings crowding around them; others were just lonely; and all had to go through a deeply disorienting experience at a relatively young age. In the chaos of the pandemic, universities were operating at speed doing things many had never done before. When this sort of thing happens, it is very difficult to keep a sufficient handle on how things can feel for everyone

affected, and how they can feel for different people in light of their very different circumstances.

Thankfully, most of the future will not be like the past two years (although we would be unwise to think that another pandemic will not happen in our lifetimes) but two points stand. First, students are complex human learners and, second, while the pandemic will end—and hopefully soon—its effects will be felt by all young people for some considerable time. As I noted above, up to 90% of learners have been affected and estimates suggest that the typical learner will have lost about 1/3 of a school year due to the pandemic [2]. These learners will be reaching higher education age at any point over the next 15 years, and with the increasing need for postgraduate and lifelong education and learning, they could be in the education system in one form or another for the next 30–40 years.

It is also worth noting that learning loss is only one part of the general effects the pandemic will have. As we emerge from home working in the UK, many adults are having to relearn the benefits of unstructured social interaction in the workplace. How much more significant might such effects be in younger people for whom the last two years have been a far greater part of their whole lives?

4 The Conclusions We Can Draw from This

Education technology has been integrated into university and school learning for a considerable period of time and we have known that, in the future, this will happen more and more. However, a cultural conservatism within universities, as well as the fact that young people have not been noticeably clamoring for change in how they consume learning has made the university sector slow adopters of new ways of providing learning. The clinching argument is usually based on how best to use increasingly scarce resources. Universities have also been reticent because it is often not clear which parts of the university student experience can be replaced or improved by education technology and virtual learning. Extravagant claims have been made in the past about how, for example, a technology 'avalanche' is coming for which we need to prepare [5]. You cannot really engage constructively with an avalanche. You can only get out of the way.

However, the last two years have forced universities to adopt education technology at scale and at speed. It has not been ideal, mistakes have been made, but I have argued that the two lessons we can learn about the future is that online and virtual learning can do extremely well in supporting and replacing a lot of the formal learning elements of university education, but far less well in supporting and replacing both the extra-curricular activities students need and want, and the support needed for individuals in their different circumstances.

This suggests the future for individual universities will be more about creating and providing their own blend and mix of learning to create their own unique student experience, with flexibility to address more directly individual student needs. This may also mean using much more content provided by and even managed by others. This

might be done by a smaller number of specialists and world-leading experts (some of whom might not be part of the university sector at all). The future for universities might well be far more about what happens beyond the classroom, and providing tailored pastoral and wellbeing support for learners and a learning environment that facilitates the engagement of students. Different learners—school leavers, mature learners, those reskilling in short courses—will need different kinds of support. And learners might choose one university over another on the basis of this kind of support, not simply what subject they are studying, but based on their expectations for the whole learning experience.

A recent report suggested that

> Universities will need to focus on student engagement and building a lifelong relationship with their students, understanding their needs and adapting accordingly. Their role as a career advisor and a guide through all the available learning options will become increasingly important [3]

and that

> in 2030, a talented postgraduate engineering student in Luanda (Angola) could access the best, leading-edge teaching from the recognized leader in her field, without having to leave her hometown. Her self-accessed, remote learning is supplemented with occasional trips to her local campus for instructor-led, synchronous teaching, delivered via high-speed video link from her professor in the US, or to use the campus laboratories for group work and practical experiments [3]

Claims like this have been made on-and-off for several years. The difference now is that the last two years have given universities direct experience of how and why these things might come to pass (even if 2030 might be a bit optimistic). Universities in the Arab region—indeed universities around the world—need to learn this, particularly given the challenges and changes to come.

5 Why This Matters

Radical innovation in how education is delivered and consumed is expected over the twenty-first century. The lessons from other sectors are that incumbents tend not to be good at radical innovation "which involves methods and materials that are novel to incumbents" [6]. Instead, incumbents are good at, and prefer, "incremental technological innovation" which builds "upon the established knowledge base used by incumbent firms, and it steadily improves the methods or materials used to achieve the firms' objective of profitably satisfying customer needs" [6].

There are plenty of examples to support this view. The US car industry lost out to the Japanese car industry in the 1970s, and there is the case of Kodak. Kodak was a world-leader in selling film but filed for bankruptcy in 2012 (re-emerging as a much smaller company in 2013) following its failure to respond to the digital camera revolution and despite investing billions in digital technology [7]. Why do incumbents face this kind of problem?

> One problem incumbents face is the identification problem: how can they identify ex ante an emerging technology that might ultimately become the basis for a radical technological innovation? There is no easy solution to this problem, because not all emerging technologies survive, and accurate ex ante identification of a successor technology is impossible for anyone who does not have access to a time machine. [6]

The last two years have given universities around the world direct experience of what the future might look like. We have been given the opportunity of 'ex ante identification' of the problems we must address. Or, if you prefer, the last two years have been a time machine-type experience. And learning the lessons is vital because significant changes are coming.

6 Changes in the Twenty-First Century

One should be wary of making too many predictions, but I think it is worth picking out some general global trends, as well as some trends in the Arab region to focus more clearly on the relevance of the points in the previous section.

The world is getting richer. As countries do this, they tend to consume more education both in terms of more people being educated and each person getting more education. David Willetts, an influential former Universities Minister in the UK, has put the point this way:

> [middle-income countries] are facing a massive demographic challenge. As they become more prosperous living conditions improve, and many more babies make it past childhood. They say the demographic transition is when first we stop dying like flies and then stop breeding like rabbits. During the transition there is a massive increase in the number of young adults, which is very disruptive, socially and economically. It is the moment when … countries are perilously poised between triumph and disaster. If surging numbers of young people are left without opportunity and employment then you get a revolution [8]

Many countries in the Arab region are going through this demographic transition now and more will in the next 20–30 years. The UNDP estimates that by 2050 the Arab region will have 600 m inhabitants, 239 m more people than in 2010. Over one-third of these will be children or young adults [9].

There are also significant economic changes and dislocations expected. We are at the early stages of the fourth industrial revolution, some of the chief features of which is the "fusion of technologies that is blurring the lines between the physical, digital, and biological spheres" [10] through "artificial intelligence, robotics, the Internet of Things, autonomous vehicles, 3-D printing, nanotechnology, biotechnology, materials science, energy storage, and quantum computing"[10]. Change will increasingly occur "at an exponential rather than a linear pace" [10]. Industries and countries will experience its disruptive effects as, of course, will individuals. Many lower-skilled jobs will be lost to technology as well as some repetitive or standardizable medium- to high-skilled jobs; these will include accounting, some parts of law, as well as generic medical testing that currently requires highly-trained individuals.

As noted above, care must be taken about predictions, but three general points seem true. First, the skills people will need in the next 20–30 years will be different from those many have relied on to date. Second, people will have to be able to retrain rapidly over the course of their working lives as sectors emerge, change, disappear and are replaced by others. Third, and more broadly, the pace and nature of change risks being quite bewildering for people.

> The Fourth Industrial Revolution … will change not only what we do but also who we are. It will affect our identity and all the issues associated with it: our sense of privacy, our notions of ownership, our consumption patterns, the time we devote to work and leisure, and how we develop our careers, cultivate our skills, meet people, and nurture relationships [10].

Governments around the world are spending increasing amounts of resources on how to understand and respond to these challenges—as well as the opportunities these changes will offer. As the need and desire for more education, training, and skills increases, higher education has the potential to be a significant export earner for more countries. The UK, one of the leading higher education exporters, earned £25.2 billion from education exports in 2019 (of which £17.6 billion came from higher education) and plans to increase this figure by 40% by 2030 [11, 12]. We should expect higher education to continue to provide a significant amount of export income for the UK but we should also expect more competition from other countries.

Some of this competition should come from countries in the Arab region as they look for new economic opportunities, in part to replace some of the revenue streams provided by oil. We might or might not have reached 'peak' oil but we should expect demand for oil to fall as more consumers and countries turn to renewable energy sources [13]. Arab countries that invest significantly in higher education will not only improve the skills and economic value of their people but could also hope to develop education services for export, particularly to other Arab countries as well as Africa—which is expected to see the largest increase in numbers wanting higher education.

7 Competition to Meet Future Demand

The global demand for higher education is going to increase, the nature of the demand—the kinds of high-level skills people need—will be different and, as the pandemic has helped demonstrate, there are fewer geographical constraints on how that demand is met. This will create opportunities for universities but it will not just be a case of keeping our doors open or opening new ones and doing what we have always done. To put this point less obliquely, if the young people of Portsmouth can get high quality formal learning virtually, why would they choose their local university over one of the more prestigious universities—Princeton, Oxford, or Harvard? The same question applies to universities in the Arab region.

One response might be that some of the global elite universities will not want to expand in this way. The University of Oxford is, for instance, far smaller than it could

Table 1 Times Higher Education World University Rankings 2022 Top 10

	University	Year founded
1	Oxford	1096
2	California Institute of Technology	1891
2	Harvard	1636
4	Stanford	1885
5	Cambridge	1209
5	MIT	1861
7	Princeton	1746
8	Berkeley	1868
9	Yale	1701
10	Chicago	1890

be and Princeton has decided that about 5000 undergraduates is enough. However, universities relying on the assumption that the elite universities will only behave in the future how they have behaved to date is little more than crossing our fingers and hoping bad things don't happen. Universities like Oxford and Harvard could always keep their core current model and expand in other ways.

While not unique there is something distinctive about the university sector. As Table 1 shows, there is a strong correlation between age and ranking.

The youngest university on the list is 121 years old. The average founding date is 1678 and if one removes the two outliers (Oxford and Cambridge), this only moves the average to 1810. Age matters. There can be many reasons for this, but the three chief reasons are credibility, expertise, and experience. Credibility, sometimes thought of as prestige, is not always tethered sufficiently to the facts but this is the exception rather than the norm. No one can argue that the universities listed are not brilliant at what they do. The point is rather that in meeting the changes and challenges of the future, their credibility, expertise, and experience will give them some advantages over younger universities. But they will also have some disadvantages. The traditional model has worked well for many universities but none more so than the elite universities. They believe, often rightly, that they do not operate under the same pressure as other universities so why change? Whether this is the right approach is best considered through a question: what is the better guide to the future for universities? The last 200 years or the last two years? My judgement is that it is the last two years and, as older universities might not notice this, they could have a disadvantage. As Peter Drucker has noted:

> A time of turbulence is a dangerous time, but its greatest danger is a temptation to deny reality [14].

With the weight of history behind them, as well as expectations about how they should operate, the older universities will experience pressures not to change too much for fear of losing their identities. Some might be right. The traditional model will work for some institutions in the future but it will work for fewer institutions

than it works for today, and it will not suit all future learners. Perhaps complacency about those changes will not hurt the Oxfords or the Harvards—although history from other sectors (referenced above) suggests that this might not be true. More importantly, universities who don't have such reservoirs of credibility, expertise, and experience to rely on—and that is most of us—must not, indeed we cannot, afford to deny a changed reality and hope to succeed.

It is tempting. Sustaining the changes many of us have implemented in the last two years, often at breakneck speed, will be difficult. We cannot just carry on with more of the same. Staff are exhausted. Staff and, more importantly, students want things to return to how they were before the pandemic. After such a stressful, and psychologically debilitating period, people want the comfort of what is known. But this understandable reaction is not a reliable guide to the longer-term. Universities that are seduced into thinking it will not lose out to those who learn the right lessons, those who realize that our reality has changed, and that the last two years were a foretaste of what could well be to come. Those institutions who learn the right lessons will not only be other existing universities but new entrants, some of whom will not be universities but private companies whose scale, income, and credibility allows them to enter the higher education market—a Google University is a real possibility.

8 Conclusion: The Future Favors the Bold

I have argued that the pandemic has given us insights into what the future of higher education will look like. There will be a different balance of provision between in person, and virtual delivery of education with universities having to invest in both high-quality educational technology and virtual learning support. At the same time, the balance of in person student engagement will tilt more towards wellbeing, pastoral, and mental health support. Universities should expect the future balance of their staffing to reflect this. We should expect many to employ fewer academic staff and rely on academics at other universities who might teach (virtually) for several universities, on different continents all in a single month.

Universities will also have to be prepared to invest far more in IT infrastructure and services than they do currently which, according to one source, is less than 5% of total budgets [15].

As the demand for higher education expands, and the need for lifelong learning increases, universities will also have to become flexible in how they deliver education. Students will expect delivery to be more tailored to their needs and different types of students will have different expectations and needs.

I have suggested that these, and other, changes will create opportunities for universities in the Arab world to challenge the traditional global hierarchy based, as it is, on credibility, expertise, and experience—or, for want of a better catch-all term, prestige. But to take advantage of those opportunities, universities in the Arab world—as well as universities like mine—will have to throw off our sometimes-innate conservatism and be bold. We will have to think differently, prioritize different things, and, to

ensure we are on the front foot, we will need to make changes before their necessity becomes obvious. Doing this and bringing our universities along with us will not be easy and creates risks, but for universities who cannot rely on prestige to generate the benefit of the doubt in staff, students, and other stakeholders. But the alternative is more risky. Universities that are not bold risk being left behind as demand increases, learners' expectations change, and more and more high-quality content is delivered virtually. Ultimately, the risk-averse universities could be the twenty-first century global higher education equivalent of Kodak. If that doesn't focus universities' leaders' minds for serious consideration of the argument in this paper, then I don't think anything ever will.

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How to Prevent a Crisis Becoming a Catastrophe

Quintin McKellar

Abstract The COVID-19 pandemic dramatically tested universities resilience and responsiveness. Those universities with the most robust infrastructure (buildings, electronic networks, personnel) were in the best position to respond. Risk management systems were helpful, but few could have predicted or prepared for such a catastrophic event. On reflection, it is clear that universities did not respond quickly enough to the rising crisis and were faced with emergency imposition of home working and online learning. As the crisis evolved, universities responded well, collaborated on good practice and have broadly negotiated the hurdles of lockdown in good order. During the pandemic, communication was critical, and as we emerge from it, retaining the embraced methods of blended learning and more flexible working, will be vital.

Keywords Covid-19 · Resilience · Responsiveness · Infrastructure · Communication

1 Introduction

It has been suggested that a crisis occurs if the Vice-Chancellor falls in a river, and it only becomes a catastrophe if someone pulls him out!

In March 2020, the world found itself in a crisis, which has undoubtedly unfolded into a global catastrophe, on a scale not witnessed since the Second World War. A novel coronavirus had been identified in a cluster of atypical pneumonia cases in Wuhan in China, towards the end of 2019. The virus had a long latency period of up to two weeks, which meant that it could be spread by people who were infected but not yet showing any signs of the disease. International travel and the highly infectious nature of the virus meant that it rapidly spread across the globe and by February 2022 more than 382 million cases had been reported and more than 5.7 million deaths had been associated with the virus.

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In March 2020, the World Health Organization declared a global pandemic, by which time many countries were imposing measures designed to reduce the spread of the disease. On March 23rd, 2020 the UK followed several other countries in announcing a stay-at-home lockdown for all but essential workers, and by April almost 4 billion people, or half the world's population from more than 90 countries, were in lockdown of some sorts.

It is of interest to consider whether universities were prepared for such a global catastrophe, how they responded to it, what they have learnt from it, what the new normal might look like, and whether they are better prepared for a future pandemic or other global catastrophe. I shall use the University of Hertfordshire as a case study but will refer to wider sectorial issues where these are relevant.

2 Were Universities Prepared for a Global Pandemic?

In considering their preparedness, it is instructive to consider firstly their state of resilience, secondly their plans and responsiveness, and thirdly their insight and recognition of the emergence of the pandemic.

With regards to resilience, it is self-evident that those institutions with the greatest wealth of resource were likely to be able to weather the storm most effectively. Nevertheless, resources go well beyond finance. Most importantly, did the institutions have the right people in the correct roles to respond effectively to the many challenges which emerged? Individuals had to have competence to progress their own responsibilities effectively, and the agility to respond to the new realities which emerged. Did the Pro Vice-Chancellor for Education have the competence in pedagogy to direct a move to online delivery and assessment, and did he/she have the confidence of their colleagues to take them on that journey? Was the Director of Estates able to secure and maintain buildings and infrastructure no longer being occupied, where new threats emerge if water systems are left stagnant, or heating and ventilation turned off? And of course, at the same time, cut the associated utility costs? Was the Dean of Students able to provide adequate counselling and support to students who found themselves at home—often in sub optimal learning environments and without access to Wi-Fi or even a desk—anxious about their studies and their future. Was the broader infrastructure of the university fit for purpose? Did the university have a virtual learning environment and suitably robust platforms to support universal online delivery? Was the university's finance system agile enough to ensure that payroll could be controlled, and colleagues paid by finance staff working from home? Were the university buildings in good condition—without concurrent issues? In the UK, university buildings with some types of older external cladding presented possible fire risks—encouraging students to isolate in halls where cladding had not been adequately assessed was not optimal. Water systems in sports complexes, notoriously susceptible to legionella, had to be kept flushed and checked.

Universities had to be confident in their supply chains; could they source food for students locked down in their accommodation and for essential workers. Were

the supplies of computers and software sufficient to meet the demands of 'digitally' poor students, and to support staff now suddenly working remotely, who required access by loan or purchase of appropriate machines?

Did the university have sufficient financial reserves to endure a period of potentially increased costs and reduced income? Was current cash sufficient, had historic surplus been high enough and was borrowing low enough to weather the storm, service covenants, pay employees and, where appropriate, release students from accommodation contracts? And where contracts had been signed with external suppliers (for food and catering for example) based on a guaranteed footfall—who would bear the risk/cost? Maintaining cash at several multiples of the monthly pay bill and having a resilient reserves policy which could now provide the funding required for substantial unbudgeted expenditure, provided essential financial resilience.

The second pillar of preparedness, which may have influenced institutional resource rests with previous planning and preparation, and how useful that planning was in the eventuality of the pandemic. The University of Hertfordshire had in place an Institutional Risk Register, which was revised regularly by the executive and by the Board of Governors. It also had an Emergency Plan (which had been updated in February 2020), a Business Continuity Framework (which had been updated in October 2019) and a Communicable and Notifiable Disease Policy. It was also able to access the Higher Education Funding Council for England (HEFCE) 'good guide' for planning and managing emergencies (last published in 2008). The University also had a detailed protocol for dealing with single and multi-case outbreaks of meningitis, which it was able to utilize until more specific protocols for COVID-19 could be created. It is of particular interest to note that of the seventeen major risk descriptors, none related to pandemic, epidemic or even disease outbreak. That is not to suggest that the Risk Register was all together useless in the face of outbreak, since many of the issues already covered around more general resilience were identified and mitigations were embraced to ensure that appropriate human resource, finance, estate and IT infrastructure were in place. By February 2020, it was becoming clear that COVID-19 could and most probably would have a profound effect on the University, and a specific COVID-19 Risk Register was drawn up. This identified twenty-nine areas of COVID-19 related risk, ranging from risk to teaching and learning, to impact on community engagement. By way of example, the first risk was to teaching and learning, described as "interruption to established model of on-campus and face-to-face teaching". The risk owner was identified as the Deputy Vice-Chancellor and the Pro Vice-Chancellor for Education and Student Experience. The likelihood was ranked 5 (the maximum), and the mitigation was "planned move to delivery of online teaching and learning via Canvas (our online virtual learning environment), increase in access to digital learning resources, communication of changed mode of delivery to university staff and students, implementation of a formal reading week to facilitate migration to online learning mode". The residual risk was likelihood 5, impact 2. By the end of 2020, the Corporate Risk Register was peppered with COVID-19 related risks to the continuity and sustainability of business, for instance "indirect impact of COVID-19 on estates maintenance, with resources being diverted away from planned maintenance works". The University Emergency Management Plan was up to date,

having been reviewed in February 2020, however it was very clearly designed for a more immediate emergency such as a fire or explosion and was explicit in its remit for the initial 24 h of any response. It did embrace serious health related issues but had been written with an explosive outbreak in mind, rather than a rapidly spreading, highly infective agent. The Emergency Response Plan did nevertheless provide the management structure appropriate for an emergency situation, and indeed this is what was used, with adaptation for the circumstances. The primary functional management unit comprised a Gold team, made up of those with critical functions across the organization. This was chaired by the Secretary and Registrar, as the individual with the greatest operational reach across the University, and included the Vice-Chancellor, Deputy Vice-Chancellor and the three Pro Vice-Chancellors, the Dean of Students, Directors of Estates, Finance and Marketing and Communications and the Student Union President. A Silver team operated virtually, to gather data on local COVID-19 cases and to distribute the notes and actions from the Gold team to the most appropriate individuals. The Bronze team, as described in the Emergency Plan, was not constructed, since the regular Chief Executive Group comprised all those essential to operationalize the actions agreed by the Gold Group and met regularly to do so.

The University had in place a Business Continuity Framework, which was in some ways more appropriate for the issues relating to the pandemic, and indeed one of the scenarios on which the plan was based was a major outbreak or pandemic. The framework was centered around eleven key functions which comprised Communication, IT Infrastructure, Estates, Registry, Student Experience, Finance, Transport, Teaching and Learning, Research, Human Resources and Enterprise. The Business Continuity Framework proposed utilizing the standing management structures, in the case of the University of Hertfordshire, the Vice-Chancellor's Executive (VCE) (which comprised the Vice-Chancellor, Deputy Vice-Chancellor, Group Finance Director, Secretary and Registrar, and Pro Vice-Chancellor for Business and International Development) and the Chief Executives Group (CEG) (essentially VCE plus two additional Pro Vice-Chancellors and heads of all business units). Nevertheless, the University chose to adopt the Gold Group—previously described in the Emergency Response Plan, which was a hybrid of the above, as its senior management unit during the pandemic. This was because it had greater operational reach than VCE and yet was agile in its decision-making functions and offered facility for rapid institution wide communication. The University Communicable and Notifiable Disease Policy was a useful document, however the national and international nature of the COVID-19 pandemic meant that specific disease related responses were largely dictated or directed by the Government's Department for Health, Public Health England (PHE), or by the local health authorities of the County and Borough councils, with whom the University developed a very close and supportive working relationship.

The third consideration in preparation for the crisis asks whether universities responded quickly enough to the gathering storm. Following the recognition of the disease in China, the Chinese authorities instituted very robust lockdowns in Wuhan city and subsequently sixteen other cities in Hubei province. The early and draconian action of the Chinese had the desired effect and as cases began to decrease,

the lockdown could be relaxed from as soon as April following the initial outbreak. Nevertheless, cases were confirmed in 26 countries, including the UK in January 2020, and in most countries across the world by the end of March. Indeed, the spread had become so serious in Italy that a state of lockdown was imposed on March 9th. In the UK, almost 600 cases were reported on March 12th and the Government started advising against non-essential travel, to avoid contact, and advised vulnerable people to self-isolate. Hospitals postponed non-essential operations and it was announced that schools would close on March 20th. Yet when the full lockdown was announced in the UK on March 23rd, few universities were prepared to go fully online immediately. At the University of Hertfordshire, on March 18th before the Government announcement, we announced a reading week to create the space for academic colleagues to put teaching material online, which they did with remarkable energy and to very good effect. Nevertheless, the question remains why we had not been more actively preparing from January or at least mid-February as spread became inevitable. In fact, we did hold a series of COVID-19 related emergency planning scenario sessions, to help us map our actions in case of an outbreak, but did not implement the actions until the lockdown was announced. The reasons are probably complex; belief that the disease might have the same impact as a severe seasonal flu, or uncertainty of the likely response by the Government, and a belief that it was unlikely that a national lockdown might affect universities. It was also true that universities were actively teaching from January through to March, and to expect academics to develop online material while they were already fully occupied teaching would have been problematic, if not impossible. The ultimate response therefore was an emergency response to the immediacy of the lockdown announcement, which precluded face-to-face teaching.

3 How Did Universities Respond to the COVID-19 Pandemic?

Using the University of Hertfordshire as the case study, it is probably more appropriate to ask how the University responded to the lockdown announcement on March 23rd, 2020, which effectively stopped face-to-face teaching. For some other universities, with large research communities with expertise in epidemiology, immunology, vaccinology and clinical medicine, their response may have been earlier and directed at the research and innovation opportunities presented by the disease itself, as they began to analyze the data being produced to develop epidemiological models and begin to develop vaccines against the responsible coronavirus. For these universities, the operational response in order to continue teaching, and other research activities, were probably similar to those at the University of Hertfordshire.

The University already had a substantial amount of teaching material in a format which could go online, and many staff had already been creating on-line material as contingency for a lockdown. However, the announcement on March 23rd gave

certainty to the position. At that time, we decided to impose a reading week for students, to allow us to draw breath and consider how to respond. It also gave those academics with the most immediate challenges of online delivery an opportunity to get marginally ahead of the curve. At this time our Learning and Teaching Innovation Centre (LTIC), who had substantial expertise and experience of online delivery, offered comprehensive support to those struggling with the technology and pedagogy. Clearly communication was absolutely critical—the tone was calm, authoritative and reassuring, to galvanize action without initiating panic or despondency, and the message was that "your best will do" (in the event "their best" was much better than could have been imagined). The reading week also allowed the senior executive team time to organize, plan and communicate. The 'Gold team' was established, as mentioned above, and convened initially on a daily basis. We also convened an emergency meeting of the Board of Governors and established a subgroup of the board to meet weekly. We increased the frequency of our Joint Negotiating and Consultation Committee (our management meeting with unions) from six times a year to once weekly. The Vice-Chancellor also began attending weekly meetings with Universities UK, the sector representative body, and the Alliance Universities Vice-Chancellors (a mission group of eleven universities, of which the University of Hertfordshire was a member). Communications began immediately, with a daily succinct electronic newsletter to all staff and a daily e-mail to all students. A weekly staff virtual Question and Answer session was also introduced, at which senior members of the Gold Group met collectively with any staff who wished to attend, and at which they fielded any questions raised. These communication methods are still in place today, although the frequency has adjusted according to necessity.

Meetings of the Gold Group proved to be highly effective. They met for one hour each morning at 08:30, focused entirely on the immediate issues of concern, and were able to make decisions with health implications and on resources without further reference or obfuscation. It was extremely agile and effective in its tasks, it acted as the single source of truth, and all communications for staff and students were crafted and checked by its members. Its early and transparent communications briefings engendered confidence in the leadership, and this was signified by the many positive e-mails received from staff and students, and by an improvement of 16% in a mid-pandemic staff pulse survey, compared to a pre-pandemic survey. As the pandemic progressed and a rhythm developed to the new way the community was working, meetings of the Gold Group moved to twice a week and then once a week until 4th November 2021 and was reconvened on an ad hoc basis to respond to Government restrictions imposed after the rapid spread of the Omicron variant towards the end of 2021.

The Board of Governors met as a full board in the first week of lockdown, then as subgroups of five independent board members on a weekly basis for the first two months following the March 2020 lockdown. All board members were extremely supportive of the executive and of the efforts being made by colleagues across the University. The breadth of expertise and experience of the board members proved an excellent sounding board for the executive as difficult decisions had to be made—for instance, should students in halls of residence be released from their

residency contracts, at a known cost to the University of £6 m (USD 7.3 m) (this was approved). It also allowed the executive to reassure the governors that they were taking appropriate action and that teaching and research were being progressed to best possible extent. It was also useful to provide reassurance that governors were meeting (exceeding) their responsibilities with regards to governance and oversight of the institution. As the pandemic progressed and the immediate emergency phase passed, the balance of our governors' interaction moved gradually from support to challenge but remained positive and constructive.

During the early phase of the pandemic, senior managers met with union colleagues on a weekly basis and the meetings took the shape of a genuine partnership, with both parties considering the best interests of staff and students. As the pandemic progressed and lockdowns were eased and then re-imposed, regions were put into tiers depending upon the rate of spread and the level of infection. Instructions from Government and local health authorities, and from the Department for Education became more complex, and the relationship between management and the academic union, University and College Union (UCU) became fractious. National and local union representatives, particularly those representing academics, became more 'political'. While management followed Government policy, unions used data from self-established "expert" groups, which conflicted with Government policies and practices, to challenge the policies and processes being adopted by the University. In particular, they wanted all teaching to move totally online during periods where Government policy permitted face-to-face teaching, since they asserted that this would reduce the risk of staff becoming infected. The University had of course imposed robust COVID-secure practices on all our face-to-face teaching, such as compulsory one meter plus distancing, wearing of face masks and routine pre and post session cleaning of desks and chairs. Furthermore, as data emerged it became apparent that very few (if any) transmissions were occurring in classrooms and staff who developed COVID-19 almost invariably became infected within their home communities. During November and December 2020, the Joint Negotiation and Consultation Committee (JNCC) meetings became more adversarial, until the academic union threatened a vote of no confidence in management. Management immediately terminated their weekly meetings on the grounds that there was no point in meeting with colleagues who had no confidence in their management. At this point the union drew back from what was clearly progressing towards an outright dispute, the parties met and agreed to progress according to the statutory meeting schedule of six times a year and agreed to be as constructive as possible while still upholding the interests of their members. During this period management continued to meet with the union representing professional members of staff and maintained a cordial and constructive relationship.

The weekly external meetings which the Vice-Chancellor attended with Universities UK (UUK) proved to be most useful. The Chief Executive of UUK, who was meeting regularly with the Secretary of State for Education and with the Minister for Higher Education, briefed members on policies and proposed changes to policies and encouraged members to feedback and raise concerns and issues around these proposals. It was particularly helpful to feedback what was actually happening

within our universities—was student behavior compliant with process or were there unintended consequences? This was particularly important during lockdowns and semi-lockdowns, when the migration of students from their residences to their homes (and in some circumstances in the opposite direction) were neither fully compliant with Government instruction, nor what might have been initially expected. There is no doubt that these excellent and informative meetings influenced policies in a constructive way for the higher education sector. Meetings with the Alliance group of universities (eleven universities of similar size and type who worked together in a constructive way and lobbied on behalf of their common interests) were equally useful. The smaller group meant that Vice-Chancellors could delve more deeply into specific issues, learn from each other and gravitate towards best practice. This was also a forum where Vice-Chancellors could let off steam and seek reassurance from colleagues with similar problems. During the pandemic, colleagues with different expertise from each of the Alliance universities—e.g. Finance Directors, Secretary and Registrars, Pro Vice-Chancellors for Education and Research, also met to share best practice.

The main pillar of our communication strategy comprised daily newsletters for staff and daily e-mails for students, and a weekly virtual Question and Answer (Q&A) session for all staff. The daily staff newsletter delivered 'bite-sized' chunks of communication, generally in bullet point or short paragraph format. This was greatly appreciated and widely read by staff during the early part of the initial lockdown, and as new policies impacted on the University. However, as with most communications people gradually weaned off it. The daily e-mail to students was equally popular, with 65% of students opening it (unheard of with routine e-mail communication). Both channels of communication were particularly important as a single source of truth, since rumor and false news were rapidly disseminated by other means, most often social media.

The other communication activity which proved extremely effective was the weekly staff Q&A. This was most frequently led by the Pro Vice-Chancellor for Education and Student Experience and Secretary/Registrar and their deputies or lieutenants. Between 200 and 400 staff (total university staff is over 2600) attended these sessions, with relatively little fall in numbers throughout. The openness and transparency, together with the authority bestowed by seniority of the leaders, meant that these sessions proved very reassuring and myth busting for staff, who gave positive and spontaneous feedback regarding their value.

As the rhythm of work steadied, and success of online and blended delivery became more assured, the frequency and nature of meetings changed, and the frequency of the daily communications slackened. Gold meetings moved from daily, to twice weekly, to weekly (and remained weekly throughout the whole of the year). The nature of Gold also changed, from emergency response to business continuity, business recovery and long-term business adaptation. The Board of Governor subgroup meetings moved from weekly to fortnightly, and then to regular bi-monthly full board meetings. Nevertheless, the success and greater intimacy created by the smaller group meetings was considered a particular success and the executive and board chair organized ad hoc smaller group meetings (with approximately five board

members). These were designed to give board members the opportunity to interrogate issues of interest in much greater depth than could be achieved at the main board. Meetings of the Joint Negotiation and Consultation Committee (JNCC), which was the committee representing employee unions and the management of the University, reverted to those required by university statute. As the meetings of Gold decreased in frequency, much of the business reverted to our normal business committees and were embraced in regular committee cycles of the University.

4 Impact of the Outbreak on the Main Functions of the University

4.1 Education

The most immediate concern following the announcement of the lockdown in March 2020 was to deliver a high-quality teaching and learning experience to our students, put in place appropriate methods for assessment, and ensure that our students met their learning objectives. In the first instance, and as an emergency response, this required us to deliver most of our educational content online. We were fortunate to have an excellent Virtual Learning Environment (VLE) on a Canvas platform, and to have embraced a Guided Learner Journey which provided a road map for the material being uploaded for online delivery. We had also introduced previously Microsoft Teams software, which allowed easy communication between academics and was essential for business continuity. Our Learning and Teaching Innovation Centre (LTIC) also supported staff to ensure that material was in an appropriate format for online delivery and encouraged academic colleagues to engage virtually with our students. It was also fortunate that the initial lockdown on March 25th, 2020 was towards the end of the teaching programs of the University and most of the practical and laboratory classes had been completed. There were substantive challenges for students who still had to complete placements and to create appropriate online assessment. We were also conscious that this would be causing students anxiety and we remained responsive to the student voice and needs, practically and emotionally. In this regard, our Dean of Students and counsellors rose to the challenge magnificently and offered outstanding welfare support. The early efforts in delivery, assessment and support were rewarded with 49% satisfaction in a student survey carried out during the lockdown. The relative respite offered by the reduced teaching load during the summer permitted academics to embrace a pedagogically driven approach to the creation of online material, to be delivered in a blended environment, with some face-to-face teaching as the lockdown restrictions were loosened from September 2020 onwards. The student feedback in relation to the blended approach was excellent, with a 73% satisfaction rate. In January 2021, the UK re-introduced a full lockdown, only allowing Health students and some other restricted categories back onto campus. While students received the same support and were able to achieve their learning outcomes, there

was an increase in student numbers seeking 'financial compensation' on the basis that the experience they were receiving was not what they believed they had been promised. At present, the University considers that the student learning should allow them to achieve the requisite learning outcomes and therefore they should not receive financial compensation. The University also embraced a safety net policy, whereby those doing their final assessments would not be penalized if the results were poorer than that expected from assessments undertaken during the previous year.

4.2 Research

The impact of the lockdown on research was largely dependent on whether the research required laboratory or field work, or items of equipment housed within the University. For most of those undertaking desk-top research, the move off campus proved relatively easy. Most had access to adequate computers and software to allow them to access research materials, publications and data sets. For those requiring laboratory and field equipment, such as telescopes, it was only possible to continue if they could demonstrate that they were essential workers (where for instance the research was to support the COVID-19 response). After the initial full lockdown period, as they were allowed to return to the laboratory, risk assessments had to be carried out and strict social distancing and cleaning protocols were put in place. The period of working from home did provide an opportunity for researchers to write papers and grant applications, and the number of grant submissions increased, as did competitive research funding acquired by the University. The position for research students who had laboratory-based research experiments to carry out was more precarious. Clearly completing research masters and PhD programs within the requisite time became problematic. In this regard, our sector representatives lobbied Government and UK Research and Innovation (UKRI), the research funding agency, who subsequently provided funding for extensions to PhD and other research programs, and extended deadlines.

For many universities, COVID-19 offered opportunities for specific pandemic related research. Imperial College London undertook detailed epidemiological analysis, which influenced Government policies and undoubtedly saved lives as a consequence. Oxford University undertook perhaps the best-known research and development work, on generating a vaccine which was ultimately produced in collaboration with AstraZeneca and provided a substantial pillar of the response to the virus. Many other universities undertook research in almost every aspect of the virus and its consequences, many also contributing to our understanding of the immune response, the success of treatments, and towards other vaccine candidates. At the University of Hertfordshire, we undertook social science research into the impact of the pandemic on communities and society.

4.3 International Students

At the time of the initial lockdown in the UK, the University of Hertfordshire (UH) had some 5430 International students studying on its campus in Hertfordshire, and a further 6380 International students studying for UH degrees with partners overseas or doing UH online degrees. We were also recruiting overseas students for the September 2020 intake. Our first priority was for the safety, security and education of those on our programs. Those in the UK were able to access our online material from their halls of residence or private accommodation. We were able to ensure that students living locally had access to food and other essentials of life. Not all our overseas students accessed the support available to them, and although our communications strategy was excellent, some clearly missed the information. Many overseas students remained in our halls of residence over the lockdown period, even after exams had been completed, and we had to ensure their wellbeing during the summer vacation period. Furthermore, many overseas students found themselves in difficult financial circumstances, either because they were unable to undertake part-time work which would normally have provided some income, or because their families or benefactors in their home countries had also been affected by lockdown and were unable to send money as they had expected. The University understood their circumstances and allowed them to carry debt beyond the normal payment deadlines, on the understanding that they embraced a payment scheme. This was time limited and capped at a reasonable maximum, since we did not wish students to get into a debt situation from which they would not be able to recover. This scheme meant that the University was carrying up to £10 m (USD 12.2 m) more student debt than would have been normal. During the pandemic year, we were able to distribute £1.2 m (USD 1.5 m) in hardship funds to more than 4000 students, 60% of whom were international students. These support funds came from the Government, or from the universities own funds and from donations. We continued to recruit overseas students for the September 2020 intake, however, were cognizant that there could be difficulty with international flights and that there could be quarantine restrictions placed on incoming students. In this regard, we chose to move our international arrivals day back by five weeks, to give students maximum opportunity to make arrangements and acquire visas (the visa application process slowed considerably in August/September 2020 in the UK). We also acquired facility from some countries to deliver the early part of the educational program online, which we did to allow students to 'hit the ground running' when they arrived. We worked with our Learning and Teaching Innovation Centre to ensure that students could receive their required teaching/learning material in a shorter semester. On arrival in the UK, overseas students required to quarantine were provided online academic and pastoral support (our "Active Student" program provided exercise routines and we delivered quiz nights and film nights. Our Student Union association were very helpful, energetic and imaginative in this regard). We had put in place contingencies, such as pre-booked charter flights in case air transport was disrupted. In the event we did not need to utilize this, although some universities, including Queens University Belfast, did utilize charter flights. Ultimately, our

efforts paid off since our international student recruitment numbers increased against previous years and those students reported satisfaction with the process put in place to support their experience.

4.4 Business Development and Engagement

The impact which COVID-19 was having globally on economies and prosperity was well recognized and profound. In the UK, the most recent reports suggest a 10% contraction of Gross Domestic Product (GDP) in the economy, the worst for centuries. Supporting local economies was therefore not only something which was practically important for universities to do, it was also morally essential. The University of Hertfordshire has a rich history of engaging with business and industry to the extent that it classified itself as a "Leading Business Facing University". In this regard, it not only has a substantial Business Development Unit, with a remit to engage businesses with academics, but also has its own business support company (Exemplas, with a turnover of £9–£12 m equivalent to USD 11–14.7 m), owns its own bus company (Uno, with a turnover of £12–£13 m equivalent to USD 14.7–15.9 m), and has its own Careers and Placements unit, dedicated to giving students the work experience required for fulfilling employment.

As the lockdown began, the Government announced several business support schemes designed to preserve employment where possible. Our business support subsidiary began to receive an exponential number of enquiries—and very quickly developed a package of support and advice, which proved extremely useful to local business. It not only helped from a pure business perspective, but also became an unofficial 'counselling' service, for owners of small businesses who were in extreme need of moral support and someone who could listen to and understand their problems. For the UK, there was a second jeopardy beyond COVID-19, since on December 31st, 2020 we would leave the European union and our trade terms with that bloc would change radically. Exemplas was able to provide information and advice to businesses, which traded internationally, as the negotiations with the EU progressed and ultimately when we left the union.

Our bus company normally carries about 6 million passenger journeys each year. This of course was dramatically cut during the complete lockdown and substantially reduced during the different restrictions imposed throughout the year. Furthermore, it required substantial changes to normal practices with regard to cleaning and social distancing—the service was reduced to what was in effect our vacation service, and we were fortunate that the Government introduced a support package for transport and permitted furlough of some of our staff. This permitted the company to operate without substantive issues throughout the year from March 2020.

4.5 Overall Business Impact

There is a debate as to whether universities are businesses in the true sense of the word, even in the UK, where the tuition fees are largely received directly from the students. For UK students these are provided through a Government backed loan scheme. Nevertheless, universities, which the Government consider 'public sector' when it wishes to impose regulation, but 'private sector' when it wants to attribute responsibility for perceived poor performance, must behave fiscally as businesses in order to be sustainable. In the COVID-19 pandemic this has put substantive pressure on their finances. For the University of Hertfordshire, the major impacts have been in food, catering, conferencing, our sports village and accommodation. During the initial lockdown, food and catering income fell to almost zero, although we did have to cater for students who remained in our halls and for essential staff (maintenance, security etc.). Some of these services were outsourced, and while it might be imagined that the risk was therefore transferred to the delivery agent that was not fully correct. Had the University not continued to offer some support to the contractor they would have terminated their contracts with us, staff would have been TUPE'd (Transfer of Undertakings Protection of Employment) back to the University with all the attached costs. Consequently, we shared the pain with our catering contractor, who continued to provide a service despite making losses themselves. Our conferencing activity fell to virtually zero and our sports village was unable to offer its facilities to staff, students and the local community, from which it normally derived substantial income. The largest single cost during the initial lockdown related to student accommodation. Our students take out an annual contract for halls of residence and we could legally have held them to their full contract. Nevertheless, when most students vacated their halls in March 2020 (as a consequence of the Government-imposed lockdown—over which they had no control, nor could they have anticipated), we agreed to release students from their accommodation contracts, at a cost of £6 m (USD 7.3 m) to the University. This had a disproportionately large impact on universities with the largest number of students in their own accommodation, with approximately 4000 bed spaces we were substantially impacted. Students in private rented accommodation were not generally released from contract. It is of interest to reflect that accommodation rebates came from the University's overall income and were therefore being funded by all students paying tuition fees. It is fair to say that those vacating halls were treated favorably in this regard. Having made this decision in March 2020, the University agreed to introduce a COVID Commitment for students entering halls of residence in September 2020, whereby it essentially agreed to give students unable to use their accommodation because of a full Government lockdown a 50% rent relief on their contract of accommodation. This was considered fair since all students entering halls from September 2020 knew the risks of further lockdown and were in effect agreeing to share the risk with the University. This commitment became reality from January 2021, when the Government imposed lockdown on all but healthcare and a few other categories of students. The overall impact of COVID-19 on the University

finances has been dramatic—from a normal expected surplus of around 3% (£7–£10 m equivalent to USD 8.5–12.2 m) to an operating deficit of £3 m (USD 3.7 m) at year end 2020. Surprisingly, and contrary to the budget set for 2021, it appears from our quarter three forecast that we shall return to the black in 2021. This has been the result of good student recruitment and very tight cost controls.

5 Evolution During the Pandemic

The response to the pandemic progressed from doubt that it would have much impact, disbelief, to adrenaline driven emergency response focusing on whether we could deliver online and whether we could pay the wages, to a more sustainable but different reality, with home working and blended delivery. Then to a second wave, where resilience seems to be the critical feature. At the time of writing we are still in the third full UK lockdown, although 15 million people have been vaccinated and the numbers of infections and deaths are falling. Resilience at this time has been severely tested. While some staff are unable to work at all, the vast majority are having to work harder than ever and in very different circumstances. Most have adapted well, but those with young children, who they are having to home teach while working, have been particularly badly affected. At this time communication is still vital, both in content and tone. For February 2021 the University Active Staff group (colleagues in our Sports Village) have organized a Big Team Challenge, whereby teams of five attempt over the month to walk the virtual equivalent of the length of England. So far, more than 100 teams comprising 500 staff, have entered and are completing the distance. The Active Staff group have encouraged participation in many other events, from wreath making at Christmas to crochet! A staff survey carried out during the early part of the pandemic and lockdown was very positive; however, the second full lockdown in winter, when the opportunities to get out were reduced, and with extended period of isolation, had a negative impact on staff morale and impacted student mental health, with many students seeking counselling.

Having worked for almost a full year with some degree of lockdown, the future nature of university work was revised. Most colleagues adapted to home working well, but often had to do so in conditions which were not ideal; they did not have bespoke workstations and appropriate desk chairs, Wi-Fi was not universally fast, and some did not have ideal computer equipment or support. Furthermore, the tendency to schedule online meetings all day without gaps meant some staff becoming exhausted. Using Microsoft Teams or Zoom very quickly became second nature and academic colleagues developed engaged teaching approaches with their students. The blended approach to learning, which combined online and face-to-face delivery, and which was delivered throughout Semester A of 2020/21 was greatly appreciated by students who gave it higher satisfaction scores than ‘conventional’ teaching of previous years. We also adopted a suggestion from colleagues during the Q&A sessions to impose ‘soft closure’ periods between noon and 13:00, to allow for exercise and escape from the screen. This was greatly appreciated.

6 Longer Term Adaptation

The pandemic has been massively disruptive to higher education, however the changes are not all bad and some of them will undoubtedly be retained in the 'new' future.

The evolution to online delivery was electric in pace—we achieved in two weeks what we have been moving to over ten years. This is partly a reflection of the conservative nature of education—it's been done this way since Aristotle so why change it now? Also, it has to be said, by the fear of technology held by many (particularly older) academics, which was overcome by sheer necessity. As restrictions partially relaxed from September 2020 and delivery became a blend of online and face-to-face, and of course as the quality of the online components improved and students and staff became more engaged and interactive, so too did the positivity of the students for this type of education. The success of the transition has led to the University more fully embracing a blended approach as a universal approach to future education and indeed it has been embraced as a Key Performance Indicator within the University's Strategic Plan. This is being led by our Pro Vice-Chancellor for Education and Student Experience, who has summarized the challenges, which this brings by suggesting that what has been achieved so far comprised "a race to the start line" and that we now must evolve the blended approach from good to great. There are implications for these changes on staff and infrastructure, and it is likely that we shall continue to embrace a more flexible approach to home working. A straw poll of staff during the lockdown suggested that those with long commutes and good home working environment enjoyed working from home, while those with children (who could not attend school) found home schooling with work commitments hard and were looking forward to getting back to the office. Nevertheless, almost all staff were enthusiastic for a more flexible approach, whereby they could work from home for some of the time. The challenge for management will be to measure the effectiveness of home working to ensure that it is in the best interests of the organization. It is likely that the efficiency or effectiveness of professional staff working from home might be more easily measured than that of academic staff, or in particular the teaching component of their work. It is likely that for professional staff, it will be possible to measure objectively activities such as student registrations or payroll adjustments. For academic staff, measuring student engagement and satisfaction will be required, and relating this to student retention, and ultimate degree and employment success, will be necessary. It also seems likely that given the innate 'conservatism' of academics and their potential to gravitate back to old ways of didactic teaching and presentism, that one of the biggest challenges will be to fully embrace and develop the new ways of teaching to the benefit of their students and society.

A blended approach to teaching is likely to also impact the infrastructure of the University. Fewer large lecture theatres will be needed, more social learning spaces will be required, and small group facilities—whether enclosed with walls or in a learning café—will be desirable. We will need fewer offices and less parking

space—an added benefit to the environment. We will still need laboratories and real-life environments to give students the practical skills essential to employment in many disciplines, but these may be enhanced by simulated experiments and activities which were created while laboratories were unavailable. Equipment will also need to change. Computer purchases should target hardware and software which will work well in the office and at home, and which can easily be transported between the two. Cameras, screens, microphones and earphones should all be optimal for virtual meetings and for desktop teaching. During the pandemic, placements for healthcare students have been vital, in some instances fast-tracking nursing and other students into the front-line. But for many other disciplines, placements have not been available. It will be essential to re-establish the links with business and industry to ensure that students get the opportunity to experience the workplace as part of their university degree program. The positive feedback which we received as a result of transition to the blended approach, during which students could come and learn on campus, is in some contrast to the concerns raised by students during the full lockdown when they have been largely confined to their homes. Indeed, the gradual return of many students to their halls (50% by mid-February 2021). despite Government instruction to remain at home, suggests that there is still a very strong desire to have a campus or at least a university experience, as opposed to simply an online learning experience. The attraction of the campus is not difficult to see—direct human contact (particularly for younger people), access to sports facilities and student societies, and of course the facility to move away from home in a relatively safe and secure environment. All of this points to a future where a university experience goes well beyond an academic education and suggests that for all the utilitarian attractiveness of an electronic education, personal interaction will retain its attraction. Although some have suggested that the new world of higher education will be virtual and cheap, it is hard to see that materialize for the majority of students. The blended model of learning is not a cheap alternative. Done well, the online components of a blended approach require more interaction between student and teacher, or between student and student, than does a didactic alternative. This does not cut the staff costs, rather the opposite. Furthermore, the face-to-face components of the blended approach are done in small group sessions, requiring high staff student ratios. For vocational courses, practical elements still require laboratories and real or simulated environments. Students will require the counselling and support services, the sports facilities and libraries, the social and catering facilities.

For all the hopes of politicians, the evolution of the university brought about by COVID-19 might be profound, but it is unlikely to be cheap.

7 Conclusion

COVID-19 has taught us many thing—we have all learnt how to mute, raise our hand and turn our camera off. We can now switch seamlessly from Zoom to Teams and can use a chat box. Many of us have found ways to stay sane, which were previously

alien; we go jogging, bake bread, plant flowers or whittle wood. We have bought espresso machines, a new desk and are thankful for updated broadband. We have also learnt, by its absence, the value of direct human contact with families, friends and work colleagues—a funny story is much less fun when everyone is on mute and the response is deafening silence!

Access to Resources for Learning and Assessment in the Time of Pandemic—What Happens When Things Misalign and When the Teacher Is not There?

Simon Askey

Abstract This chapter considers the experience of Undergraduate Laws assessments in 2020 when the COVID-19 pandemic forced summative assessment to move from invigilated face-to-face pen-and-paper examinations in local examination centres around the world to online delivery. The first section provides, first, by way of context, a brief overview of the University of London and Undergraduate Laws (UG Laws) explaining how this distance and flexible learning program is delivered to around 16,000 students and providing a cameo of the very diverse student body. It then describes and reflects on the alternative assessments in 2020 outlining the attempt to replicate online the face-to-face invigilated examinations using 'record and review' software and considers why the absence of one resource for learning—the teacher—adversely impacted this endeavor. In the second section it explores how the resources for learning for many UG Laws students converge in 'the teacher'. It considers how distance learning materials created around the learner and an outcomes-based model of learning can be layered not only by additional support established in the outcomes-based model but also in a teacher-centered paradigm of learning. It suggests that the pandemic has revealed a fissure created by misalignment between these two models of learning and that 'the teacher' many students had looked to for direction in the past was diminished in the melee of the pandemic.

Keywords Online assessment · Record and review · Teacher · Learning resources · Outcomes-based learning · Teacher-centered learning

1 The University of London and Undergraduate Laws

In the early nineteenth century when London became the largest city in the world [1] it lacked one thing that most of the European capitals had longed possessed: a university. University College London (UCL) dates its foundation to 1826, known then as London University, a secular institution that was unpopular with the British

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establishment and dubbed "the godless college in Gower Street" [2]. The establishment response was the Anglican foundation of King's College London in 1829 and, by Royal Charter in 1836, these two unlikely bedfellows became the University of London. The first Royal Charter inaugurated the University of London as "a Metropolitan University, with power to grant academical degrees to those who should study at the London University College, or at any similar institution which his Majesty might please hereafter to name" [3]. This did not establish a university that most would recognize as such in the classic sense of a *universitas magistrorum et scholarium* (community of masters and scholars) as the ancient English universities at Oxford and Cambridge were or, the then recent foundation at Durham (1832) was, and the University of London was popularly described as a "mere examining board". The power to award degrees lay with the University but the responsibility for teaching sat with its colleges and institutions.

Some 74 years after its foundation, in 1900, the founding colleges were joined by six new institutions, only two of which still exist: the London School of Economics and Political Science (LSE) and Royal Holloway. And so, at the start of the twentieth century, the University became a federal research and teaching university but retained centrally run examinations. Today it is decentralized, and many of the schools and colleges, now known as Member institutions of the University (University of London Act 2018), while still not universities in their own right, nevertheless award their own degrees.

Today's 'internal' undergraduate laws student attends UCL, King's, Queen Mary, SOAS, Birbeck or the LSE and, with the exception of Birkbeck, on successful completion of their degree receives an award from their respective institution. Only Birkbeck students still receive a University of London award. For the most part then, these 'internal' students might be forgiven for not realizing that they attend a University of London Member institution.

2 External Students of Empire

By 1850, the examining body that was the University of London had extended its reach across the then British Empire approving local institutions to teach its curriculum and to present examination candidates for University of London degrees. Just eight years later, in 1858, for all but degrees in medicine (for which many are doubtless grateful), the examinations were opened to all and the University's reputation as an examining board was cemented. "Mere examinations" lecturers at King's College bemoaned "without evidence that a regular curriculum of study has been followed, are a very insufficient test of education" while their colleagues at University College lamented that such changes "not only lower[ed] the value but alter[ed] the very meaning of an English university degree" [4].

The first overseas examinations took place in Mauritius in 1865, marking the start of the University's worldwide role in distance education or perhaps more accurately, distance examinations. And when the colleges and schools of the University began

to admit 'internal' students at the start of the twentieth century, 'external' students, who studied anywhere, and possibly nowhere, sat different examinations which represented so "far as possible the same standards of knowledge and attainments" (Statutes of the University of London, 1900) as internal students [5].

3 Undergraduate Laws Today

Some 16,000 students study on the University's distance and flexible learning programs in undergraduate laws (UG Laws) through University of London Worldwide. They live in more than 100 countries but are concentrated in a handful of countries, where Recognized Teaching Centres (RTCs) are the principal marketing tool. Today's 'external' students can be 'independent' and study using the texts and Virtual Learning Environment (VLE) resources UG Laws provides, they can attend an RTC for face-to-face teaching, or, if geography and finances permit, they can attend an RTC for some modules and study others alone. This model, which is one of historical accident rather than purposeful design, contains elements of the affiliated institutions of 1850 and the examinations opened to all in 1858 as well as introducing some elements of online learning. As interactive online Module Guides linked to other resources and discussion forums have replaced hard copy materials, we have increasingly provided a contemporary toolkit and a framework for learning. What we do not provide—and have never provided—is teaching.

By way of context, the cost of one module in 2019–20 (the standard degree is 12 modules) including one examination attempt was £340 (about $450 USD). This low-cost model has, since 1865, sought to provide access to higher education for those who might not otherwise be able to achieve an internationally recognized award. Module convenors, who are responsible for the academic integrity of the subject matter, generally have full-time jobs within University of London Member institutions or other UK universities and the day-to-day academic direction and management of UG Laws lies with the Dean, one Associate Dean and four part-time Teaching Fellows. An academic workforce equivalent to 3.5 Full-time staff.

UG Laws students have no typical profile, but a few generalizations will provide some insights. In March 2020, 75% of students lived in just six countries: Pakistan (25%), Malaysia (16%), Bangladesh (10%), Hong Kong (10%), Sri Lanka (8%), and Trinidad and Tobago (6%). In these six countries the overwhelming majority of students attended an RTC. Hong Kong had the lowest RTC attendance rate in 2020 (64%) but in the other five countries the lowest was 84% and the highest 94%. The difference in RTC attendance rates in these six countries can be explained by a single factor; in Hong Kong most students are graduate entrants and have already completed an undergraduate degree in another discipline. They tend to be older, working professionals, studying part-time, and take a mixed approach to their studies. They take support from an RTC for some modules and study other modules alone or with self-selecting groups. In the other five countries, the students are generally school leavers from local education streams, and they mostly attend an RTC full-time. On the whole,

the support they receive is much more extensive than an undergraduate would receive at a typical UK university and their access to their teachers is unparalleled. Teachers often report, during inspection visits, that they are expected to create *WhatsApp* or similar social media groups to be in touch with students outside scheduled hours and that students regularly call them with questions outside working hours especially around examination times.

To complete this vignette of UG Laws students, one further point is worth noting, and that is the Certificate of Higher Education in Common Law (CertHE Common Law) access route to the Bachelor of Laws (LLB) degree. Around 25% of students access the LLB via the CertHE Common Law and this has no formal entry requirements except that the student must attend an RTC recognized to teach the CertHE Common Law, and undertake additional skills courses. In reality, most CertHE Common Law students have completed local schooling which ends at Year 12. Around 50% of students enter with 'A level' qualifications or equivalent (Year 13 schooling) and follow the Standard entry degree (12 modules) route and the remaining 25% follow the Graduate entry (nine modules) pathway.

The LLB offered by distance and flexible learning is an English law degree and, subject to completing the degree within a specified time frame, achieving a minimum class of award, and passing the required foundations of legal knowledge courses, it is recognized by the Bar Council in England and Wales as fulfilling the academic component of training for to pursue a career as a barrister. Inevitably, most UG Laws students come from common law jurisdictions where the English common law system arrived on their shores as part of a colonial package. Today their respective domestic laws will differ from English law in some of the detail, but machinations of their legal systems will nevertheless share similar approaches to statutory interpretation and the use of case law as precedents.

Just as the similarities and variances with English law will vary from jurisdiction to jurisdiction, so will students' fluency in English. For many students, English will not be their first language but it will often be "a strong second language" as in Malaysia [6] or be widely used, as in Pakistan, where it still effectively functions as the official language [7].

This overview of UG Laws has sought to highlight the salient features of the student body and the boundaries of delivering undergraduate programs in law through this low-cost access model. As will be seen, the challenges of delivering assessment during a pandemic, a task intrinsically taxing for any university, was all the more demanding given the dispersed and diverse nature of the student body. With around 16,000 students, UG Laws had more undergraduate students than the entire undergraduate population of most UK universities in 2019–20. The mean undergraduate population of a UK law school in 2019–20 was 713 students and in the law schools of University of London Member Institutions it was 646 [8]. Of the 125 UK higher education institutions offering law at undergraduate level, only six had more than 1500 students and only one, the Open University, had more than 6000 students [8].

4 Assessment in the Time of Pandemic

It will be apparent from what I have outlined above that when the pandemic struck, and we left our offices in London in March 2020 to begin the long 'work from home', the issue at the forefront of our minds was the examinations. The materials UG Laws produce for the VLE, the Module Guides, the pre-recorded mini lectures were all in place and had been since October 2019. Access to databases and library resources were unchanged. We could do no more on that front; what we, UG Laws provided for students in a typical academic year was still there. Those students who usually had face-to-face teaching were at RTCs around the world and for the most part had completed the syllabus. In most RTCs teaching is completed by the end of February in preparation for a lengthy revision period followed by a break just before the May examinations. It was for RTCs to make alternative arrangements for revision classes but the issue we all faced, in common with universities around the globe, was how to assess students.

This was never going to be straightforward for any university, but it was a very different challenge for us. The University did not usually run its own examinations. Once the UG Laws examination question papers had been through the scrutiny committee, proof-read, and signed off for printing, then UG Laws played no further part in the process. The question papers were securely distributed to global hubs and ultimately to examination centres. The British Council or local examination syndicate organized local examination entry and secured examination halls and invigilators (proctors). They provided the first line of support for students on examination day, and they organized the safe return of the completed paper answer booklets to London. When the answer scripts were returned months later for grading it was the responsibility of the Exams Distribution Office to ensure that the bundles of handwritten scripts were couriered to examiners and it was the Assessment team's responsibility to ensure all the marks were properly checked and recorded in time for the meeting of the Board of examiners. The Associate Dean with responsibility for assessment would help the Chair of the Board prepare for the Board of examiners meeting, but that was the full extent of UG Laws involvement. It was otherwise entirely in the hands of administrative departments.

Until 2020, summative assessment for undergraduate laws students was, but for the assessment in the Dissertation module, by unseen, closed book, handwritten examinations lasting three hours and fifteen minutes. Although the Colonial Office, responsible for couriering the examination question papers to Mauritius in 1865 was consigned to history, the functions it once performed had barely changed. The British Council and a handful of local examination syndicates now performed the task of local examination registration and timetabling. The printed question papers were still securely distributed from London to more than 100 countries and, as they had been for 155 years, and the handwritten efforts of twenty-first century students, like those of their nineteenth century predecessors, were packed up and returned to London to be graded.

In 2020 the examinations moved out of halls and into students' homes, from handwritten to word-processed, from closed book to open book, and couriers were replaced with documents uploaded to the VLE. That, at least, is where we ended up. But that was not the intended destination.

4.1 The Process

"I have no desire to suffer twice" Sophocles is quoted as saying, "in reality and then in retrospect". In recounting the events of March–October 2020, I am doubtless ignoring this wisdom. When the pandemic hit London in March 2020 and the first lockdown began at the end of that month, the examination question papers for the May–June 2020 examinations had already been scrutinized, signed off and sent to print. But instead of waiting to grade the handwritten scripts in July, we now had to consider how to deliver the assessments to the 11,000 or so students who had registered for May/June examinations; a group spread across 115 countries and 265 examination centres who had already signed up for some 36,000 module examinations. This was not simply a matter of adapting our usual practices; this was a matter of filling a significant gap as well as undertaking a task that we had not previously fulfilled. The British Council and local examination syndicates were no longer the students first port of call, the University was. In line with UK government requirements all but essential staff moved to home working where their spouses, partners, housemates, and children were also locked down (most schoolchildren in England stopped going to school from mid-March 2020 until the start of the new school year in September 2020) and they wrangled for IT equipment and internet access as home networks suddenly had to accommodate video lessons and online meetings.

For most universities, the cohort they had to assess was an already known quantity, that is, they had been taught face-to-face, participated in tutorials and workshops and, in many cases, already completed formative or summative assessments. We had none of this contextual information. We might have moved a step or two away from being a "mere examining board" and made our learning materials more interactive, providing the opportunity for formative assessment in a handful of modules and some occasional tutor interaction but we were still very much a distance learning program. And the pandemic amplified this distance.

When the first lockdown began, we were just 30 working days away from the scheduled start of the May/June examinations and so the first thing we did was to postpone the examinations by two months to July and to reduce the assessment burden. We announced this on 30 March 2020, just one week after the first lockdown in the UK was announced.

4.2 Selecting an Assessment Method

A drastic change to the way in which students are assessed in a module or course can require significant changes to the learning and teaching of the module. The resources we had all pointed in one direction, and that was to the summative closed-book examination that had been our mainstay for one-and-a-half centuries. The past examination papers, the Chief examiners' commentaries, the formative assessment exemplars of student work with annotations and grades were all created by way of preparing students for these end of year examinations. Further, the students learning and, for those who attended an RTC, the teaching they had received had been in preparation for this particular mode of examination. No students had completed extended essays or coursework as part of this program, and even delaying the May/June assessments until July still only gave 12 weeks until the assessments began, and so any changes needed to be communicated quickly and clearly, and any further resources provided almost immediately so that students would be able to prepare appropriately. Guidance and advice were only just emerging when we decided to try and replicate online the usual student examination experience of an invigilated examination centre. The only option for this was a type of proctored assessment.

Moving to online assessments was a gargantuan undertaking given the time available and required enormous dedication from the staff involved to accomplish, in seven weeks, a project that would ordinarily take many months, if not years, of preparation. The legal complexities in the United Kingdom of the General Data Protection Regulation required extended contractual negotiations, a privacy impact assessment, data protection impact assessments, and IT stress and security testing before we could settle on the platform and move to student testing and familiarization. Many providers of proprietary software for online proctoring offer only one option for proctoring and this is live proctoring where the student is monitored remotely, by a human proctor, who is typically responsible for invigilating anything from six to 15 students at any one time. This requires the student to have basic IT equipment running Windows or macOS equipped with a webcam and microphone but, more importantly, a good internet connection. The requirement for a good internet connection of 300kbps download and 250kps upload speed ruled out the use of live proctoring. Our survey of student IT equipment and internet access had confirmed that most students did not have the required internet technology to be live proctored. A step down from live proctoring is what is usually described as 'record and review' although each provider brands this option differently. Record and review uses either an already installed internet browser (such as Google Chrome or Firefox) or a proprietary browser which students download to their device. On assessment day the student logs into the assessment platform and the question set is downloaded to their machine. Once the assessment window opens, the clock begins to tick, and the student's computer is locked down until they complete the assessment and submit it or when the time to complete the assessment expires and it is automatically submitted. The main advantages of record and review are that it provides an ID check, it records the student sitting the assessment, and any interruptions are flagged

for review. Record and review does not require the student to be online except at the start time and, ideally, at the end time when they submit the assessment. Because it records activity and saves this data on a local file it also provides the security for the student of knowing that even if they cannot get online at the submission deadline their work is securely stored for submission later and, in terms of equity in assessment, ensures that all students complete in the allotted time.

Live proctoring or recording students' personal data, their ID, the inside of their homes (if they choose to take assessments there), the contents of their computer screen as well as anyone who may enter the frame during the assessment does of course, as many commentators have identified (see, for example [9]) raise serious privacy concerns. The main aim of higher education institutions in proctoring or recording assessments is to ensure the integrity of those assessments. This is all the more important where the numbers of students attempting an assessment is high. Lanier [10] has identified that academic dishonesty is more prevalent in online and distance learning courses than in the traditional face-to-face teaching environment and Newton [11] revealed the big business of cheating when assessments move online, and "no one is watching".

By mid-May 2020 we had completed the privacy impact assessment and were able to run a large-scale pilot for more than 1000 students and to test the marking functionality, and it seemed that we were on track. The pilot identified a technical problem in Bangladesh and a further pilot resolved the glitch using a VPN. That is not to say that it was plain sailing and inevitably the final product was premature, born of compromise and pragmatism. One notable compromise was that even though the assessments were monitored they had to be open book. This was because most module examinations had permitted materials in the form of a printed statute book. Since it was not possible to inspect the statute book in the same way as happened in an examination center to check that it was in fact just the specified statute book without notes, annotations, or additional pages, we concluded that the most equitable way to proceed was to admit that it was open book.

4.3 The Real Test

The first day of assessment, involving just over 1000 students placed enormous strain on first line support and the second day, involving over 4000 students, revealed that the scale of first line support required to assist students was unsustainable. While the overwhelming majority of students, 93%, were able to successfully complete each assessment, 12–15% required help at some point on assessment day. While there were some problems in individual cases in terms of power cuts, internet connectivity, and outdated IT equipment, it was ultimately the support requirements that brought the endeavor to its knees. The assessments for the remainder of the examination session moved to the VLE where the question paper was released at a specific local time and had to be submitted two hours and 45 min later as a document.

This first section has provided the context. It has described the milieu of this flexible distance learning program and located the response to replacing face-to-face assessment in 2020. The overview of assessment in 2020 is precisely that. Anyone familiar with moving assessments online will recognize that it is a huge multifaceted operation involving specialist inputs from a whole range of colleagues from IT to legal and from comms to—perhaps most importantly—first line support. More than two years on from the outset of the pandemic there is a proliferation of resources to guide planning, highlighting pitfalls, and securing a successful transition to online assessment. The solution for every course, module or program will be different and this will often be due to variables such as student numbers, whether the course is undergraduate or postgraduate, how it is taught (if indeed it is taught), the assessment methods used, and so on. Reflections on how far assessments in 2020 were successful will likewise need to take account of the extraordinary realities of 2020. In *Roe* v *Minister of Health* [1954] 2 All ER 131, the English Court of Appeal considered whether a medical doctor had been negligent when administering an anesthetic [12]. In 1947, when the incident occurred, it was common practice to store the anesthetic in question in glass ampoules immersed in a phenol solution. In 1947, it was not generally known that glass ampoules might have microscopic cracks permitting inward leaks that could ultimately contaminate the anesthetic. Holding that the doctor was not negligent Denning LJ said "[we all] have to learn by experience; and experience often teaches in a hard way. Something goes wrong and shows up a weakness, and then it is put right… We must not look at the 1947 accident with 1954 spectacles". Much can happen in a couple of years, especially given the pace of change today, and we must remember when looking back on the events of 2020 that we were not wearing 2022 spectacles at the time!

In the second section, I will reflect on something that we did not see directly in 2020. It might or might not have entered our peripheral vision; our focus was on more pressing tasks. This reflection will look more closely at what went unobserved and consider what happens when one particular resource for learning—the teacher—is not there or can no longer fully realize their authoritative role. This specific point is considered in the wider context of how resources for learning and access to those resources impacts learning.

5 Resources and the Modes of Learning

Modes of learning, that is the ways in which learning transpires or comes about, and the methods by which learning is articulated and performed varies across time and amid cultures. What is learned, what knowledge or skills are acquired through study or the experience of being taught is not fixed. Indeed, the very notion of knowledge as an objective phenomenon is contested in the post-modern era. How we learn very much depends on the access to resources for learning. By this I mean not only texts and the associated media technology provides, but also the human actors in this endeavor of learning and teaching.

The predominant structure of the late twentieth century and early twenty-first century undergraduate degree has been through the alignment of teaching, learning opportunities, resources, and assessment. Outcomes based learning, explicitly or implicitly, has permeated higher education as the fundamental tool of alignment. This is relatively straightforward in a face-to-face model where students engage with the teachers who designed the course and assess them, but where the functions are distributed it is more problematic.

In outcomes-based learning, "what matters ultimately is not what is taught, but what is learned" [13]. The design for learning starts with learning outcomes and from these outcomes the details of the curriculum are teased out. Teaching becomes activities or opportunities for learning, and assessment becomes a presentation of what has been learned. Gosling and Moon [14] define a learning outcome as "a statement of what a learner is expected to know, understand and/or be able to demonstrate at the end of a period of learning" and the teacher's task is to "ensure that there is alignment between teaching methods, assessment techniques, assessment criteria and learning outcomes" [15].

The focus of outcomes-based learning is a student-centered approach. In contrast to the teacher-centered approach, where the focus is on the academic content of a module, this student-centered approach is focused on what the student must achieve both as a benchmark to meet the module outcomes and how they might perform well, and surpass the benchmark, in assessments.

Successful learning should lead to success in assessment, but this too requires alignment, and assessment tasks should effectively mirror the learning outcomes. Insofar as students are concerned, the assessment is the curriculum: "From our students' point of view, assessment always defines the actual curriculum" [16]. Figure 1, adapted from Biggs [17], illustrates the strong link between curriculum and assessment from both the teacher and the student viewpoint, but it also shows

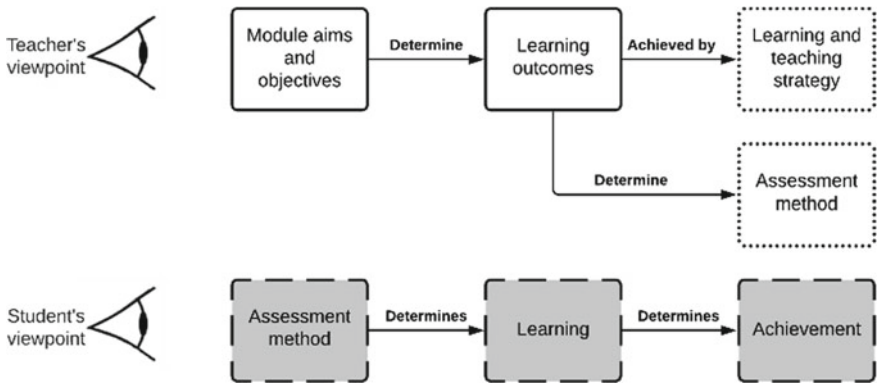

Fig. 1 Assessments from difference viewpoints

how these are very different perspectives. From the teacher's perspective, "assessment is… the end of the teaching–learning sequence… but to the student it is at the beginning".

Each UG Laws module has a module descriptor which outlines the module purpose, overview and aims, and conveys the intended learning outcomes in terms of both knowledge and skills. The learning outcomes are informed by the Quality and Assurance Agency (QAA) law subject benchmarks 2019 [18]. The primary resource for learning is the Module Guide supplemented by additional resources on the VLE. The resources are designed for self-directed learning (the 'independent' student) and the VLE provides some audio presentations and quizzes but the only substantial interaction a student who does not attend an RTC can have, beyond these resources, is with other students on the module discussion forums. The learning and teaching strategy is focused on the independent student and although the resources on the VLE have been developed to include opportunities for formative assessment and peer review, this has been done with this independent student foremost in mind. The rationale for this is that an RTC student learns, and is taught, face-to-face locally and this is *additional* support. The UG Laws materials provide the learning opportunities for an independent student to succeed; they also enable an RTC student to succeed because the RTC students have the benchmark materials and more.

Implicit in this approach is that additional layers of support can be added to the standard resources. At the center are the core learning materials that provide the benchmark provision. These include the Module Guide and the VLE resources as well as access to databases and e-books. The core materials are designed for the independent learner, and students can then choose to add to this core additional layers of support. Figure 2 shows face-to-face teaching and private tuition as extra layers simple because these are the two most common 'add-ons' for UG Laws students. The face-to-face teaching is generally, but not exclusively, provided by RTCs and on

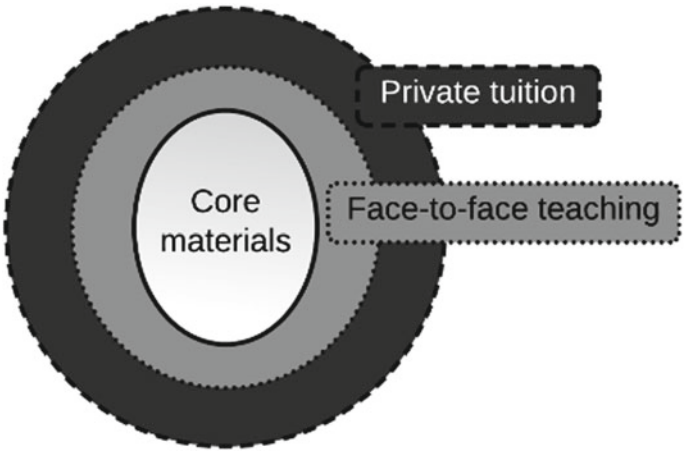

Fig. 2 Layering resources with teaching

top of this many RTC students take private tuition. In Pakistan 11% of rural students and 54% of urban students take private tuition during their school years and this has spilled over into higher education [19]. Somewhat counterintuitively, Khan and Shaikh found that "private tuition is, in fact, a supplement undertaken by already high-achieving students" and not necessarily those we might anticipate would seek additional support [19].

The 'learning goals' for UG Laws students are still dominated by final examinations, a model that many universities began to move away from as early as the 1970s [20]. The claim that 'students learn [only] what you inspect and not what you expect' [21] cannot be easily cast aside but, even where face-to-face teaching is the norm, students can and doubtless do at least sometimes, ignore the teaching or fail to engage in learning opportunities. What they cannot, if they wish to achieve a qualification, is ignore the assessment.

Term time teaching for those UG Laws students in the RTCs is dominated by answering examination questions from past examination papers. The syllabus is tackled by studying a chapter and then looking at a past examination question of relevance to the material in the chapter. Private tutors replicate and reinforce this approach to learning. Criticized by the RTCs for spoon feeding students with notes and sample examination answers, private tutors nevertheless imitate, in a condensed format, the model of teaching that students are very familiar with throughout their school years. There is of course much sense when preparing for the test, to actively check your knowledge and understanding, and apply this to a problem-based scenario similar to that which you would face in the examination. So far so good, but when students from our biggest markets, in Southeast Asia, were separated from their teachers—the principal resource of their learning—then things started to go awry. We did not fully understand the extent of this mode of learning in 2020, nor of its high dependency on a single resource for learning—the teacher.

6 The Sage on the Stage

Describing learning in Pakistan, Khattak [22] writes,

> The teachers generally act as authority in the classroom, dictate commands, and assign work and work-related activities. Similarly, to encourage a complete reliance on memory, it appears that the developers of the board exams have intentionally maintained a content heavy pattern, where the students are graded mainly on exact reproduction of the textbook content.

The outcome of this method of teaching is that it "create[s] students dependent on direct instruction, cramming, drilling and coaching, reliant on expert instruction by teachers who are expected to guide learners through a carefully prescribed body of knowledge, assessed in predictable ways" [23]. Nevertheless, "mere examinations" it seems, even where "a regular curriculum of study has been followed, [can be] a very insufficient test of education" [4]. The syllabus can be dense and demanding but it can

be ‘learned’ in more ways than one. At Level 4 (the first year of undergraduate level in England and Wales), what emerged from the 2020 assessments was a patchwork of rote learning loosely stitched into a quilt of many patterns. In some cases, the stitching was pretty basic, and in others more intricate, but for the most part the stitching was clearly visible. Students had moved beyond the single text but not beyond the notion of the text as the knowledge to be learned and the teacher—albeit diminished by the pandemic—was still the vestigial authority identifying what needed to be remembered and regurgitated.

Inevitably, all assessment systems are embedded in academic customs and the “institutional habitus” [24], and yet somehow this culture of outcomes-based assessment had, in pen and paper examinations, been tackled successfully in ways which its designers never anticipated. The shift to online assessments, the only feasible assessment regime in the locked down world, shook the foundations of more than 150 years of assessment. Now we had to worry about plagiarism and essay mills, and those students who were rooted in modes of learning which had previously delivered successful outcomes discovered that remembrance and regurgitation was now called ‘cut and paste’.

Worse still, their teachers knew only what had suddenly become, for us at least, the ‘old world’. They too were products of the same education system, and their value was that they knew how to take those rote learned patches and create a serviceable quilt, and, more importantly, how to coach others in this skill. This approach to teaching does not conceptualize teaching as creating learning opportunities, but as instruction based on content to be learned in preparation for an examination. Assessment, from this perspective, relies first and foremost on remembrance of knowledge, which can then be applied following learned patterns based on the precedent of previous tests. This might enable someone to achieve “the minimum that a law student will know or be able to do in order to pass at undergraduate level with honors, in other words the threshold standard”, but it would not meet the aspiration that “law schools will expect the vast majority of their graduates to be able to do much better than achieve this minimum standard” [18].

7 Seismic Cracks and Paradigm Shifts

In common with many other universities that had to find ways of assessing their students in 2020, we thought that we were simply moving something that had previously been done physically, using a pen and paper, and invigilated in an examination center, to the online environment. It is reminiscent of the ways in which the first online courses were effectively the hard copy printed materials naïvely moved to what was effectively an online filing cabinet. But this apparently small change was no small change, and the fractures it revealed were far from hairline. The teacher—the core resource for many students—was no longer there. Physically they had disappeared as RTCs, like schools and other teaching institutions, were closed down or face-to-face teaching was restricted. Online classes were particularly difficult in places

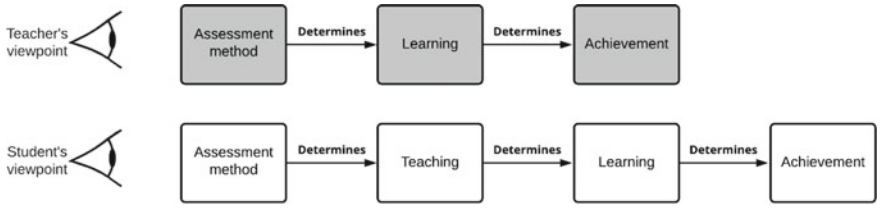

Fig. 3 Assessment from the teacher-centered approach

where internet connections were poor, and what we perceived as minor changes to the assessment had effectively robbed them of their authority.

UG Laws core materials are designed around an outcomes-based model of learning, but the teaching many students receive is instituted in a teacher-centered approach to learning. The assessment method, as Fig. 3 shows, determines first the teaching, and then the students look to that teaching, and more pertinently the teacher, "the authority in the classroom", to determine their learning in the hope that this will, in turn, determine their success in the examinations [22].

Implicit in the UG Laws model of distance and flexible learning is the notion that additional support is more support for the *same thing*. It anticipates support which builds on the same student-centered model and one which points to the same goals. Somewhat bizarrely, the teacher-centered (and private tutor) model is much more aligned with student expectations, as illustrated in the bottom line of Fig. 3. Biggs (2003) contrasted the different views of assessment held by students and teachers, saying that "[t]o the teacher, assessment is at *the end* of the teaching–learning sequence of events, but to the student it is at *the beginning*" (emphasis added) [17]. In this particular teacher-centered model both student and teacher agree that assessment is at *the beginning*. The teacher takes the assessment method as the starting point for teaching what they deem essential to achievement in assessment, and in turn, the student learns what the teacher tells them is worthwhile learning, motivated to achieve good results in the examination.

What this also reveals is that the layers of support were not in fact even part of the same onion! The core UG Laws materials were built around a student-centered approach and the teaching many students received was founded in the teacher-centered approach, as illustrated in Fig. 4.

This misalignment was uncovered by the pandemic but there is no evidence to suggest this was a recent phenomenon. Instead, it seems that the pandemic severed the long-standing link between student and the source of knowledge, the teacher. Additionally, the teacher had, to some extent at least, suffered a loss of authority in that they had little idea about how to prepare for open book assessments and they were as equally unfamiliar with the technology as their students. This was not, after all, an online course. Before the pandemic hit, the Module Guides and statute books were still provided in hard copy and RTCs had libraries of printed books and people could, until early 2020 at least, continue to learn in much the same way as they had for most of the twentieth century. And perhaps this was driven by assessment.

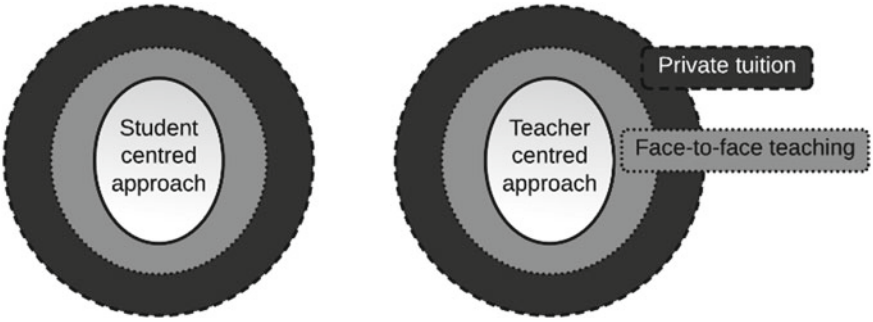

Fig. 4 Layering from different approaches

In the last five years or so, UG Laws has introduced different elements of assessment to the closed book final examination. This has been through academic articles, selected sections of statutes or single law cases provided six months before the assessment, which students know will be addressed in the examination. More than 30 years ago, Habeshaw et al. identified that time-constrained closed book examinations are a way of testing that rarely appears in the world of work and contended that they are an ineffective way of testing and measuring ability [25]. In law (and in many other disciplines), at undergraduate level, they are still nevertheless common currency in assessment. This is not an attempt to justify the continued use of closed book time-constrained examinations on the basis that it is only as bad as common practice, but simply to note that UG Laws is not out of step with what happens elsewhere. UG Laws does, however, operate in a very different environment to other higher education providers and, as we have seen this brings its own unique set of challenges.

8 Conclusion

In September 2021, I received an email from a German academic. It was headed 'the toothpaste is out of the tube'. I didn't know the phrase and it is inelegant but he's right; things can't go back to the way they were before. We can't push the toothpaste back in the tube.

The assessments in 2020 highlighted the disconnect between the student approaches to learning when driven by a teacher-centered approach in RTCs and other teaching centers and the intended student-centered approach through outcomes-based learning. Bringing about significant change is never straightforward and UG Laws has, to quote an oft used phrase, 'a lot of baggage'. Students are given a six-year period of registration to complete the award and although most students complete in three to four years, it is not uncommon for this to be extended by a year or two for students to finish their studies. These students signed up for a particular product, at

a particular price point to be delivered in a particular way, and while that does not constrain assessment entirely, it does create limitations.

The idea of the University of London has been through several iterations and now it seems that even its examinations are in need of re-assessment. The work has, of course, already begun. The challenge for all universities in this global marketplace that education now inhabits is the same as it ever was; to enable students to learn and to achieve the credential to achieve their goals. UG Laws has a proud history giving opportunities to those who would not otherwise have access to university qualifications, to sit its examinations. From prisoners of war to prisoners of conscience (including Nelson Mandela) and from Antigua to Zaire. And now we must begin a new chapter.

The shape of this new chapter is first, a clean break. Instead of tinkering large scale with the old model, we will let it run its course and fix only the essentials. A new online supported model for independent students will launch in 2023 and this will be developed entirely under our aegis where alignment of assessment with the learning outcomes can be configured through learning opportunities (at least from the teacher's perspective in Bigg's model [17]). A second version will be provided for the RTCs, moving all the learning resources online, and with a focus on training and supporting the teachers at RTCs.

This chapter has sought to provide a snapshot of how the COVID-19 pandemic affected one particular distance and flexible learning program in 2020. It started with finding ways to assess students; an essential step for most universities as we entered lockdown. Reflecting on that revealed (among many other things which this chapter has not touched on) that the teacher, the authority, and director of learning for many students, had been displaced by the changes to assessment and how much assessment had driven a kind of learning not to be found in the programs intended learning outcomes. A typical checklist for moving assessments online will probably not include a point on first checking that your assessment already drives the right kind of learning. It should, however, be an opportunity for all educators to revisit the question.

> Since assessment is a driving force for learning, we must be clear in our minds about the type of learning we want from our students so that the assessment tasks we set them will help achieve the desired learning [15].

Moving assessments, like moving learning and teaching online is not simply a matter of moving hard copy into electronic format. It is a paradigm shift. Whether such a shift comes about through the discovery of cracks (seismic or otherwise) or through periodic review matters not. What matters is that we act now on what we know now. Lord Denning's words in *Roe* v *Minister of Health* are as true for the educator's task as they are for the law of negligence, when "[s]omething goes wrong and shows up a weakness" what the reasonable person does is to consider how to put it right [12]. They execute the changes needed on the basis of current knowledge, and after considering the alternatives. History may, in due course show them to be wrong, but if future revelations is a barrier to current action, then a great deal of good may never get done.

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Bridging the Gap Between Academia and Business

Malcolm Parry

Abstract The tertiary education sector in all countries has been affected by the social impact of the COVID-19 era. The provision of 'on-line' or 'hybrid' teaching has enabled some education to continue but other aspects of campus life, such as postgraduate and other laboratory-based research activities, have been curtailed. The public hygiene strategy of cutting back some businesses through the COVID 'lock-down' has also interrupted some of the links between industry and universities, although some universities have expanded collaboration with local government and other agencies to work for recovery. Despite the effect of COVID, the demand for premium knowledge by individuals on which to build their careers has not diminished. In many countries both government and society have intensified their interest in universities with the view to them taking an increasingly active role in economic and social development. This expanded activity is now commonly described as a 'third mission' (TM). The development of TM has been growing across the whole of the international tertiary education spectrum for more than fifty years. Individual universities have developed deeper working relationships with industry, business, and the public sector. One of the consequences of COVID on universities has been to accelerate the need to put in place TM related activities, thus bridging the gap between academia and business. This chapter explores the issues and reflects on some aspects of the third leg mission for universities in an international context and particularly in the Arab World.

Keywords COVID-19 · University · Research · Teaching · Third mission · Knowledge exchange · Knowledge transfer

1 Introduction

Universities have evolved over many centuries. Some have long histories, but a significant proportion have developed in the last 150 years, and many more are younger.

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The generally accepted view of their mission has been to create high value knowledge from research and then to pass this on through teaching. This makes universities attractive places for talented people to work. Their breadth of interest spans from seeking a better understanding of the principles of science to its more practical value as technology. In the context of teaching the value to students is to help them understand the bigger picture, learn the high-level skills needed to find employment, and develop the capacity to pose and solve problems through critical thinking. These are cherished attributes but the financial demands of creating these communities have outstripped the capacity of the funding stream from the public purse and influenced universities to develop other means of creating some independent income. Since the 1980s there has been an expectation that universities should add more practical value to the knowledge they create. In the immediate term, this challenge has been exacerbated by the shock of COVID-19. It has resulted in an acceleration of the need for universities to become even more enterprising (entrepreneurial). This matches the same need in the commercial sector in which there has also been a significant shift in the balance of business towards adopting an entrepreneurial approach to drive development. The pandemic has also come at a time in which there is a much longer-term influence on tertiary education. The perceived value of universities by society has prompted an international trend of increasing demand and provision for higher education and has disrupted what was an elitist model. This demand has predominantly been driven by the increasing number of young people who value knowledge to the extent that they stay in education beyond the age of 18. As a response to this demand there has been burgeoning supply. It occurred in North America and Europe in the early 1960s and more recently in the Middle East and Africa [1, 2], Latin America [3], China [4], and other Asian countries [5]. For those countries that have been responding to this trend since the 1960s, the result is an average of 45.5% of those in the 25–34 age group (in the period 2017–2020) with tertiary education qualifications [6]. The transformation of science into practical application has been built on the advances developed in industrial laboratories, in research institutes, and to an extent by the academic research community. A major part of this utility of knowledge was advanced by the cohorts of university graduates joining the workforce. These combined resources have been active in moving beyond science to invent new technologies and develop new products that are the foundation of much economic activity today [7, 8]. Looking forward, it is likely that adding digital technology to this mix will increase the region's absorptive capacity and further accelerate economic activity. However, the extent to which this added absorptive capacity may be limited if the value of the knowledge lacks alignment with the skills needed by technology companies in order to develop market related products and services. A study of 15,000 universities in some 1500 regions across 78 countries, reported in 2019, noted that the presence of a university in a region increased the gross domestic product (GDP) per capita by 0.4% [9]. This additional value was found to result from the effect of an increased supply of human capital that remained in the region after graduation. This increased the absorptive capacity for economically useful knowledge with a consequence of driving innovation in the economy over and above the increase of a university's expenditure by staff and students [9]. The long-term challenges faced by

society, including ageing populations, youth unemployment (a particular problem in the Arab world), urbanization, environmental degradation, climate change, and the likely persistence of COVID or emergence of other pandemics, all need solutions. In seeking these there has been increasing interest by governments and society in the roles played by universities. There is a need to continue to bridge the gap between universities and business with social and economic entrepreneurship [10].

The concept of the Third Mission (TM) for universities has been slowly developing as an important structural element for regional and national economic development. This leaves the traditional university roles of research and teaching intact, while adding a range of managed activities that have important beneficial regional impacts. As centers of research, universities are a critical ingredient which increases the stock of human capital that flows from the combining faculty members, research activity, and the unique role of teaching students to first degree and higher levels. The importance of this role to regions is that they are a necessary ingredient although not alone a sufficient condition for driving economic development as they need to be part of a wider regional knowledge ecosystem. This implies that the spill over of knowledge has a geographic dimension and emphasizes the importance of the element of their TM activities that link universities to industry and business to modernize their activities and in creating effective knowledge-technology ecosystems. Going beyond this combination, there is also potential of linking research and teaching with entrepreneurship that can accelerate the impact of human capital in the economy by moving economic resources from lower to higher productivity and yield. This idea has modernized and extended to encompass driving innovation into the economy through the capacity of alertness of individuals to new business opportunities. The importance of the process has attracted a whole industry to support these economic entrepreneurs that cover financing their activities, as they test ideas against demand and competition. However, it is important to recognize that not all entrepreneurship leads to building a successful profit led organisation as many entrepreneur led ventures fail, but their value in building recognition of the need to overturn subjectivism or a concept of an incontrovertible norm in the economy is important in pushing economic development. Personal experience is that the developing entrepreneurship among students is a missed opportunity in many universities that needs to be developed as part of the post COVID growth of these institutions. Where this opportunity is already being exploited, this involves programs to help students better understand the processes, characteristics, and tools that support entrepreneurship, with the intention of developing their utilisation in the business and social environment, and help them as individuals develop as either necessity or opportunity driven entrepreneurs, but in both cases either increase the employability of their graduates or encourage them to build businesses.

The opportunities for entrepreneurship as an economic activity also has the benefit of creating the foundation of social entrepreneurship. This extension is based on entrepreneurship that is focussed on developing business-based strategies that create solutions to cultural, social, or environmental challenges. In these cases, the value of these are measured by the degree of the beneficial impact on society or the environment. One of the factors that define the critical distinction between entrepreneurship

and social entrepreneurship lies in the value proposition of the intended activity. This argument is based on the premise that, for economic entrepreneurs and their investors the value of their enterprises must derive some financial gain, and that the market will fund this process. In contrast, the value proposition for social entrepreneurship is founded on the assumption that the enterprise does not anticipate nor organises its investments to create substantial financial profits for investors. The intention of social entrepreneurship is to achieve value in the form of large-scale, transformational benefits for either a significant part of society or society at large.

2 Research in Universities

Research activity in universities is one of the factors that enable the creation and teaching of premium high value knowledge. This relationship is part of the process of creating sound and effective pedagogy. Other benefits for society include the discovery of new knowledge that will be essential across the immediate and long-term time horizons. The expansion of the university system worldwide has increased the demand for funding for research. This interest is driven by a number of factors. These include the natural desire of academics to develop new knowledge, the potential this has for advancing their careers and, at the institutional level, by helping to raise the ranking of their university (with the consequent potential of attracting more able students). Governments are thus challenged to spend more money. The competition for funding has required research applications to increasingly reflect social or economic impact and show that the proposed project has sufficient international interest and value. In this competition one of the benefits of an effective TM strategy is that it builds relationships with local, regional, and national businesses. There are counter arguments by academics in the scientific community that the reliance on the methods of the measurement of international interest in research output skews the funding and may miss a critical opportunity to localize the relevance of research, because of the need to publish outputs. This new direction is beginning to increase the momentum towards a more sophisticated and meaningful approach to the evaluation of research [11]. This is happening at a time when new dimensions to economies are actively developing, with technology becoming increasingly embedded in economic activity. This includes increasing social and commercial interest in invention, innovation in exponential technologies and platforms, and a drive to increase the use of digital technologies in commerce and by governments, all of which examples require high level skills in the labor market. Creating and maintaining this alignment is not a simple task as there is a drag on change due to the history of some institutions. There can be a negative influence from the culture in which they operate, by the prevailing economic conditions of the region, and the business model of each institution. However, there is potential for each university to focus its mission to overcome these constraints by developing a relevant and effective TM to increase the university alignment with regional challenges. This new TM activity as an evolving idea is less precise in its definition and practice compared with research and teaching, but

with time it has begun to evolve into a number of better-defined strategies. These match the different business models in which universities operate and the prevailing economic and social conditions in which they function. Its development is likely to set the pace of change in universities post COVID because of the increasing level of interest by societies and governments in delivering skills for the future and in research outputs. If universities adopt a more regional focus, then a stronger influence on driving specializations that concentrate on particular topics and technologies will result. However, implementation of both building vocational courses and relevant research that complements the main academic mission in a local and regional context is likely to face a number of barriers, not least of which is the business model of each university.

3 Teaching

In the short term, the influence of COVID has been particularly significant for the education sector because it has impacted on all young people by interrupting their education, as well as curtailing the social value of the education process. Experience of operating student enterprise education programs is that many student-led enterprises are based on ideas and potential markets that the more entrepreneurial and alert students develop while working and living among their peer group and use the opportunity to test their ideas to assess demand and competition, which if successful, can lead to some form of small investment as a prize. The isolation of students during the COVID era may possibly have an impact on the early stages of business ideation. It is widely acknowledged that for those in compulsory education, missing some proportion of education is likely to have a long-lasting impact on their life chances, particularly if they have been unable to gain access to online teaching and learning. This deficit may have some implications for those cohorts both coming through their university education and those now leaving to join the labor market. For the latter group, they are likely to find a reduction in the availability of opportunities in the employment market because economies have shrunk. Their progress may also be hampered by the educational deficit in terms of knowledge and skills that has resulted from the closure of university campuses and the move towards online teaching. On the positive side, the development of online courses is likely to have had some value in resolving this deficit by making course work and teaching more accessible outside university terms and the period of the original degree course. This kind of development can help students extend their exposure to education, particularly if it includes elements of business development. In addition, the development of remote educational material and the refinement of the process behind participation may be part of a long-term trend towards the democratization of education, bringing with it the broad-based benefits of access to useful knowledge. Of course, this is subject to public policy on expanding digital connectivity and the plans on offer to students by individual universities.

The closure of campuses has had a profound effect on those students undertaking postgraduate and doctoral research that requires access to a laboratory and equipment. Many examining bodies and organizations that fund research have adjusted their regulations to accommodate and help overcome this, but funding for a catch-up period will remain a challenge. Some universities are reported to have waived fees and helped by offering support programs. At an institutional level, depending on the long-term virulence of the virus and the success of modern public hygiene at containment, universities are likely to help regional economic recovery over the coming period as their graduates find their way into the economy. To build on this opportunity, the work of university 'Careers and Employment' offices need to be part of the TM process.

Universities also play a regional role as drivers of economic growth, and they influence local social and economic dynamics by creating physical assets or bringing in direct investment through their role in research. This is particularly the case if a university is able to lay the foundations by using research to build clusters that attract interest. In the longer term, following the impact of the pandemic, universities will continue to teach. Some may develop new ideas and increase the rate of change in their programs and alter how they fit into national research structures as local economies rely more heavily on knowledge as a productive agent in the economy. It is very likely their most significant impact will be to increase their individual role in regional development.

4 History of the Development of the University Links as a Precursor to the Third Mission

The collaborative links between universities, industry, and business have a long history. It started in the late 1800s when a number of universities in the industrial world were founded with the intention of educating students in engineering, technology, and science in order to support a regional or national industrial base. Examples of these include Stanford [12] in the USA, the University of Surrey in the UK [13], French Engineering Schools such as the Ecole des Mines [14], the University of Science and Technology in China [15], and the Indian Institutes of Technology of which the first was founded in 1951 [16]. However, the relationship was institutionalized by America's post World War II science policy that resulted in long standing links between universities, government, and business [17–19]. It was then consolidated by the Bayh-Dole Act of 1980 that allowed academics to exploit their patents [20]. In 1963 the government of the UK made it clear that if the UK was to prosper, the "new Britain" needed to be "forged" in the "white heat" of the "scientific revolution" [21]. By the late 1960s this was marked by the important milestone of the development of science and technology parks, and in particular the founding of the Cambridge Science Park [22]. A funding crisis in universities in Europe led many of them to license, and in some cases to form, university spin offs, such as

SSTL (Surrey Satellite Technology Ltd), to exploit their portfolio of patents in order to generate independent income. This raft of activities prompted universities to take a widening role in supporting regional economic development [23]. At the same time the historic industrial research base, established in the 1930s and conducted to run expensive corporate research laboratories, was contracting. There was a shift from a focus on research to one based on innovation [24, 25]. This led to some companies looking outside their business to find ideas they could internalize or push into the market. The aim was to add value for customers, and to start and develop a trend towards an open innovation strategy (of which one source has become university research groups with which these companies created links). An example is the development of a 5G communication research facility on the University of Surrey campus in Guildford that has attracted significant industrial research funding. In China the government began to support university led technology transfer (UTT) programs to push up university research capability. This led to significant further investment in the 1990s, with an increasing concentration on national innovation systems, university operated enterprises, science parks, university spin offs, university-industry linkages (UIL), the formation of university technology transfer offices (TTOs), and patents and licensing [26]. The World Bank has emphasized that in its opinion the tertiary education system needs to be at the heart of the transformations required throughout economies and societies, and that to do this requires investment in the system [27].

5 The Third Mission

Today the TM for universities continues to grow in importance [28]. Despite this its interpretation and implementation vary, which makes it difficult to define it in any more detail other than stating that it refers to all activities concerned with linking research and teaching to third parties. The close to universal adoption of the TM function by universities has prompted many to create a formal Knowledge Transfer Office (KTO) to implement the strategy. The most frequently stated reason for the development of a TM strategy, in Europe and to an extent in the USA, is that a reduction in public funding has caused a need to create alternative sources of income to make up for the loss of public subsidy. However, it is important to recognize that in some countries, such as China, and more recently in some universities in the Gulf States, there has been an increase in investment in their universities with the intention of supporting national innovation strategies. Despite the significant interest in TM it remains an activity that needs to be either grafted onto each individual institution or generated from within. Each institution has been shaped by its own history, which in turn has been the foundation to its business model. This means there is no clear template nor in many cases a national or regional policy framework on which to base the developments. The COVID pandemic has proved to be a major disruptor to universities. In relative terms when compared with other historic challenges, this interruption has been short-lived but severe. There are few if any activities that have not been restricted and the legacy of the pandemic will have

more profound implications for some sectors than others. There is a view that some industries have been influenced to an extent that they may not be able to continue in the same form as pre-COVID, while others have identified new opportunities and pivoted in order to thrive. Between these extremes most businesses—small, medium, and large—are working to survive and in some cases consolidate as society learns to live with the virus. In many cases, survival has been dependent on support strategies from the government. As these are phased out, the companies concerned are likely to have to increase their investment in technology. The relevance of this to university TM programs is that many governments are looking to their universities to play an active role in the recovery by taking a regionally focused partnership role as part of a collaborative recovery plan. Some universities have published the plans they have developed in collaboration with local government but these, naturally, tend to have a local focus [29 30]. They do express the view that developing responses and solutions sits well within the purview of the potential of any university's TM. Specific ideas in this context include playing a role in supporting cluster formations, which may include taking a strategic role in the relevant research and related education or training programs to support those organizations already operational in a cluster. If there is no existing cluster then strategies to drive this process are developed by working with the public and business sectors to mastermind potential options. Universities may start local research projects to evaluate the spectrum of technologies that have potential in gaining traction in the significantly large market in Arabic speaking countries, using business-to-consumer and consumer-to-consumer foundations as examples. The development of the delivery of the TM is equally as convoluted as its history. In the UK the government has been refining its ideas and has produced over five reports on the topic [19, 31–34]. A National Centre for Universities and Business has been established with the intention of encouraging knowledge exchange activities and of developing new effective innovation strategies [35]. In an international context many governments are also creating legislation to support their strategies. Examples include 'Patent Box' that gives tax exemptions to companies exploiting patents registered in their territory. In addition, the idea of 'sand boxes' are now increasingly supported. These give companies tax benefits while exploratory work is undertaken to identify potential value in innovative ideas. Some governments have also assisted their universities by funding professional training for their national Knowledge Exchange Organizations [36], and in many countries government funding of university research requires each application to be supported with a statement on social or economic impact. In some instances, if a business is able to support the application then it gains points in the assessment for the funding process.

6 Third Mission Programs

The range of services and functions that most TM programs offer to the academic community and external organizations that want to connect with the host is broad,

and continually evolving. However, there are a number of common services and functions that have been developed to deliver this mission.

Knowledge exchange involves a two-way exchange between researchers and research users, such as businesses, to share ideas, research evidence, experiences, and skills. It refers to any process through which academic ideas and insights are shared, and external perspectives and experiences brought into academia. This is a specialist process that can help to increase the impact of academic work. The purpose is to provide training and support for academics as they build external relationships.

New venture programs are now common in many universities, of which some have been pioneered by the KTO in the University of Surrey's SETsquared student enterprise program, and are illustrated in Fig. 1 [37].

These programs are based on operational approaches that include workshops using lean startup and Strategyzer [38] tools, spin off programs, business plan competition, mentor and incubator meetings, pitch sessions, and design thinking. The intention of these entrepreneurial programs is to help support both students and staff to think as entrepreneurs by stimulating individual motivation, creativity, risk taking propensity, and by emphasizing the need for achievement and autonomy. Physically they include startup weekends, demo days, pitch events, hackathons and prize challenges. The programs that are aimed at 'innovation to commercialization' are focused on commercializing ideas that have commercial potential by moving up the value chain and out of the laboratory and validate the idea in the marketplace. In some programs once an idea has been validated the development team can then build on this and pitch for other sources of funding to assess whether there is stronger market

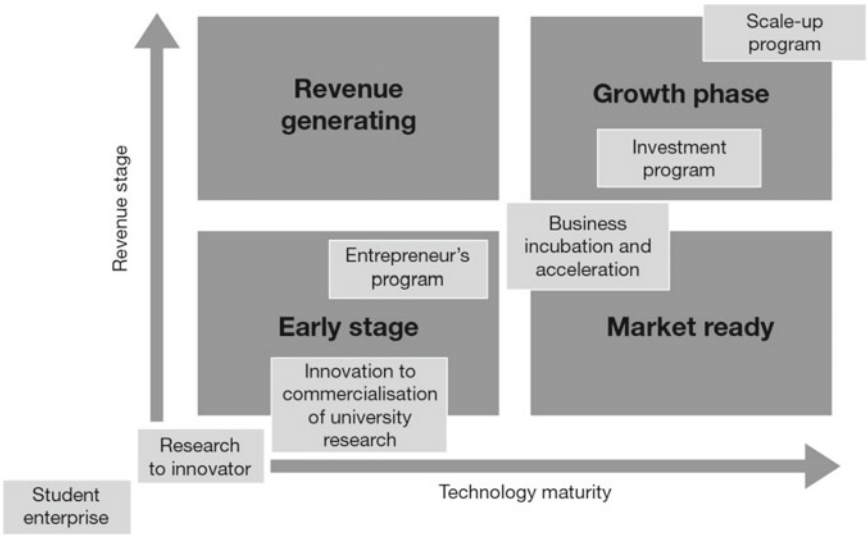

Fig. 1 Perse comm Programs for linking university R&D to entrepreneurship—(perse comm SETsquared Surrey)

interest. To help with this process some of these internal programs attract interest from investor groups that have market knowledge that can be helpful in advising the development team. The target groups in universities for the early-stage commercialization programs, beyond the student enterprise and 'research to innovator' programs, include early career researchers, senior researchers that are often principal investigators, technology transfer officers that sit in the KTO, or business advisors that may sit on a faculty's business advisory panel. The value of these kinds of programs goes beyond the actual output. Companies scale and build employment by using this entrepreneurial education to develop an interdisciplinary based lifelong process which fosters collaboration between business schools, social science and humanities (SSH) faculties, technical faculties, and research institutes. If this is achieved then it helps develop cross-fertilization of ideas which, in turn, encourages the involvement of entrepreneurial actors. It also facilitates the establishment of 'living lab programs', often run by civic authorities within their jurisdiction, and of fab labs and co-working spaces on campus, all of which help to add value to basic research and provide graduates with the skills necessary for complex problem solving and drive innovation. Forty years of personal experience of many science and technology parks (STPs) and incubators is that the origins of companies include spin-offs from the host and companies from the business community, although most have a gateway policy that controls entry. This normally requires those that join to be science, technology, engineering, technology, or social science and humanities based. This goes further in some incubators and not only allows access to companies with a commercial focus but also those that support social entrepreneurs. The value of attracting companies from outside the academic community is that they commonly bring business experience to the community, and some bring business angel investors; an important part of the innovation cultivation process and an aid to building an academic-business network. Worldwide initiatives by universities to support student entrepreneurship have been established. There are many formal projects now in play across MENA [39] some of which include multi university collaboration such as TAQADAM Startup Accelerator [40]. In Pakistan the National University of Science and Technology has established a center [41], while in India initiatives include some incubators calling for startups and entrepreneurs to strengthen the fight against COVID [42, 43]. In the UK, the SETsquared program is run by six universities through an overarching operation company, and their role extends into student enterprise as well as taking a regional role in nearby towns and cities where there is an opportunity to widen the catchment to other graduates that are unemployed. Other place-based activities include building into a campus space, facilities that creates an internal student incubator, fab-labs and making places that can be used for prototype development and student entrepreneurship hubs, where students can hone ideas for building businesses. One of the critical roles of KTOs is to manage research contracts which include the preparation of research grant applications. This requires expertise that goes beyond the technical explanation (with associated details of the research program). The added value of this function comes with a detailed knowledge of the ambitions of the grant awarding organization, and the kind of detailed terminology that is likely to support the application. This required a combination of the expertise of other specialist team

members, who have close connections with potential partners, and able to express the commercial potential of the project. These contacts can be built through personal relationships or through agencies such as the equivalents of chambers of commerce or other business-related professional groups that are active in the region. To be effective in building an academia-business link requires a high skilled TM team**.** When establishing this team there is great advantage in recruiting staff that have experience of working in industry and who understand R&D, sales and marketing, contracts, and how to negotiate. They are not only of value in the day-to-day operation of a KTO but they also help academics to be more effective. Those in the TM team need to take an outward facing approach to their role so that they can develop a better understanding of the kind of contribution they can make in developing their internal and external relationships. An area of expertise that is growing is software commercialization. To deliver effective advice on this requires those supporting the process to understand disclosure. This is a skill that can help to add value to a KTO. The need for skills in general intellectual property (IP) management has been well understood for many years. Typical skills include a good understanding of the kinds of documents that can be used to protect IP. Publishing advice and advisory documents given to academics, doctoral college students, and undergraduates is now normal practice. If these documents are supported by an experienced KTO, this can add value by using their skill to advise those who believe they have developed IP with value as to its exploitation through either licensing or commercialization through a spin out. These team members can help protect, register, and license or commercialize by giving advice of the best route to market.

6.1 Enterprise Education—Often Linked to a Business School

The curriculum for supporting start-ups typically involves:

- Starting a startup—this involves assessing the technical viability of an idea, determining market demand and its likely value, and then raising funding and developing the idea. The experience of running these programs is that some potential entrepreneurs come to this process having worked in a business environment and others come with no previous history of commercial experience. Depending on the level of business knowledge these programs are intended to help refine the product-market fit of their idea but also to allow the entrepreneurs to gain insight and to support the business processes behind the formation, development, and execution.
- Business incubation—the target groups for this phase are startups that are already active in the incubation process, that have developed a finance-ready business plan, but which need further funding to scale the business. Some of the individuals involved will come with well-advanced ideas that are refinements of products that

already have a market, while others will propose ideas that as yet have no recognized market. The program is aimed at helping to bring together a team for technology/product/service development, marketing, and moving to Series A funding. This A round of funding is the first that startups use to raise working capital beyond their initial seed capital funding that has drawn on personal resources, friendly business contacts, or family. The A round is the stage at which there is an equity exchange and introduces a third-party investor. This is usually needed to provide the finance for a company to take their product to a mass market and stabilize the company, and is a high risk period in which companies have outgrown their ability to generate revenue and need working capital to build their market. The focus for this is to build a market viable prototype (MVP) and take it up the value chain to find the first and subsequent customers.

- The next phase of growth—the target groups for this phase are startups that have graduated from incubation, and which are looking to accelerate growth. It involves the organizational, operational, and financial functions of a growing business while also addressing strategic issues for the future of the enterprise. This includes establishing an outward-facing team responsible for building a customer base and for creating an internal business team to develop the business structure and supply chains to deliver the company's service or products to customers.

6.2 Operating a Business Incubator and Accelerators

This process is dependent on whether the service is offered exclusively to internal startups or to the wider community. Much of what is offered is also dependent on the scale and scope of the physical facilities. However, beyond the normal business services, these will typically involve varying degrees of business education by professionals, combined with mentoring and coaching to build a finance ready idea. This normally follows the pattern of enterprise education.

In some instances where universities have land that can be developed, or have capacity in a redundant building, there may be scope to create an STP. Originally the majority of these were established by universities and their success has now attracted commercial landlords that not only offer space but also investment for companies if they are involved in the right industrial sector. STPs that are in the right location and well managed have enormous potential for building clusters of either narrowly focused technology sectors, or a more general range of tech-businesses. The value of companies on parks is that they can attract significant levels of inward investment, with some from overseas, providing space for 'returners' that have had a period of international science and business experience. Some countries offer special rates for those who return and establish companies.

Some universities have established their own science and technology park, business incubators and accelerators, and through these create a channel for commercializing ideas developed from their research base, as well as create links with technology companies that they attract to their site. The scale of these varies. Where they offer

incubation and acceleration programs as well as space for successful companies to 'scale', this needs an operations team. Where these parks are owned by the university, the management team usually reports to the KTO office. In other cases where the STP is a joint venture and there is a joint holding company, the responsibility for managing this relationship is through the KTO.

6.3 Organizational Structures of Knowledge Transfer Office

The development of a KTO, or what are also operated under different titles that include Technology Transfer Office (TTO), Industrial Liaison Office (ILOs), Office of Technology Licensing (OTL), UTTO (University Technology Transfer Office), and Research and Innovation Offices (R&I), have become commonplace. The structure of these offices and services vary across the sector. These include an internal unit reporting to a senior member of academic staff, external not for profit units, and companies that operate as a commercial entity [44]. The portfolio of responsibilities cover also varies but are usually influenced by each university's mission. The most common activities include services that support enterprise and innovation, and working with research teams on campus to develop research strategies with the view to writing and managing bids, with a growing interest in building local and regional links.

Typical enterprise and innovation activities include:

- A technology transfer function that embraces IP management and exploitation. In some universities there are officers that support grant applications and measuring the impact of any government funded research. This team may also work closely in managing collaborative work with companies that are developing a new technology and need assistance from the academic community.
- An enterprise development program, which can span both student and staff enterprises as well as working with external companies in an incubator on an STP. To deliver this service most use an internal team of experts from the KTO. These teams usually include 'entrepreneurs in residence' that support start-ups through coaching and mentoring particularly in relation to customer acquisition and funding but many also draw in experts from a local business community.
- The management of industry partnerships. Many of the employees (partnership managers) in these roles are subject experts that have sufficient knowledge to be able to work with companies while developing ideas that can lead to research contracts and build relationships with companies in their catchment area.

Research strategy and research services include:

- Bid writing. This is a specialist area and many grant funding authorities have tight rules for disbursement of funds. To support this function many KTOs are responsible for helping the academic community to prepare and submit bids to

regional, national, or international grant giving agencies and can entail developing these bids in collaboration with regional based companies.
- Using the skills and support of the KTO's partnership managers that are active in their enterprise and innovation work to help create links with businesses that have an interest in a particular technology to build a cluster of companies into a regional specialism. In some instances, the formation of a cluster is led by a university developing a specialism that produces spillover into the business sector, and in some instances the reverse is the case.
- Supporting research activities that are successful in attracting funding. A KTOs– team can also provide the academic community with support where research is subject to national or international regulations. Examples of where this applies is in healthcare research where this has to comply with legal, ethical, and scientific obligations.
- Providing the academic community with support in the context of the legal agreements that are used to manage external research contracts.

These various aspects of KTO operations are important as they create the foundation to TM activities that then helps to build effective outreach programs into their region. It is likely that post COVID, these outreach programs will increase in importance for universities, as they focus on building relationships with their communities.

6.4 The Management of the KTO

An extensive review of TM activities has identified a number of specific ingredients that are important for their successful operation [19]. These include:

- Leadership. To deliver a TM requires dedicated leadership and management that has significant authority and seniority, the gravitas and power to analyze potential areas of the research, and teaching that can be used to develop the mission. Without authority it is very difficult to gain the confidence of senior academics in pursuing central TM practices.
- Image of the university. It is important in the context of these relationships, and its history. High status universities are likely to attract more interest in their research over a wider catchment compared with universities that have a shorter past and which are still building their reputation. The latter can be offset by fostering clusters that attract companies of varying sizes, that can then build up to extend the cluster with specialist smaller businesses that can help to drive its economic impact around a specific technology or theme such as AI, health, or other advanced technologies. These cluster build around relationships between universities, government agencies, and the business community. This relationship brings efficiencies that are accelerated through networks as well as collaborative work that helps to transmit tacit knowledge across the boundaries between academia and business.

- Contribution. Universities need to work to understand better the kind of contribution they can make in developing their relationships.
- Representatives. Those involved should include representatives from industry and business as well as internal academic leaders that have a leaning towards supporting business development.
- Strategy development. It can be aided by a survey of existing connections with local businesses and by building a customer relationship system (CRM). This can be used to help prioritize the use of university assets and staff time. On the other side of this arrangement, both businesses and government organizations need to be brought together so that customer influence can be developed in relation to the service in question, and they can make the necessary investments to support it. This process can help to mold teaching and research strategies that can help develop productivity of collaboration.
- Confidence building. Developing a business incubation or other enterprise building structure, bringing in external stakeholders such as business angels, well connected mentors and other professionals such as lawyers and accountants, can then help to build confidence in TM activities.
- Political influence. The relationship can be strengthened if any political influence can be included in any processes. Such things may have value in developing funding streams and have a positive influence on policy decisions.
- Relevance to market needs. The principle of responding to market needs is more likely to deliver positive outcomes in any collaboration. Experience shows the immediate interest of business is a competitive advantage.
- Educational programs. The kinds of educational programs offered by KTOs need to have a strong operational and training element.
- Reward system. There needs to be a reward system for academics that take an active role in delivering a successful TM activity.
- Research career. The development of student and early career researchers' enterprises is often better supported using mentors from the industry on which their ideas are focused than from some of the wider more generalist support.
- Engagement. The engagement of external investors and supporters of staff is of value.

6.5 Some Contexts for the Success of Third Mission

A literature-based study of what makes industry-university collaboration succeed concluded that the relationships between university academics was influenced by a number of external and operational factors [45]. The strongest influences were four high-level moderators and comprise:

- The scale of the company e.g., micro, small and medium enterprises (mSME), large or international corporations. Experience of operating in this environment suggests that many of the smaller companies are interested in consultancy as the

best mechanism for knowledge transfer for their project. In contrast, larger companies are often looking for deeper levels of investigation in order to gain insights into the details of the science behind a technology. However, many universities are found to be difficult to penetrate by business.

- The level at which the relationship is established e.g., the status of those involved in the leadership of the relationship and their authority, and the internal processes that are put in place to deliver outputs. The traditional structure of university management has grown up around research and teaching. The introduction of the TM has required a new management structure to be developed to match the relationship of selling services to customers, managing the development of contracts, and organizing delivery within the terms of any contract. The uncertainty about the value of outputs of research, not through incompetence but as a result of negative responses to any experiments that are by nature open ended, adds a layer of complexity to any relationship.
- The stage of the development of establishing the relationship. This hinges on the period of the relationship and respective appreciation and acknowledgement of the professional competence of those involved in projects.
- The scientific discipline e.g., science, technology, engineering, or social science and humanities.

In turn, the framework factors that set out the operating borders of the links include the following, and the degree to which the participants are aware to these details:

- The business environment in which the relationship is established, whether on the client's site or on campus.
- The owner of any IP that arises.
- The nature of the contract that defines the parameters of the relationship. Many universities have standard contracts, which does not suit all external organizations, so this needs to be flexible.
- The geographical distance between the parties, although post COVID this may change with wider use of online connections.

Direct factors on the institutions side are listed below, the major cumulative feature of these elements being the degree of flexibility in their implementation.

- Resources that are allocated to undertaking the work.
- Management structure of the contract and its execution.
- Willingness to change as the project evolves and the extent of the permitted change in the contract before it alters any commercial terms.
- Internal processes—this concerns the relationship between those involved internally in terms of who checks adherence to the contract, delivery of the outputs, and collection of payments due from the project.
- Control over the relationship.

Relationship factors, which require honesty in terms of the collaboration, are also important:

- Communication.
- Commitment.
- Trust.
- Culture.
- Partner selection.
- Image.
- Expectation.
- Experience.
- Role of leadership.
- Team expertise.
- Conflicts.

Output factors, which have clarity at their core by defining the nature of the outputs that are being looked for through the project.

- Objectives—it is important that the objectives are clearly defined.
- Knowledge transfer—the extent and scale of the success of the knowledge transfer to the recipients varies across disciplines. In some instances, this involves patents and licenses, in other cases students finding employment or staff transfer for short periods is more relevant, and still further this can occur through published papers and conferences. This process can also be influenced by the research capacity of a company and the ability of its staff to absorb and utilize ideas.
- Technology transfer.

In addition, experience shows that the links between academics and business are likely to be more successful if they are part of a long-term existing relationship. This can be helped if alumni are also active in the company with which the relationship is being developed or extended.

7 Wider Opportunities to Support Post COVID Recovery and Growth

7.1 The Structure of Business in the MENA Region

In countries where there are many traditional family businesses, the value of universities to the commercial and industrial domain may not have been fully recognized. This lack of understanding between the universities and business has various causes, including a lower capacity to absorb knowledge that can influence innovation, a reluctance to invest to implement innovations where markets are high risk, and a lack of appreciation of new opportunities. This is particularly the case in countries where mSMEs play a major role in all economies [46]. These companies make up

some 90% of businesses and are important contributors to job creation and economic development. The World Bank among other international organizations also see them as critically important for creating some of the 600 million jobs that it estimates will be required by 2030 to absorb the growing global workforce. However, as an observation, despite this importance, there is no internationally agreed definition of the size or financial turnover of these enterprises, because the number of employees and their financial turnover is relative to their country's economy. In addition, the digital transformation of most societies and their institutions has resulted in digital technology creating the opportunity to build new business models. This has created significant economic and social opportunities for people of all ages and genders. In particular, it has enabled many women to connect with the market through the organization of their time while still creating startups and delivering economic and social impact. This process has helped to democratize the business environment. Despite the scale of the mSME sector of the economy, in many countries universities have ignored them as potential markets for their research. The World Bank has noted in its report on the MENA region that education is skewed towards providing graduates for the public sector. In addition, the report notes that schools are still geared toward channeling graduates into large public sectors, which means they place less emphasis on fields such as mathematics and science. In addition, it reports the view that a bloated public sector is crowding out the private sector, which would otherwise be a larger provider of high-skill, high-wage jobs [47]. And their final observation is that with the future economy needing technologically capable workers, curricula should be reoriented toward STEM (science, technology, engineering, and mathematics) subjects, and away from the social studies that were long prized by public-sector employers. One of the challenges that is now part of mainstream thinking across most countries is the need for widening participation in business. This has not only attracted the interest of governments but also of independent investors. The response by many governments has been to create legislation and funding structures to support startups. In parallel, the interest of investors has begun to professionalize the way entrepreneurs are responding in developing their companies in order to match the demands of the investors. This structure of the business environment raises a number of questions of how a TM program can be tailored to suit local business conditions.

7.2 Building Links with Emerging Technology Companies

In addition to the local and regional focus, for a small number of elite universities there is potential for selective investment by government to develop a competitive research theme, in any of the exponential technologies that are regarded as part of the Fourth Industrial Revolution that can build local competence that helps companies gain a competitive advantage [48].

A World Bank report [47] has also proposed a strategy of setting up a network of science centers of excellence in the MENA countries to promote interactive approaches, excellence, and innovations that have specific beneficial regional impact.

The suggestion is that this network would use selected technological institutions and research centers associated with universities in the MENA region as regional hubs to facilitate cooperation through joint research projects, and to promote high-level training. The strategy urges MENA countries to increase financial support for R&D from the current 0.3% of GDP to 3%, with the private sector contributing 30–40% of the funding. This idea has also been developed in other countries as it is now widely recognized that universities play an important role in strengthening regional capabilities by creating the infrastructure that shapes the ability of organizations to collaborate, and from that drive innovation through commercial and industrial activity.

A UK study [49] undertaken by the National Centre for Universities and Business grouped some of the activities where universities are actively contributing to and having an impact on innovation. These themed groups included: technology and product development; developing organizational strategies and practices; developing systems to support innovation; and product supply and process development.

Typical examples of technology and product development involve generating knowledge, ideas, and technology. This needs universities to be involved in undertaking basic and applied research, particularly where the basic research has a focus on national opportunities and supporting prototype development. To support the application of knowledge opportunities include developing the connections and skills necessary to help business solve technical problems. They also need to take opportunities where possible to launch products and services or to support businesses to do this, build technical and informal networks that range from those at an international level to those with a regional reach, and absorb and adopt the latest innovations through monitoring international publication and themes that are emerging with the intention of helping businesses understand the opportunities that derive from new ideas. To enable these elements to be developed they also need to develop facilities and equipment to support industry, and also work to develop, demonstrate, and test new opportunities for innovation when technologies are still at a technology readiness level (TRL) of 3 but need to be at TRL 6 before private investors are likely to show an interest.

To enable these activities, universities need to develop systems and internal infrastructure that is capable of capturing, understanding, interpreting, and providing a regionally or nationally based leadership role in interpreting change. This involves internal leadership that helps universities to set a strategic direction for their role in delivering innovation related impact. This also involves being active in a role in informing policies, regulations, and legal frameworks that define boundaries of knowledge. This also needs universities to develop a workforce to do this as well as ensuring those transitioning from education to the workforce have the capability to transfer this knowledge. The intention of these activities is to help develop the skills in the regional workforce and this includes providing continuing professional development programs for those people already in the workforce. To support outcomes, many universities are also building relationships with groups such as Business Angel Clubs and Venture Capital Industry groups to support business development as well as understanding and monitoring funding opportunities of grant awarding bodies.

There is also an international based drive across most universities to implement and strengthen innovation and an entrepreneurial culture. Finally, there is also a role for universities in raising public understanding of the opportunities for innovation.

8 Conclusion

The disruption caused by COVID is plain to see. Universities have adapted to this. Their business models will be altered but their importance will be likely to grow. For the universities in the MENA region to take advantage of this growth they will need to create increasing levels of independent income. Building a TM function that fits with national, regional, and local conditions seems to be a favored strategy for creating this additional income stream. Beyond income generation, the successful implementation of a TM strategy is likely to raise the value of each university in terms of its social and economic impact. Implementing any TM program requires careful management and coordination with public agencies to bring businesses and universities closer together, and through a synergistic effect to help build clusters and modernize the roles of both sectors. To have the greatest level of impact requires careful planning. The options for this relationship are broad but the simplest starting point in the context of bridging the academia– industry gap is to work on developing existing business and academic assets, using a TM program to link with business with the intention of defining potential routes to deliver the right level of education and upgrading the region's entrepreneurial capacity.

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The 'New' Normal of Business Education in a Post COVID Era: The CDIO Approach

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Abstract With the resumption to normal life peering at the end of the tunnel, one cannot help but pause and ponder what the future of business education will look like in a post COVID world. Based on the evolution of the professional business context that goes beyond basic disciplinary knowledge, this chapter caters to the current and future needs of this discipline and presents an innovative framework and roadmap for Business schools to follow using the Conceive-Design-Implement-Operate (CDIO) adjusted Business Syllabus and applying standards that go hand in hand. Moreover, the chapter includes a Business Generic Management Curriculum that includes the required knowledge, skills, and attributes needed for successful business graduates.

Keywords Higher education · Innovation · Curriculum · Reform · Business programs · Business education · CDIO · Syllabus · Standards

1 Introduction

Since 2019, the pandemic has accelerated the speed of digital transformation in business schools across the world and within the Arab region. Business schools, overnight, turned to remote online teaching. Faculty and students had to quickly adapt to this new normal. Programs of study and pedagogies were modified to accommodate this sudden shift.

With the resumption to normal life peering at the end of the tunnel, one cannot help but pause and ponder what the future of business education will look like in a post COVID world. The contours of this world seem to be shaped by words like 'agile', 'adaptable', 'resilient', and 'innovative'.

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Business schools are now at a stage where their education is becoming more of a personalized journey characterized by flexibility, active pedagogy, digital transformation, and adaptability. These are the principles of Education 4.0.

The pandemic highlighted the challenges facing business schools. These range from shifting student demography, facilities, strategy, and governance to pedagogy, research, and partnerships. It also affected the mode of learning, assessment designs, deadlines, and academic integrity.

To tackle these challenges and the impact of the pandemic, innovative practices targeting reform are required across the business education sector. These include but are not limited to research, teaching and learning, governance, pedagogies, curriculum development and design, community and industry engagement, and student experiences.

Reforming a curriculum requires a paradigm change in a university's landscape. Innovation requires action and a recognized need for change. The process of innovating a curriculum requires universities to embrace an innovative culture. This means that the higher education sector cannot innovate its curricula without reforming its fundamental pillars as well. Expectations on program performance of those inside higher education should align with performance expectations of those outside these institutions. The elements of an innovative culture such as leadership, shared governance, comprehensive program design and evaluation, rewarding innovation, training faculty and staff, not imposing too many rules, and autonomy and accountability are critical in the reform process. These are important tools that can be used by Arab universities while re-thinking their curriculum.

Within the Arab region, business degrees are highly sought after. For instance, in 2017–2018, out of the 55,820 students enrolled in universities in Dubai, 24,463 were registered in business courses [1]. Graduates from business schools tend to work in different sectors and their impact is observed in several sectors. Due to the high demand for business education in the Arab region, this chapter will emphasize the importance of building innovative programs of study that meet the local and regional needs of the labor market.

Through this chapter, an innovative approach to reforming the curricula for business schools is presented using the Conceive-Design-Implement-Operate (CDIO) framework. Many engineering programs across the world have had success stories through the application of CDIO. However, outside engineering, the adoption of this model has been relatively modest. CDIO can be applied in different contexts including business programs. This model focuses on experiential learning, which implies learning through experience. A CDIO curriculum ensures that graduates are leaving their institutions ready for a post COVID world and geared with practical, professional, system thinking, and interpersonal skills including cognitive and disciplinary knowledge that will enable them to survive and adapt in a highly dynamic and agile work environment.

The guidelines presented will provide a flexible structure for business schools to leverage from. Its strength lies in its relevance to working life and closeness to industry while ensuring that the quality of education is not compromised. The CDIO syllabus provides a benchmark that will codify the principles for designing

programs and methods of learning to ensure students are being taught the right skills in these uncertain times. As such, this will assist universities in program evaluations and development cycles. To support this narrative, this chapter presents a complete CDIO syllabus for business studies and a case study of the Australian University in Kuwait that demonstrates the application of CDIO in the School of Business. Also, a four-year Business Generic Management Curriculum mapped to the CDIO syllabus is included. This chapter is divided into several sections that cover the evolution and context of business education as well as current challenges highlighted by COVID. CDIO Standards and Syllabus adapted to business majors are incorporated via an innovative curriculum. The chapter ends with recommendations and appendices.

2 Redefining Business Education

2.1 The Evolution of Business Education

There is a common misconception that the world's first business school was Wharton School of the University of Pennsylvania, which was founded in 1881 by Joseph Wharton.

However, the first business school is actually the Ecole Supérieure de Commerce de Paris, which was founded in France in 1819 by a circle of economists and traders including the famous economist Jean-Baptiste Say and the banker Vital Roux [2].

In the past, business programs were a type of vocational training where students learned skills to sell products [3]. During the times of industrial revolution in the nineteenth century, management theories started to evolve as a result of increased industrial development and the rise of labor work. By the end of the nineteenth century, management became a systemic field of study.

Because of the need to increase productivity and to compensate for the shortage in the supply of labor at the time, scientific management theories began to surface in the early twentieth century. These theories focused on doing time and motion studies per task/job at the factory level. Management theories kept progressing so that by 1949, organizational management principles and their universality became popular. These are still being taught to date [4].

The impact of the external environment meant that some of the classical theories were no longer suitable in the world of business. For instance, the principle of centralization, which over-emphasizes formal structures, was no longer applicable in every situation. In 1963, behavioral theories, which highlighted human relations and behavioral science theory, started to surface. As such, the focus shifted from the job to the worker who performed that job. This is where the element of human resources became a new component in business education.

As complexities in organizations increased, modern management theories started to develop. Management concepts progressed to become more knowledge-based, multidisciplinary, effective, and dynamic. This also led to further changes in the

context of business curriculum. Management became a multi-disciplinary area which considers the impact of psychological, sociological, behavioral, technical, and other sciences. In addition, students started to train in statistics, research, and problem solving [4].

Moving ahead and because of the current recession and technological advancements, the concept of entrepreneurship became a priority in governmental planning. Education institutions proceeded to embed the concept of entrepreneurship within their business study programs. As a result, the number of courses offered in entrepreneurship have increased over the past two decades. Business schools are also creating Entrepreneurship Centers which support innovative projects developed by students. In addition, business schools started to teach change management courses so that students can understand the dynamics of constantly changing environments [5].

In the twenty-first century, business education was dominated by innovation and marketing experts. Business schools began to incorporate courses in marketing, focusing on target markets, consumer behavior and product, and process innovation. Furthermore, technology started to be integrated within business studies instigating courses such as operations research, management information systems, digital marketing, data analysis, modeling, and simulation in the business curriculum.

Recently, the increase in awareness of environmental issues and sustainability in business practices has led some business schools to update their curricula to incorporate social responsibility courses and promote the use of sustainable business practices that make an impact.

2.2 Business Education Context

The context of business profession is integrated within other professions such as medicine and health, education, commerce, engineering, industries, services, and in public and private organizations and establishments. Therefore, business education plays a vital role in the socio-economic growth and development of any nation. In a fast-changing era, business professionals require certain and specific graduate traits that are centered around creativity, adaptability, in-depth business knowledge, and management skills with an entrepreneurial spirit.

In addition, graduates are expected to be well versed in business research, review, benchmarking, strategic thinking, in addition to strategic planning, flat organization, and pattern recognition. There is also an expectation that business graduates should be socially, ethically, and environmentally aware individuals.

Nowadays, business professionals are required to possess an entrepreneurial mindset marked by communication skills, passion, leadership, accountability, dedication, and sacrifice. They need to have the right amount of curiosity to venture into new opportunities while being agile, team-oriented, and possess a risk mitigating mindset.

2.3 Challenges Facing Business Education Highlighted by COVID

Moving forward, 'uncertainty' is a term resonating within the business education landscape since the start of the pandemic. Business schools have had to re-strategize to consider the challenges imposed upon them by the pandemic and design solutions to move forward.

Learning goals have shifted. Business schools must ask themselves whether they are doing a good job in preparing students for a complex workforce. They must also consider the impact of the pandemic and reimagine organizations and labor market needs post COVID19.

Business education in universities is expected to produce 'the leaders of tomorrow' with competencies centered around critical thinking, adaptability, agility, teamwork, knowledge of the marketplace, and transparency. These skills reflect the changing needs of the workforce and society. Most importantly, these are the shared skills of great business managers and leaders.

As economies are becoming more volatile, the industry is looking for agile and adaptable business graduates. Business schools play a critical role in ensuring they keep supplying the next generation of talented managers who will meet the challenges facing organizations in the twenty-first century.

We must ask ourselves whether current business programs are relevant in a post COVID future. What is clear is that profound change is eminent. The next few paragraphs will highlight some of the major problems facing business schools today which have been exacerbated by the pandemic.

2.3.1 Shifting Student Demography

The student population is shifting away from the traditional 18-year-old heading off to university to students who are older and possessing lower income [6].

There seems to be a continual drop in domestic college-age population paralleled with an increase in diversity, more non-traditional students, less international students, and adjustments in the current Gen Z population [7]. To put it into perspective, in the United States of America, nearly half of those entering post-secondary education are over 25 years old and nearly half of those work at least 30 h a week [8]. Within the Arab region, there is a similar occurrence in the influx of older students pursuing education.

These older students are commonly referred to as non-traditional. A non-traditional student is defined as any student who is 25 years of age or older according to Hittepole of the University of Denver [9]. Non-traditional students are on their way to becoming the new majority amongst college-going students. However, despite their growing presence in higher education institutions, many universities and colleges do not have services that cater to their needs. Services are still designed to cater mainly to younger traditional students.

The youth-centric collegiate culture could at times serve as a barrier for non-traditional students to engage in post-secondary education. Since their presence on campus is projected to continue to grow as academic requirements for job qualifications is on the rise, ignoring this section of student diversity will have economic and social ramifications [10].

The pandemic has also augmented the influx of mature students returning to universities as more people are thinking about lifelong learning and relearning [11]. The one size fits all model is no longer viable. Competency-based models are now considered attractive alternatives to the traditional credit hour model for non-traditional students. Such models focus on whether students are learning the necessary skills rather than measuring how many credit hours were completed [12]. In addition, competency-based learning rewards prior experience.

Lifelong learning is becoming a permanent part of the workers' professional lives; in turn, educators should develop the necessary infrastructure to support lifelong learning [12]. The increase in the demand to learn will affect how the landscape of business education will innovate itself.

2.3.2 School of Business Facilities

Business schools cannot innovate their curricula if they do not have the appropriate facilities within the universities. Findings from a study conducted by Elliot and Healy [13] found that student centeredness, campus climate, and institutional effectiveness have a strong impact on how satisfied students are with their educational experience.

Higher education resources are categorized by campuses, facilities, human resources, curriculum, and students. Expenditures on campuses and facilities is the second largest cost item after salaries in higher education [14]. The physical environment of a university plays an important role in its approach to innovation. The changing needs of the business environment including globalization and wide use of technology coupled with the different modes of delivering education means that business programs should consider how their facilities foster innovation.

Demonstrating innovation mastery requires universities to have the supporting infrastructure and technology. Campus design is considered a prime catalyst for transforming universities into becoming the societies' engines of growth [15]. As an illustration, some campus facilities have been designed with the intention to expose students to people and ideas that are different to what they are used to [16]. In addition, universities should gear their facilities and infrastructure for an environment that is based on building competency development skills. This is known as the Learning Factory Concept. To this end, training facilities and the learning environment should allow students to learn and train in a realistic manufacturing environment by bringing it closer to industrial practice [17]. The sudden shift to emergency remote teaching during the pandemic showcased the importance of developing the universities' facilities to accommodate any type of change in the modes of learning.

In the past, facilities were considered single-use buildings on campus. Today, the boundaries are blurring. For instance, a residence hall might include classrooms and

a coffee shop while an academic building might house a variety of units and projects [18]. Schools of business halls can include screens open to international markets.

University facilities are consumables and with time they require maintenance, replacements, or upgrades. Often, the scarcity of university funds affects the budget allocated to facilities. In addition, facilities management departments in universities were not designed with technological integration in mind. Such change requires the lines between information technology and facilities to blur as technology becomes integrated within the campus. Universities should adjust their structure and goals to ensure they are crafting the right policies to foster these integrations [18].

Vidalakis et al. [14] argue that the value of higher education facilities depends on the organizational objectives and needs; hence, the dynamic relationship relies on the changes in the education sector, teaching and learning methods, and students' expectations. They stress that the role of facilities should be part of the university strategy and culture. By providing faculty and students with the necessary infrastructure that form the basis for the university's functions, facilities become the pillar for achieving the goals of the university [19].

In parallel, high-quality facilities have a major impact on the learning process. They can influence the students' decision when selecting a university and can damage or reduce student motivation [19].

When attempting to invest in facilities, business schools should have clear objectives as to what they want their infrastructure to achieve. The benefits of such investments should be clearly mapped with the university's strategic objectives. Because many universities have limited funds to invest in facilities, cost–benefit analysis exercises should be a priority.

2.3.3 The University Strategy and Governance Model

Business schools do not exist in a vacuum. They cannot progress if the university-at large does not have a clear mission which emphasizes the importance of innovation.

Business schools should move toward embedding innovation within their strategic planning by focusing on several key areas. The first area should be directing more funds into research and development (R&D). Sub-par investment in R&D is associated with a decline in innovation.

To ensure business schools are key players in innovation, they should endeavor to collaborate closely with the industry and government sectors. Once collaboration is established and managed in areas of research, innovation, and education, it can increase the capacity to exchange knowledge between the industry and the higher education sectors. An example of a successful collaboration between the higher education sector and industry is the 'Faculty for Factory' initiative, which was launched by the University of Jordan in 2003, to tap the potential of applied scientific research in improving the productivity and competitiveness of industry. The program has become a national success and an effective tool to link industrial companies to academic institutions [20].

In terms of university governance, progressive and collaborative leadership must be at the forefront of reforms. Embracing effective and shared leadership amongst faculty and executives will allow universities to change their classic management styles into more innovative pathways.

Canals [21] explains that there are several layers of governance that business schools must consider. The first is the relationship between the university's executive governing body and the school of business itself which is often impacted by the lack of strategic and financial autonomy. The second layer of governance is around issues surrounding accountability and the powers of the dean and senior executives in the school where they do not seem to be clearly defined. Thirdly, the important role that faculty can play in strategic planning, curriculum design and decision making are often not capitalized on and overlooked.

2.3.4 Pedagogical Approaches

In addition, the pedagogical approach of business schools must support innovative practices such as research based learning, case studies, and project based learning. Universities should develop a pedagogy that serves to transfer practical knowledge and develop relevant skills that support entrepreneurs. Students' learning experiences should aim to foster an entrepreneurship mindset. Such teaching methodologies ensure graduates are equipped with critical and system thinking skills, problem solving abilities, strong communication, teamwork, agility, analytical and systematic skills, and interpersonal skills. As such, universities are stimulating innovation and preparing their graduates for increasingly innovative working environments. Graduates will also acquire skills that will enable them to become in-demand within the industry and highly sought after.

2.3.5 Relevant Academic Research

Academic research needs to be targeted and aligned with the needs of the industry and stakeholders. There seems to be a gap between business research and teaching. Academic research often fails to consider its application in real-world as it lacks practical elements [22].

A study of over 1600 business and management authors reflected a gap between working professionals and academics in their choice of research. Professionals preferred to publish in outlets that value practical relevance while academics favored journals with high impact factor. Furthermore, the results of the survey revealed that 76% of academics had the luxury to engage with working professionals for their research but only 36% felt incentivized to do so [23].

Some of the most useful management ideas such as lean manufacturing and global supply chain have emerged out of business practice and later have been redefined in business school research [21]. Researchers in business schools need to consider

the needs of practicing managers in their research and aim to find solutions to their problems.

2.3.6 Faculty Readiness

With the evolving needs of business education, faculty readiness and adaptability have become paramount. Derkach [24] identified independence and critical thinking, active participation in solving socially important problems, and development of creative abilities as pre-requisites for the readiness to conduct innovative work.

Faculty readiness requires motivation to overcome difficulties and minimize resistance. There are certain elements of structural readiness that are essential for faculty to conduct their work. They are centered around the five pillars of readiness: psychological, scientific, theoretical, practical, and physical [25]. Once these pillars are incorporated within the training structure of a university, faculty readiness can be augmented.

Innovation within business schools requires faculty readiness to shift from the standard methods of teaching toward content and technological change that is more efficient and effective. Professional training programs must aim to develop not only skills, but also positive attitudes and mindsets geared toward innovation. Recruiting faculty with industry experience can enhance the process of teaching and learning. With the proper level of faculty development, readiness for innovation can be attained.

2.3.7 Importance of Innovative Partnership

Innovative partnerships on a local and international level can contribute to building the reputation of business schools. Partnerships are essential in the context of innovation. Business schools must take advantage of local, regional, and international institutions to spur collaborations that have an impact. These partnerships are a two-way stream in terms of benefits. They facilitate research and activities dedicated to solving real world problems while at the same time the advancements of knowledge make the industry more competitive. Such collaborations also ensure that graduates are equipped with in-demand skills.

Partnerships, however, require an ecosystem to develop. On the internal front, the universities' strategies and policies must be geared toward building partnerships. This should be supported with the right governance models and organizational units.

For partnerships to succeed, critical factors must be present, such as, clear communication of expectations between partners, synergy to ensure stakeholders are treated fairly and equally, impact evaluation to measure the effectiveness of the partnership, and clear measurable objectives and transparency to ensure accountability. Financial commitments that ensure continued sponsorship of endeavors should be defined at the beginning of an agreement.

2.3.8 University Degrees Versus Professional Certificates

There has been an ongoing debate as to whether academic degrees should be supplemented by industry-related certificates to better prepare students for the job market. One form of degree is not meant to exclude the other. However, evidence is pointing to the fact that certain jobs now require graduates to combine their degree with a quality certification. In fact, many universities and colleges now offer industry certifications and independent credentials alongside their degrees. This way the student will benefit from attaining specialized certified skills in addition to their program of study. Such strategies are important for the graduates' success and continuation in a workforce that is rapidly changing.

The concept of corporate universities is proliferating in all sectors such as banking, pharmaceuticals, and the food industry. For instance, the food chain McDonald's launched its own university 'McDonald's Hamburger University', which trains students in restaurant management skills and has over 275,000 graduates [26]. Within the Gulf region, the Kuwait Foundation for the Advancement of Sciences has launched its 'KFAS Academy'. The Academy provides an array of higher education courses for students interested in pursuing self-learning. This has posed a direct challenge to local universities where students might select international universities in a local setting. It is also critical to highlight the important role that specialized certifications play in the workforce where at times a certified specialist without a bachelor's degree could be more appealing to employers than a university graduate with academic qualifications only. For this reason, many tertiary education institutions are now linking with professional associations so that students graduate with a qualification and professional certification.

A study by Marquardson and Elnoshokaty [27] investigated the cybersecurity entry level job offerings and found that 60% required college degrees and the rest professional certificates. This is a strong illustration on how job market requirements may be shifting away from demanding academic degrees and where advanced studies are being replaced by practical professional certificates.

Recently, companies such as Google, Apple, and Oracle have dropped the college degree requirement, and instead emphasize work experience and specific skills [28].

It is important to highlight that the competition between university degrees and professional certificates varies amongst disciplines. This requires business programs to be innovative in their strategy, pedagogical design, and decisions as they integrate certifications with academic programs to enable students to seek both. Business schools should consider including courses that prepare students for professional certificates such as CFA, CMA, CPA, PMP, and many more.

2.3.9 Disruptive Technologies

The sudden outbreak of the COVID-19 pandemic required business schools around the world to invest in different types of technologies to support all their activities including teaching and learning, administrative and management units, research,

and infrastructure. Disruptive technologies are creating challenges for universities. According to Flavin [29], disruptive technologies are defined as those that disrupt established practices, often starting with a small number of users, but growing over time to the extent that they displace a previously dominant, incumbent technology.

Technologies adopted by business schools are mainly used for e-learning and assessment purposes; however, both students and faculty rely on other disruptive technologies like Google, YouTube, social media, and Wikipedia to support their teaching and learning inside the classrooms.

Disruptive technologies created new routes to knowledge which are convenient, accessible, and often free. This poses a challenge for universities when they monitor the quality of learning. Therefore, it is important to clearly understand how students use and experience e-learning/technology in their learning activities as this is essential for the development of tools, pedagogy, and teaching practices. In general, students use technologies in their learning to research, attend classes, submit assessments, and communicate.

Disruptive technologies are affecting the way business schools design their operations and as such, the following principles of education technology need to be considered:

- The environment surrounding students, since they are now learning in complex and dynamic environments that rely on the usage of technology;
- The usability of technology and its ability to adapt to the changing needs of the business programs;
- The accessibility of knowledge;
- Teaching and learning strategies that rely on a variety of technologies; and
- The institutional infrastructure should support the design and implementation of technology.

2.3.10 Forms of Learning

With the rapid development of technologies, new trends in teaching and the emergence of diverse learning tools and environments, business education should endeavor to adopt the three forms of learning: (1) formal learning, which is the traditional type based on classroom offerings and textbook knowledge (with certification); (2) non-formal learning that is based outside the classroom (no certification); and (3) informal learning that is derived from unofficial sources of knowledge.

The growing impact of informal learning is diminishing the value of systematic formal learning. Marsick [30] states that although informal learning is defined in contrast to formal learning, they are intertwined as they both impart and augment knowledge and skills. Illeris [31] identified five main learning approaches: everyday learning; school and educational learning; workplace learning; interest-based learning; and net-based learning.

Business schools need to embrace different learning styles within their pedagogical design. International organizations like UNESCO, OECD, and others have been

researching and shedding light on the importance of life-long learning and the recognition of non-formal and informal learning. Large corporations around the world have also stressed the importance of learning outside the formal structure. This represents a challenge for business programs as they need to embed informal learning within their systems.

Given a generation of students with unique personality profiles and different learning styles, business schools are faced with the challenge of going beyond the textbook to innovate creative educational learning that is designed to meet the individual needs of students while meeting job and social requirements.

3 Understanding Innovation Within the Context of Business Education

3.1 Positioning Innovation

In general terms, innovation is defined as the introduction of new ideas, a new way of thinking, new products, or transformational change in the way things are done.

Innovation as it currently stands can be classified into three broad categories: disruptive innovation, sustaining innovation, and efficiency innovation. Disruptive innovation is concerned with a new way of doing things. On the other hand, sustaining innovation is built around the practice of doing something that is already being done but in a better way. Efficiency innovation is about doing more for less. As nations continue to transition into knowledge-based economies while accommodating the needs of Society 5.0, all categories of innovation become critical for economic growth.

Within the context of business education, many simply correlate innovations with technology, robotics, and artificial intelligence. According to OECD [32], innovation in education is defined as a significant change in selected educational practices. The context for successful innovation requires an interconnection between national/regional and institutional factors, with the adoption of a horizontal and vertical approach. Innovation in business education means 'doing new things' and 'doing existing things better'.

Diffusing a culture of innovation within business schools is no easy undertaking as it affects the higher education institution at large. Higher education systems are known to be rigid in management. The process of innovation requires universities to think of new ways of doing things instead of the traditional methods. Universities have been referred to as 'dinosaurs' and the staff as 'men in their ivory towers' [33]. The innovation process for business programs touches every aspect of the higher education institution and this includes its leadership, programs of study, infrastructure, faculty and students, community involvement, research, and knowledge. Even though universities are experts in teaching management methodologies, university

managers are not trained in innovation practices as in most cases they are promoted academics [34].

Entrepreneurship and innovation are leading economies with a focus on small and medium enterprises. Business schools need to shift their focus to teach leadership skills rather than simply teach the basic knowledge.

3.2 Culture of Change and Innovation Factors

One of the many lessons learnt form the pandemic is the importance of embracing change and being innovative. This is of particular importance in the education sector. Brennan et al. [34] explained that three main elements centered around components, relationships, and functions impact the success of innovation. At the components level, direct and indirect individual and institutional actors are influenced by innovation. At the relationships level, cooperation, networking, and increased mobility are crucial. While at the functions level, the impact is observed on the education function as well as the research and engagement functions.

Innovation is about creating a culture of change where every member of the university is part of the change process. It represents a significant shift in the mindset of the university community as members must endeavor to move away from their comfort zone and break into new experiences.

Embedding innovation within business programs of study is a process that begins when the university builds the right conditions that foster innovation. Seven factors have been identified, that if used properly can catalyze, enable, and sustain an effective innovation culture. They are leadership, communication, resource allocation, capacity, structure and process, learning agenda, and policy environment. These seven factors are dynamic and interactive. First, university leadership must recognize the problems hindering innovation and find creative solutions. In addition, they should acquire a clear vision with a roadmap. Leaders must ask the hard questions and the 'so what questions' that often arise in the process of innovation. Within this context, it is very important that the leadership provides the space for the team to try new approaches and embrace the learning experience that comes with failure. As for communication, the university leaders should be clear, transparent, and avoid ambiguity as they embark on change. They should have clear objectives of desired innovation outcomes so that targets are clear for the faculty and all those involved. Most importantly, university leaders should champion engagement of stakeholders by opening a two-way dialogue with faculty and staff. With regards to resource allocation, professional development opportunities should be invested in to promote the teams' skills. Even though many universities suffer from insufficient funds, the allocation of dedicated resources and financial funds for innovation is important. Capacity entails adopting a growth mindset where all team members of the university regardless of their rank are important for the success of innovation. The university must have the needed capacity to instill innovation as well as the correct structures and processes. Universities must develop clear processes for how innovation will

be promoted and supported. Design loops and prototyping can enhance innovation opportunities. On the learning agenda, change leaders should be able to pilot small-scale version of change concepts over a short period of time before moving forward. They must also devise new indicators different from the old processes with clear metrics based on continual improvement cycles. Leaders should work toward creating a policy environment that promotes and rewards innovative behaviors [35].

According to Brennan et al. [34] policy recommendations on innovation should be clustered around three central themes. The first is related to the changing landscape of teaching and learning in higher education; this is done by establishing a regulatory framework that addresses the hindrances facing online learning. The second policy recommendation is related to technology and student performance, where policy makers should consider the need to clarify the funding implication and outcomes for innovation, as well as collect and analyze feedback from all stakeholders. The third policy recommendation is related to globalization and internationalization strategies, where higher education institutions should develop international strategies and provide support for the mobility of students.

4 The Innovative Business Curriculum

Designing and redesigning curriculum has evolved into a topic of considerable debate [36]. It involves conflicting perspectives among policy makers, experts, stakeholders, and society at large.

First and foremost, the definition of a curriculum needs to be clarified. There are varied definitions of curriculum. For some, curriculum means the way educational content is organized and presented in the classroom to meet different learning needs [37]. However, given the changing landscape of the higher education sector and the high pace of development occurring worldwide, curriculum cannot be viewed within a narrow lens as the simple conveyer of knowledge. Therefore, for the purposes of this chapter, the curriculum is viewed as a political and social agreement that reflects a society's vision while considering local, national and global needs, and expectations [36].

Students are now more autonomous in their learning process and self-determined. An innovative business curriculum engages students and faculty in interdisciplinary education that is based on inspiring creativity, as well as analytical and critical thinking in an experiential learning environment.

Modernizing and innovating business programs of study is not a straightforward process. It must be built on past reviews and be future-oriented. As stated in the earlier sections, it is a process that begins with transforming the university's vision and mission. In this case, the university will be reforming its paradigm from a teacher-centered model into a learning-oriented one. With that said, this approach puts students at the forefront of the learning process where they are the drivers of their knowledge.

When discussing curriculum reform, it cannot be done without a proper understanding of UNESCO's pillars of learning. Central to innovation is learning how to learn; therefore, education should be holistic and cover not only knowledge (Learning to Know), but also skills (Learning to Do), engagement (Learning to Live Together), and awareness (Learning to Be). Universities, in addition to their roles in research and education, must remain the "guarantors of universal values and cultural heritage" [38]. At a later stage, a fifth pillar, Learning to Transform Oneself and Society and a six pillar, Learning to Get Employed, were added.

5 Design of the Business Innovative Curriculum Structures and Content

Three key words should guide the design of an innovative business curriculum: intent, implementation, and impact.

Business schools must ask themselves what they are trying to achieve through the redesign of the curriculum (*intent*). They must also create a clear pathway that demonstrates how the intent of the curriculum will be achieved (*implementation*). Finally, they need to have a quality assurance framework based on continuous monitoring, evaluation, and improvement so that they can measure the impact of the curriculum (*impact*).

Before delving into the canvas of the innovative business curriculum, it is important to highlight the seven pillars of teaching and learning [39], which act as the basis of any innovative curriculum design. They are as follow:

1. Create an engaging, motivating, and intellectually stimulating learning experience.
2. Encourage the spirit of critical inquiry and creative innovation informed by current research.
3. Emphasize the importance, relevance, and integration of theory and knowledge with professional practice to develop solutions to real world issues.
4. Provide learning experiences that develop inter-culturally capable graduates who can make a difference as socially and ethically responsible global citizens.
5. Value and recognize individual and cultural diversity through the provision of an inclusive context of support and respect for all students.
6. Enhance student engagement and learning through effective curriculum design, pedagogy, and assessment strategies.
7. Continuously improve teaching practice through academic staff professional development and critical reflection informed by a range of evaluation approaches.

Business Innovative Curriculum Framework

For the purposes of this chapter, a comprehensive innovative curriculum roadmap has been designed which could be used by business schools when they intend to reform

their programs of study. It is an integrated framework based on six components that is intended to be dynamic and interactive. It allows users to use each component independently and create tasks from within them.

Each block contains overarching guiding content that can direct the process of thinking. It can be used to design/redesign a course, project, assessment or assignment, or an entire business curriculum. The components are as follow:

(a) **Stakeholders**

This category is very broad. It is defined by anyone who is affected by the design of the curriculum. Students, faculty, chairs, deans, administrative staff, industry experts, research leaders, and government officials are all stakeholders. They can even be categorized into internal stakeholders (those from within the university) and external stakeholders (from outside the university). The important step here is to identify what is the role of each stakeholder and what kind of feedback is required from them. Of course, different stakeholders will play different roles within this process; therefore, this needs to be clarified from the beginning of the planning process. Clear communication is key here.

(b) **Leadership**

The university needs to identify who will lead and champion these changes. Identifying leaders is not restricted from within the university's executive management. They can assign faculty from within departments, experts from the field, and/or external consultants. Often, change is not easy and managing this process along with expectations requires agility and adaptably. Universities should select leaders who are able to navigate change and diffuse tensions that can arise.

(c) **Program and Course Design**

As stated earlier, this framework can be used to design any type of course, program at a large or just assessments, assignments, and student activities. Business schools must be clear on the desired and intended outcomes they want the curriculum to achieve. They should also have an insight into the desired impact and how this will be measured. All the planning should be geared toward creating a student-centered environment with facilities that allow students to be the champions of their learning process. With the changing demographics and the increasing proportion of older students, a flexible learning environment should be created. In addition, it is critical that technology and research-based learning is infused into the curriculum.

(d) **Resources**

At this stage of the planning, business schools must identify the required resources through manpower planning with clear job descriptions. In addition, all the financial, facilities and infrastructure implications should be identified and mapped. Policies and procedures are also part of this process where they can be drafted/reviewed to ensure they are meeting the needs of the university.

(e) **Limitations**

No matter how thorough the planning is, constraints and limitations are part of this process. Highlighting them and working to mitigate them will provide

business schools with the space to navigate boundaries through innovative measures.

(f) **Quality Assurance**

An overarching quality assurance cycle based on the principles of plan-do-check-improve needs to be in place with this framework. Quality assurance should be guided by two fundamental questions:

- Are we doing the right things?
- Are we doing these things in the right way?

As such, developing a continuous cycle of support, development, and improvement will ensure that the innovative curriculum is setting out to achieve its intended purpose while maintaining and meeting the legislative, regulatory, industry, and university requirements. The framework is depicted in Fig. 1.

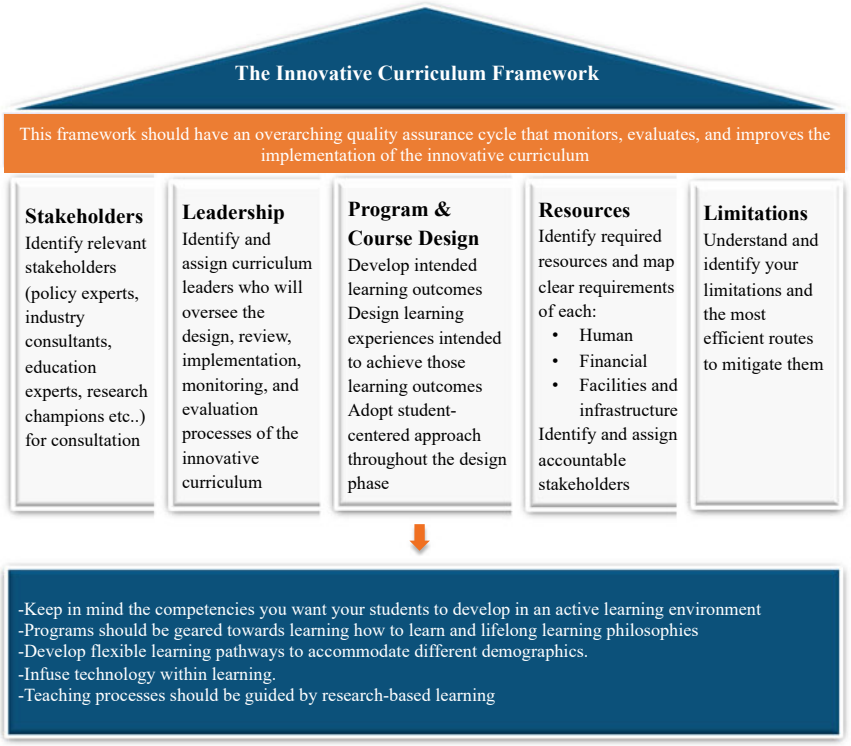


Fig. 1 Innovative curriculum framework

6 Adoption of the CDIO Model

6.1 CDIO Background

The following sections will provide a pathway for innovating business programs in particular the learning outcomes and syllabus that should be used in conjunction with the Innovative Curriculum Framework, which was detailed in Sect. 5.

Throughout much of the twentieth century, engineering programs offered students hands-on practice. As the century progressed, scientific and technical knowledge expanded rapidly while engineering education evolved into the teaching of engineering science. Teaching engineering practice was increasingly de-emphasized. As a result, the industry in recent years observed graduating students that were technically adept but lacked many abilities required in the real-world of engineering situations. Consequently, major companies created lists of abilities they wanted their engineers to possess [40].

The Accreditation Board for Engineering and Technology (ABET) was founded in 1932 to encourage schools to meet real world needs and rethink their educational strategies while listing expectations for graduating engineers. In the late 1990s and still faced with the gap between scientific and practical engineering demands, the Massachusetts Institute of Technology along with three Swedish universities proceeded to reform engineering education. The result of the endeavor was the worldwide Conceive-Design-Implement-Operate (CDIO) initiative [40].

6.2 CDIO Initiative, Standards and Syllabus

This initiative focuses on building programs of study centered around active and experiential learning experiences for students such as project-based learning, problem-based learning and research-based learning, multidisciplinary knowledge, and specific learning outcomes. The learning process is engaging and is set in classrooms as well as modern learning laboratories and workspaces. The teaching and learning process is constantly improved through robust assessment and evaluation processes [41].

The ***Conceive*** part relates to the needs of the customer, technology, enterprise strategy, and regulations, in addition to conceptual, technical, and business plans. It allows students to understand business problems and synthesize a solution. The ***Design*** part is concerned with taking the conceptual idea and converting it into a practical solution. It is based on plans, drawings, and algorithms that describe what will be implemented. In ***Implement***, the student transforms the design into a product, process or system including manufacturing, coding, testing and validation. As for ***Operate***, the student must demonstrate how the physical solution resolves the problem or challenge by delivering the intended value, including maintaining, evolving, and retiring the system.

The first tangible outcome of the CDIO initiative is the CDIO standards and syllabus which is a codification of contemporary engineering knowledge, skills, and attitudes [42, 43]. The objectives of the syllabus are to create clear, complete, and consistent set of goals for engineering education in sufficient detail that they could be understood and implemented by engineering faculty [44].

The CDIO Initiative developed 12 standards which address program philosophy (Standard 1), curriculum development (Standards 2, 3 and 4), design-implement experiences and workspaces (Standards 5 and 6), methods of teaching and learning (Standards 7 and 8), faculty development (Standards 9 and 10), and assessment and evaluation (Standards 11 and 12) [45].

CDIO standards include:

- The adoption of the principle that product, process, and system lifecycle development and deployment are the context for engineering education.
- Specific, detailed learning outcomes for personal and interpersonal skills, and professional competencies consistent with program goals and validated by program stakeholders.
- A curriculum designed to integrate personal and interpersonal skills, as well as product, process, and system building skills.
- An introductory course that provides the framework for engineering practice as part of the curriculum.
- The participation of students in two or more design-implement experiences at various levels.
- workspaces and other learning environments that support hands-on learning are
- fundamental resources for learning to design, implement, and operate products, processes, and systems;
- An environment for the integrated nature of the learning process (training, real practice).
- Teaching and learning based on active experiential learning methods.
- Enhancement of faculty competence in CDIO implementation.
- A students' assessment system focusing not only on the acquisition of disciplinary knowledge, but also on the evaluation of their ability to create new products, processes, and systems [41].

The 12 standards are listed in Sect. 7.1.

The strength of the CDIO syllabus is that it is adaptable across all engineering schools. The level of detail provided in the syllabus creates the basis for curricular and assessment planning in engineering education.

Most importantly, the CDIO syllabus is used as a reference to derive specific learning outcomes in engineering education and classifies learning outcomes into four high level categories [43, 44]:

1. Disciplinary Knowledge and Reasoning
2. Personal and Professional Skills and Attributes
3. Interpersonal Skills: Teamwork and Communication

4. Conceiving, Designing, Implementing and Operating Systems in the Enterprise, Societal and Environmental Context: The Innovation Process.

Recently CDIO released their extended syllabus which includes Leadership and Entrepreneurship. Modifications on innovation, invention, internationalization, and sustainability were incorporated into the revised version [41].

6.3 CDIO Initiative and Business Education

There is no reason why CDIO cannot be applied in other disciplines. As an illustration, Singapore Polytechnic adapted the CDIO framework into institution-wide initiatives including non-engineering programs such as business, music, and info-communication programs. They were able to customize the graduate attributes for their own fields including specific learning outcomes for each course (Standard 2). Once they identified the graduate's attributes, they proceeded to develop the relevant student skills that ranged from communication and teamwork to creative, innovative and enterprise skills. Students were able to work in multidisciplinary teams to draw insights and create prototype solutions. The Design thinking method was adopted to conceive and design new products and services [46].

With the increased competition from traditional and non-traditional higher education institutions as well as the pressing need to improve curriculum design that meets the needs of different stakeholders and improves the quality of business education, many business schools should start considering the CDIO approach to education.

According to Crawley et al. [47], CDIO can be applied to non-engineering programs by:

- Developing a description of the profession's context of practice as a starting point (CDIO Standard 1)
- Working with stakeholders to identify their requirements for the graduates (CDIO Standard 2)
- Adapting pedagogical and curricular elements of CDIO to the discipline's needs (CDIO Standards 3–11)
- Applying the CDIO curriculum development and quality assurance processes (CDIO Standard 12)

One of the main roles of business programs is to produce innovative thinkers with multidisciplinary perspectives. Business programs should ensure students are able to keep learning even after they finish their studies, have strong in-depth knowledge, and have solid communication skills. These three requirements are in essence what the CDIO initiative is geared towards.

The main advantage of the CDIO is that it uses a systematic thinking approach that leads to product/business development. It also provides practical hands-on experience that allows students to implement theory in practice, which is a job market requirement. The relevance of this model is that it is based on active learning where students

take charge of their learning, and the instructor takes on the role of a facilitator and mentor.

Through active learning, students are more engaged as they learn to critically think, solve problems, and make decisions. They are given the opportunity to apply their knowledge to make room for a deeper understanding of concepts and retention of information. Project-based learning (PBL) is a good example of active learning that allows students to develop a set of competencies that are needed in the job market.

Furthermore, the CDIO approach offers practices that guarantee clear and measurable assessments for the learning outcomes. The model adopts various assessment tools like projects, portfolios, and reflective exercises that focus on creativity and measuring of skills beyond basic knowledge.

7 Modified CDIO Standards and Syllabus for Business Education

Adopting the CDIO Initiative into business education provides the required roadmap for innovation especially as it covers four main pillars related to disciplinary knowledge, personal and professional attributes, interpersonal skills, and social context.

The CDIO standards and syllabus tackle three fundamental questions in curriculum redesign: *why, what* and *how*. By asking the "why" question, universities will be able to redesign their business programs to ensure they graduate professionals who understand how to Conceive-Design-Implement-Operate complex business products, processes, and systems in a modern team-based environment. The "what" question targets the knowledge, skills, and attitudes students should possess as they graduate from university. In the CDIO context the answer includes disciplinary knowledge, personal, professional and interpersonal skills, and the knowledge of how to conceive, design, implement and operate products, systems and services. As for the "how" question, it is concerned with the way a program of study will ensure students learn the necessary CDIO skills. This is done by implementing an integrated curriculum with clear learning outcomes and assessments, developing innovative teaching and learning methodologies, and enhancing faculty competence and learning workspaces.

This section demonstrates how CDIO standards and syllabus can be adapted to business majors. It covers the overall set of knowledge, skills, and attitudes required from business graduates.

The following table outlines the CDIO standards contextualized to Generic Business Standards. It outlines a framework for improving curriculum design for Business Schools. It also showcases the Australian University in Kuwait (AU) College of Business experience as a case study. In addition, a detailed mapping of the CDIO curriculum developed by AU's College of Business- Management Program is presented in Appendix 1.

7.1 CDIO Standards—Adjusted to Business Major

CDIO standards	Generalized business CDIO standards	AU as case study
1. The context	The context: Providing students with business knowledge accompanied by hands-on learning opportunities, industry engagement, social impact and dedication to professional practice studies	College of Business Vision: To produce business graduates who are capable of developing into effective mangers that contribute to the success of any organization that employs them, and to the economic development and welfare of Kuwait or the country in which they work
2. Learning outcomes	Learning outcomes A. Demonstrate an understanding of the importance of ethics and the legal environment of contemporary business B. Explain the major concepts in the functional areas of accounting and finance, HR, Marketing, MIS, Corporate Governance and Management and entrepreneurship C. Use quantitative and qualitative skills to facilitate management decision making and/or problem-solving D. Evaluate human behavior and possess high level of Emotional Intelligence E. Evaluate the economic environments of businesses F. Apply knowledge of business concepts and functions in an integrated manner G. Apply academic knowledge in a professional setting H. Obtain through electives in-depth knowledge and understanding in more specific related areas, yet wider perspective I. Research a topic, develop an argument and organize supporting details J. Develop proficiency in business communication—oral, written, and non-verbal K. Develop business/ product plans	AU developed learning outcomes for its College of Business majors (Marketing, Management and HR—both at Diploma and Bachelor levels) under the following graduate attributes • Professional behaviors • Communication and teamwork skills • Critical thinking • Entrepreneurial skills • Planning and organizational skills
3. Integrated curriculum	Integrated curriculum: that is designed with interdisciplinary subjects, with an explicit plan to integrate personal and professional skills and attributes, interpersonal skills, and professional competence	AU developed a curriculum that includes electives, PBL, internships, entrepreneurship, and Business Integration final project
4. Introduction to engineering	Introductory course: that provides the framework for professional practice, and introduces essential personal and interpersonal skills	Introduction of courses on subdisciplines (Management, Marketing, Accounting, Economic etc.). Courses on business communication that are also integrated in all the other courses
5. Design-implement experiences	Professional practice experiences: that provides corporate internship opportunities	Internship opportunities, entrepreneurial competitions with local and regional institutions that foster the entrepreneurial application at young age
6. Integrated learning experiences	Integrated learning experiences: that lead to the acquisition of disciplinary knowledge, as well as personal and interpersonal skills, and professional competence	Event management course based on PBL that requires the plan and execution management of an event from A to Z
7. Learning Assessment	Learning assessment: that target personal and interpersonal skills, and professional competence, as well as in applied disciplinary knowledge	Traditional assessments coupled with oral, job -shadows, evaluations, portfolios, and project presentation

(continued)

(continued)

CDIO standards	Generalized business CDIO standards	AU as case study
8. Engineering workspaces	Workspaces for professional practice: that include workspaces and laboratories that support and encourage experiencing professional practice, disciplinary knowledge, and social learning; ex: stock market simulation	Computer labs, plan for banking and stock market simulations
9. Active learning	Active learning: through applying student center teaching pedagogies and engaging activities	Courses include engagement activities like field visits, gaming, competitions, role play, peer review, debating, case-based learning, PBL etc
10. Enhancement of faculty competence	Professional development: that enhances faculty competence in personal and interpersonal skills, as well as professional competence	Provision of in-house technical professional developments, participation in discipline-related conferences, and collaboration with local institutions for executive training programs
11. Enhancement of faculty teaching competence	Enhancement of faculty teaching competence: through teaching and learning training	Teaching and Learning Center conducting workshops on teaching pedagogies, planning annual forum that fosters teaching and learning excellence attended by distinguished international speakers, organizing seminars that target generic, personal, and interpersonal skills (Change Management and Social and Emotional Learning, Online Learning and Effective Components of Instructional Design etc.)
12. Program Evaluation	Program evaluation: through internal/external audits and international accreditations	The College of Business is accredited by the Accreditation Council for Business Schools and Programs (ACBSP). ACBSP is a leading specialized accreditation body for business education supporting, celebrating, and rewarding teaching excellence. The association embraces the virtues of teaching excellence

7.2 CDIO Syllabus—Adapted to a Business Major

The objective of the syllabus is to develop clear, detailed and a comprehensive set of objectives for a generic business major while providing the necessary flexibility for implementation of sub-discipline specifications, especially with regards to level one where major-related knowledge and reasoning is applied (HR, Marketing, Management, finance, economics, accounting, entrepreneurship, MIS, and Corporate Governance).

The CDIO—business adapted syllabus below provides a reference framework for specific learning outcomes in business education.

The four levels of details in the syllabus represent the competencies for business graduates. The levels and sub-levels are mapped below in the syllabus.

It is important to also highlight that the CDIO syllabus is linked with UNESCO's five pillars of learning, which were previously highlighted in Sect. 4. An important component of the syllabus is the focus on system thinking. The syllabus organizes

system thinking into four main areas: thinking holistically; emergence and interactions in systems; prioritization and focus and trade-offs; and judgement and balance in resolution [48]. This component is often missing in accreditation bodies for business. For instance, when the syllabus was mapped with the business accreditation body, AACSB Accreditation Standards, the result demonstrated that system thinking was not present in the AACSB standard (refer to Appendix 2 for the result of mapping AACSB to CDIO Standards and Appendix 3 to the Syllabus). The following section demonstrates a comprehensive CDIO Syllabus for Business Management mapped up to the fourth level for business programs.

CDIO Syllabus for Business Management

1. **KNOWLEDGE AND REASONING**
   - 1.1. General knowledge
   - 1.2. Math and social sciences
   - 1.3. Basic knowledge
   - 1.4. Disciplinary fundamental knowledge (acc, eco, market, mgt, computer)
   - 1.5. Disciplinary specialized knowledge

Level 1 — 2. **PERSONAL & PROFESSIONAL SKILLS & ATTRIBUTES**

Level 2 — 2.1. BUSINESS REASONING & PROBLEM SOLVING

Level 3
- 2.1.1. Problem identification and formulation
- 2.1.2. Modeling
- 2.1.3. Estimation and qualitative analysis
- 2.1.4. Problem analysis using statistical knowledge
- 2.1.5. Solution and recommendation

2.2. RESEARCH AND KNOWLEDGE DISCOVERY
- 2.2.1. Hypothesis formulation
- 2.2.2. Survey of print and electronic literature
- 2.2.3. Conducting survey/interviews (data collection)
- 2.2.4. Hypothesis test, and defense
- 2.2.5. Application of research in practice

2.3. SYSTEMATIC THINKING
- 2.3.1. Thinking holistically
- 2.3.2. Interdisciplinary interactions
- 2.3.3. Prioritization and focus
- 2.3.4. Trade-offs, judgement, and balance in resolution
- 2.3.5. Practical analysis/ case study

2.4. PERSONAL SKILLS AND ATTRIBUTES
- 2.4.1. Initiative and willingness to take risks
- 2.4.2. Perseverant and flexibility
- 2.4.3. Ethical behavior
- 2.4.4. Diligent/ hard working
- 2.4.5. Enthusiasm and passion for career
- 2.4.6. Creative thinking
- 2.4.7. Critical thinking

Level 4
- 2.4.7.1 Purpose and statement of the problem or issue assumptions
- 2.4.7.2 Logical arguments and solutions
- 2.4.7.3 Supporting evidence, facts and information
- 2.4.7.4 Points of view and theories
- 2.4.7.5 Conclusion and implications
- 2.4.7.6 Reflection on the quality of thinking

- 2.4.8. Awareness of one's personal knowledge, skills and attributes
- 2.4.9. Curiosity and lifelong learning
- 2.4.10. Time and resource management
- 2.4.11. Adaptability to complicated real situations
- 2.4.12. Cross-cultural/ diversity awareness
- 2.4.13. Emotional intelligence
- 2.4.14. Self-management skills

2.5. PROFESSIONAL SKILLS AND ATTRIBUTES
- 2.5.1. Professional ethics, integrity, responsibility, and accountability
- 2.5.2. Professional behavior
- 2.5.3. Proactively planning for one's career
- 2.5.4. Entrepreneurship
- 2.5.5. Ability to work independently & in teams
- 2.5.6. Ability to self-motivate at work
- 2.5.7. Ability to develop and promote ideas and products
- 2.5.8. Customer and partner care skills

3. **INTERPERSONAL SKILLS: TEAMWORK AND COMMUNICATION**

3.1. TEAMWORK

3.1.1. Forming effective teams
3.1.2. Team Operation
3.1.3. Team growth and evolution
3.1.4. Leadership
3.1.5. Ability to work with diverse teams

3.2. COMMUNICATION
3.2.1. Communications strategy
3.2.2. Communications structure (argument, idea arrangement, debate, negotiation)
3.2.3. Written communication
3.2.4. Digital/ social media communications
3.2.5. Presentations
3.2.6. Oral inter-personal communications

3.3. COMMUNICATION IN FOREIGN LANGUAGES
3.3.1. English- listening and speaking
3.3.2. English-reading and writing
3.3.3. Other languages

4. APPLYING KNOWLEDGE TO BENEFIT SOCIETY

4.1. EXTERNAL AND SOCIETAL CONTEXT
4.1.1. Roles and responsibility of business graduates
4.1.2. The impact of business on society
4.1.3. Society's regulation of business
4.1.4. The historical and cultural context
4.1.5. Contemporary issues and values
4.1.6. Developing a global perspective

4.2. ENTERPRISE AND BUSINESS CONTEXT
4.2.1. Appreciating different enterprise cultures
4.2.2. Enterprise strategy, goals, and planning
4.2.3. Entrepreneurship and relationship between enterprises, the economy & the global market
1.2.3.1 Entrepreneurship opportunities that can be addressed by technology
1.2.3.2 Technologies that can create new products and systems
1.2.3.3 Entrepreneurial finance and organization
4.2.4. Working successfully in organizations

4.3. CONCIEVING BUSINESS IDEAS
4.3.1. Set up business objectives (based on the market need and societal context)
4.3.2. Basic definitions, concepts, theories as foundation
4.3.3. Modeling of ideas and insuring goals can be met
4.3.4. Development of project management (risks, feasibility, costs, resources…)
4.3.5. Developing entrepreneurship (SMEs)

4.4. DESIGNING ECONOMICS/ BUSINESS PLAN/ PROJECT
4.4.1. Feasibility studies
4.4.2. Plans or project's approach (approach methods, steps...)
4.4.3. Utilization of knowledge in developing the plan
4.4.4. Disciplinary plan/project design (tools, methods and relevant process...)
4.4.5. Multi-disciplinary plan/project design (relationships among tools, methods and processes, departments and sub majors)
4.4.6. Multi-objective plan/project design (designing implementation plan, testing, environmental factors, reliability..)

4.5. IMPLEMENTING BUSINESS PLAN/ PROJECT
4.5.1. Training/ coaching
4.5.2. Selecting resources for implementing plan/project
4.5.3. Organizing the implementation of plan/project

4.6. OPERATE & EVALUATE
4.6.1. Designing standards/criteria to evaluate performance/ outcomes
4.6.2. Evaluating performance/outcomes (economic- social- environmental…)
4.6.3. Adjusting/ upgrading plan/project
4.6.4. Creating new plans/project

8 Recommendations and Conclusions

A wise man once said, 'if you don't change, you will be changed' and this is where business programs in the higher education sector currently stand. As the world is learning to live in this new normal imposed by the pandemic, business schools must look beyond the horizon and find new and innovative approaches to revamp their programs. This chapter mapped the difficulties facing business schools that were highlighted by the pandemic. It then presented the method for reforming programs of study in business schools using the CDIO approach. AU in Kuwait was used as case study to showcase how the University adopted CDIO in its College of Business and designed an entire program that meets the CDIO requirements.

Moving forward, there are many expectations from business graduates nowadays. They are expected to be adaptable, agile, problem solvers, analytical, and have strong abilities to think outside the 'box'. Preparing them for an ever-evolving workforce begins the minute they are admitted into their programs of study. As such, business programs need to be highly innovative and engaging.

Universities must embrace the culture of change that came with the pandemic. Open leadership, industry partnerships, technology development, research with impact, innovative pedagogies, and community engagement must all be examined closely and reformed to ensure the progression of the university. Business schools need to examine what they are teaching their students and how they are delivering this knowledge and the skills accompanied with it. There is no doubt that business schools can be real drivers for change and development. We instill in our students the notion that they need to be learners for life, however, higher education institutions need to have the same expectations from themselves as well.

Appendix 1

The below curriculum is designed for Business Management Studies which is mapped to the CDIO Syllabus. The flexibility is embedded, and the program is adapted to the four principles of CDIO (Conceiving, Designing, Implementing, Operating). The program (4 years) is targeted to equip business students with graduate attributes that are applicable in real-life job market. With sub-major specific course modifications, this program can be applied to other majors under the business umbrella.

Business Management Curriculum—Diploma (Two years)

Semester 1

Unit Name	Mapping to CDIO Syllabus
Business Computer Applications	1.1 General Knowledge
English for Business	1.3 Basic Knowledge

(continued)

(continued)

Unit Name	Mapping to CDIO Syllabus
Marketing Principles	1.4 Disciplinary Fundamental Knowledge (Acc, Eco, Mrkt, Mgt, Computer)
Management Principles	1.4 Disciplinary Fundamental Knowledge (Acc, Eco, Mrkt, Mgt, Computer)
Business Math	1.2 Math and Social Sciences

Semester 2

Unit Name	Mapping to CDIO Syllabus
Principles of Economics	1.4 Disciplinary Fundamental Knowledge (Acc, Eco, Mrkt, Mgt, Computer)
Business Communications	1.2 Math and Social Sciences 3.2 Communication
Accounting Principles	1.4 Disciplinary Fundamental Knowledge (Acc, Eco, Mrkt, Mgt, Computer)
Business Law	1.4 Disciplinary Fundamental Knowledge (Acc, Eco, Mrkt, Mgt, Computer)
Foundation of Management Information System	1.4 Disciplinary Fundamental Knowledge (Acc, Eco, Mrkt, Mgt, Computer)

Semester 3 (Includes 2 PBL Courses)

Unit Name	Mapping to CDIO Syllabus
Event Management (PBL)	2.3 Systematic Thinking 4.5 Implementing Business Plan/Project
Business Ethics	2.4 Personal Skills and Attributes 2.5 Professional Skills and Attributes
Principles of Finance	1.3 Basic Knowledge 1.4 Disciplinary Fundamental Knowledge (Acc, Eco, Mrkt, Mgt, Computer)
Business Planning (PBL)	2.2 Research and Knowledge Discovery 4.4 Designing Economics/Business Plan/Project
Electives (humanities, social skills, arts, drama, music)	1.1 General Knowledge 4.1 External and Societal Context

Semester 4 (Includes 2 PBL Courses)

Unit Name	Mapping to CDIO Syllabus
Business Leadership	1.5 Disciplinary Specialized Knowledge (Sub-Major) 2.1 Business Reasoning & Problem Solving 2.4 Personal Skills and Attributes 2.5 Professional Skills and Attributes 3.1 Teamwork 3.2 Communication
Change Management	1.5 Disciplinary Specialized Knowledge (Sub-Major) 2.1 Business Reasoning & Problem Solving 2.2 Research and Knowledge Discovery 2.3 Systematic Thinking 2.4 Personal Skills and Attributes 2.5 Professional Skills and Attributes 3.2 Communication 3.3 Communication In Foreign Languages 4.1 External and Societal Context
Innovation and Entrepreneurship (PBL)	1.5 Disciplinary Specialized Knowledge (Sub-Major) 4.1 External and Societal Context 4.2 Enterprise and Business Context 4.3 Conceiving Business Ideas 4.4 Designing Economics/Business Plan/Project 4.5 Implementing Business Plan/Project
Business Research (PBL)	4.1 External and Societal Context 4.2 Enterprise and Business Context 4.3 Conceiving Business Ideas 4.4 Designing Economics/Business Plan/Project
Operations Management	1.5 Disciplinary Specialized Knowledge (Sub-Major) 2.2 Research and Knowledge Discovery 2.3 Systematic Thinking 4.1 External and Societal Context 4.2 Enterprise and Business Context

Summer Internship I: Covering all aspects of CDIO Syllabus (applying theory to practice)

Business Management Curriculum—Bachelor (2 years after the Diploma, in total 4 years)

Semester 1

Unit Name	Mapping to CDIO Syllabus
HR in Organizations	1.4 Disciplinary Fundamental Knowledge (Acc, Eco, Mrkt, Mgt, Computer) 2.4 Personal Skills and Attributes 3.1 Teamwork 3.2 Communication 3.3 Communication in Foreign Languages 4.1 External and Societal Context
Managerial Accounting	1.4 Disciplinary Fundamental Knowledge (Acc, Eco, Mrkt, Mgt, Computer) 2.1 Business Reasoning & Problem Solving 2.3 Systematic Thinking
Organizational Behavior	1.5 Disciplinary Specialized Knowledge (Sub-Major) 2.1 Business Reasoning & Problem Solving 2.3 Systematic Thinking 2.4 Personal Skills and Attributes 2.5 Professional Skills and Attributes 3.1 Teamwork 3.2 Communication 3.3 Communication in Foreign Languages 4.2 Enterprise and Business Context
Customer Service	2.4 Personal Skills and Attributes 2.5 Professional Skills and Attributes 3.1 Teamwork 3.2 Communication 3.3 Communication in Foreign Languages 4.1 External and Societal Context 4.2 Enterprise and Business Context
Elective (Humanities)	1.1 General Knowledge 4.1 External and Societal Context

Semester 2 (Includes 2 PBL Courses)

Unit Name	Mapping to CDIO Syllabus
Managerial Economics	1.4 Disciplinary Fundamental Knowledge (Acc, Eco, Mrkt, Mgt, Computer) 2.1 Business Reasoning & Problem Solving 2.3 Systematic Thinking 4.1 External and Societal Context

(continued)

(continued)

Unit Name	Mapping to CDIO Syllabus
Business Data Analysis (PBL)	2.1 Business Reasoning & Problem Solving 2.2 Research and Knowledge Discovery 2.3 Systematic Thinking 4.3 Conceiving Business Ideas 4.4 Designing Economics/Business Plan/Project
Market Research (PBL)	2.1 Business Reasoning & Problem Solving 2.2 Research and Knowledge Discovery 2.3 Systematic Thinking 4.1 External and Societal Context 4.2 Enterprise and Business Context 4.3 Conceiving Business Ideas 4.4 Designing Economics/Business Plan/Project
International Business	2.4 Personal Skills and Attributes 2.5 Professional Skills and Attributes 3.1 Teamwork 3.2 Communication 3.3 Communication in Foreign Languages 4.1 External and Societal Context 4.2 Enterprise and Business Context
Strategic Management	1.5 Disciplinary Specialized Knowledge (Sub-Major) 2.3 Systematic Thinking 3.1 Teamwork 3.2 Communication 3.3 Communication in Foreign Languages 4.1 External and Societal Context 4.2 Enterprise and Business Context

Semester 3 (Includes 2 PBL Courses)

Unit Name	Mapping to CDIO Syllabus
Wealth Management (Investment Simulation)	2.1 Business Reasoning & Problem Solving 2.2 Research and Knowledge Discovery 4.1 External and Societal Context 4.2 Enterprise and Business Context
Managing Organizational Change (PBL)	2.4 Personal Skills and Attributes 2.5 Professional Skills and Attributes 3.1 Teamwork 3.2 Communication 3.3 Communication in Foreign Languages 4.1 External and Societal Context 4.2 Enterprise and Business Context

(continued)

(continued)

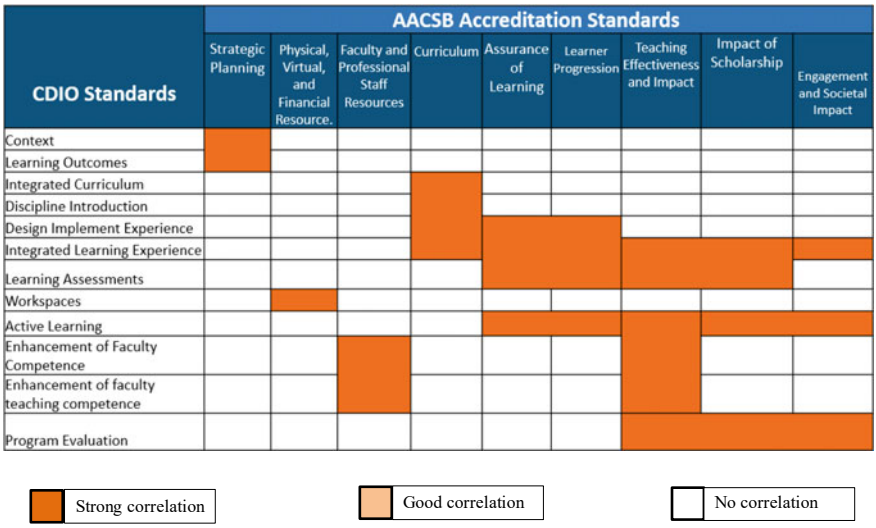
Unit Name	Mapping to CDIO Syllabus
Entrepreneurship, Innovation and New Ventures (PBL)	2.1 Business Reasoning & Problem Solving 2.2 Research and Knowledge Discovery 2.3 Systematic Thinking 4.1 External and Societal Context 4.2 Enterprise and Business Context 4.3 Conceiving Business Ideas 4.5 Designing Economics/Business Plan/Project Implementing Business Plan/Project
Islamic Finance	1.4 Disciplinary Fundamental Knowledge (Acc, Eco, Mrkt, Mgt, Computer) 4.1 External and Societal Context 4.2 Enterprise and Business Context
Elective (Language)	3.2 Communication 3.3 Communication in Foreign Languages

Semester 4 (Includes 2 PBL Courses)

Unit Name	Mapping to CDIO Syllabus
Emotional Intelligence	2.4 Personal Skills and Attributes 2.5 Professional Skills and Attributes 3.1 Teamwork 3.2 Communication 3.3 Communication in Foreign Languages 4.1 External and Societal Context 4.2 Enterprise and Business Context
Digital Marketing (PBL)	1.4 Disciplinary Fundamental Knowledge (Acc, Eco, Mrkt, Mgt, Computer) 2.2 Research and Knowledge Discovery 4.1 External and Societal Context 4.2 Enterprise and Business Context 4.3 Conceiving Business Ideas
Quality Management	1.5 Disciplinary Specialized Knowledge (Sub-Major) 4.5 Professional Skills and Attributes
Business Information and Decision Systems	2.1 Business Reasoning & Problem Solving 2.2 Research and Knowledge Discovery 2.3 Systematic Thinking 2.4 Personal Skills and Attributes 2.5 Professional Skills and Attributes 4.5 Implementing Business Plan/Project
Graduation Project (PBL)	Covering all aspects of CDIO Syllabus Start-up companies with team members from different business sub-majors (HR, MIS, ACC, Finance, Marketing and Management as simulation to how real companies operate)

Appendix 2

Correlation between AACSB Accreditation Standards and CDIO Standards



Appendix 3

Correlation between AACSB Accreditation Standards and CDIO Syllabus

CDIO SYLLABUS 2.0	AACSB Accreditation Standards								
	Strategic Planning	Physical, Virtual, and Financial Resource	Faculty and Professional Staff Resources	Curriculum	Assurance of Learning	Learner Progression	Teaching Effectiveness & Impact	Impact of Scholarship	Engagement & Societal Impact
1. DISCIPLINARY KNOWLEDGE AND REASONING									
1.1 Knowledge of underlying mathematics and sciences									
1.2 Core engineering fundamental knowledge									
1.3 Advanced engineering fundamental knowledge, mathematics and tools									
2. PERSONAL AND PROFESSIONAL SKILLS AND ATTRIBUTES									
2.1 Analytic reasoning and problem solving									
2.2 Experimentation, investigation and knowledge discovery									
2.3 System thinking									
2.4 Attitudes, thought and learning									
2.5 Ethics, equity and other responsibilities									

Strong correlation Good correlation No correlation

CDIO SYLLABUS 2.0	AACSB Accreditation Standards								
	Strategic Planning	Physical, Virtual, and Financial Resource	Faculty and Professional Staff Resources	Curriculum	Assurance of Learning	Learner Progression	Teaching Effectiveness and Impact	Impact of Scholarship	Engagement & Societal Impact
3. INTERPERSONAL SKILSS: TEAMWORK AND COMMUNICATION									
3.1 Teamwork									
3.2 Communications									
3.3 Communications in foreign language									
4. CDIO SYSTEMS IN THE ENTERPRISE, SOCIETAL AND ENVIRONMENTAL CONTEXT- THE INNOVATION PROCESS									
4.1 External, societal and environmental context									
4.2 Enterprise and business context									
4.3 Conceiving, system engineering and management									
4.4 Designing									
4.5 Implementing									
4.6 Operating									

Strong correlation Good correlation No correlation

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Leveraging Research and Innovation for the Post COVID-19 Era: Lessons Learned and Future Plans Towards Economic Resilience

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Abstract Since its dawn, the COVID-19 pandemic has posed new challenges in the Arab world, and across the world that have adversely inflicted unforeseen types of damage upon the traditional notion of globalization. This has, inherently, resulted in the initiation of several new pathways for research and innovation by local government agencies in various Arab nations. Spillovers from government and industry-specific research and investment to combat COVID-19 may yet prove to be beneficial to several of the sectors involved. In view of such opportunities and growing demand, research and innovation systems in the Arab world may need to rethink and reorient research priorities to align them with imminent needs. Furthermore, the Arab world is facing daunting challenges in research and innovation due to the deep scarcity in the human capital and material resources needed to shore up economic prosperity. It is therefore imperative that Arab countries start to recognize and appreciate all genuine efforts tallied by researchers in the ways of advancing the wellbeing of the communities, and along the way help the underlying economies move in progressive pursuits. To help the various sectors of the economy go about the various activities suggested in this chapter, one can readily surmise that an all-out effort would require

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some concerted activities involving the concerned government agencies, participating academic institutions, first-tier researchers, various components of the industrial sector, together with funding agencies that would take up much of the expenses involved in the process of research and innovation so as to keep pace with the rest of the knowledge-based societies around the world. Indeed, this would necessitate that the various sectors (medical and health, agricultural, industrial, information and communications technology, and the educational sectors) leverage existing infrastructures and embark upon new capital investments that are ready to shoulder the responsibility of effectively moving the Arab world into the post-COVID era rapidly and successfully.

To do that, we must be able to identify sectors and institutions that can be potential partakers in the various activities of the processes involved. This would readily lead us to identify a few national organizations, which would offer access to their infrastructures to researchers and the various participating industries involved. Furthermore, the process must occur in piecemeal fashion, starting with the vital segments of the economy and transcending gradually to other segments, while observing health-directed practices in all phases, until the economic lifecycle would kick into a normal setting. The effects of the pandemic on these sectors and industries, as well as natural market forces and regulations are discussed in this chapter. These effects must be identified for policymakers to be guided toward more evidence-based planning to address the challenges that are inherently associated with them. This chapter also addresses ways and efforts of helping the various sectors go about the recommended research priorities in preparation for an era of reconstruction to build resilient national economies that are readily amenable for pan Arab integration in the post COVID-19. We finally recommend avenues and policies whereby the Arab world could levy some of the great benefits that have accrued because of the COVID-induced drawbacks in restricting global trade and economic integration.

Keywords COVID-19 coronavirus · Economic resilience · Medical and health · Agriculture · Industry · IT · Education · Arab region

1 Introduction

The World Health Organization (WHO) declared the outbreak of a new type of Coronavirus, SARS-CoV-2 that causes the COVID-19 respiratory disease, a global pandemic on March 11, 2020. Since then, the COVID-19 was not only considered a health crisis, but also a large-scale humanitarian crisis that has led to the suffering of all humanity and has, also, put its social, economic, and scientific research on the brink of collapse [1]. The WHO published a Coordinated Global Research Roadmap: 2019 Novel Coronavirus on March 12, 2020, that aimed to build a robust global research response based on the outcomes of the Global Research Forum held during February 11–12, 2020, by the WHO and the Global Research Collaboration for Infectious Disease Preparedness and Response (GLOPID-R) [2]. The Global Research Forum

followed the WHO research and development (R&D) Blueprint strategy as a framework that aimed to coordinate and accelerate global research work to target diseases that threaten humanity, rapidly develop diagnostics, medicines and vaccines, and promptly respond to outbreaks thereby preventing other future epidemics [2].

Overall, health management strategies around many Arab countries have proven effective in limiting excessive human losses, with strict containment measures implemented in the early stages of the outbreak. However, week-on-week case growth towards early 2021 had grown significantly in many countries such as Iraq, Morocco, Lebanon and Jordan but slowed in other countries like Saudi Arabia [3]. The Arab world has been socially and economically implicated by the COVID-19 pandemic. The Arab world has begun to witness the negative and disproportionate effects of COVID-19 on the economies and societies involved. This is in addition to the adverse effects that it has had on the medical and health industries, and the agricultural, industrial, and IT sectors, and the associated educational processes and the underlying scientific research infrastructure. While there was no definitive treatment for this novel infectious disease at the time, the medical and health industries were assisting governments in meeting such unlikely COVID-19 needs, ranging from research and development to proposing potential treatment strategies, to balancing the medicines supply chains in such dire times of crisis. Towards the onset of the year 2021, 11 vaccines were granted emergency use authorizations by national regulatory authorities. At least one WHO-recognized stringent regulatory authority has approved six of them for emergency use [4]. Many Arab countries had been stepping up inoculation initiatives as case numbers continued to grow in the region. Along with this, medical and health industries were battling to maintain natural market flow, as the new pandemic has had its toll in restricting access to essential medications at reasonable cost; something that had constituted the primary goal for any medical system to fulfill [5]. The pandemic has put the medical systems of Arab countries under strain, with some of them being particularly frail and overburdened. Obviously, while the situation was not the same in the wealthier Gulf countries, the lack of hospital beds and testing facilities posed a major concern in developing economies in the Levant and North African regions, or in fragile and conflict-plagued countries.

In Lebanon, Morocco, and Tunisia, the first wave had left public hospitals and their staffs overly exhausted. While some other countries that managed to escape the adverse impacts of COVID-19 on public hospitals, have had to suffer rather more severely during the second wave. The challenge of fighting an emerging disease in low-income countries could prove to be the challenge of a lifetime, as economically capable countries with robust healthcare systems have struggled to detect and contain COVID-19. To that end, the global infrastructure for combating epidemics is rather shaky [6]. For instance, COVID-19 has led to pronounced repercussions on the different sectors involved including reduced funding on scientific research with an inevitable decline in productivity in a few areas and programs at different academic and research institutions in the region. One of the most important challenges and consequences of the COVID-19 pandemic is the economic crisis that the Arab world has been experiencing; something that has led to a pronounced reduction in the direly needed funding for conducting scientific research in general, with major

focus directed at expenditure on treatment and the support of the healthcare sector. At times, there also appears to be a significant lack of the components and tools that can be leveraged for scientific research and innovation. This is on top of the amalgamated complexities in the absence of a much-needed leverage in the ways of financial support for research and innovation by governmental and non-governmental agencies.

2 Immediate Impacts of the Outbreak of the Pandemic

The emergence of COVID-19 has caused great harm to human lives in general, and to the global energy sector. The precautionary measures undertaken by many of the world's governments to restrict movement of individuals across geographic boundaries by closing border crossing points, airports, seaports, factories, amongst others, all contributed significantly to a pronounced decline in the demand for energy of all kinds. Preliminary estimates indicate that the Arab region is at risk of losing $42 billion in gross domestic product (GDP), as a result [7]. It is also expected that unemployment rates in the region will progressively increase by 1.2 percentage points due to the outbreak of COVID-19, which means that the region would lose about 1.7 million jobs in a single year since the outbreak [8]. Between January and mid-March 2020, businesses across the region recorded massive tangible losses in their market capitals, amounting to $420 billion, resulting in a loss of 8% of the region's total wealth [8]. Several Arab governments have implemented a set of measures to deal with the steady economic decline and to address the expected negative economic and social impacts on the communities and businesses involved, in attempt to mitigate the damage. For example, the United Arab Emirates announced a $27 billion economic stimulus plan, which included subsidizing water and electricity for citizens and for commercial and industrial activities. Qatar also announced a similar package worth $23 billion to support and provide financial and economic incentives to the private sector. Saudi Arabia, on its part, announced a $13 billion package to support businesses and small and medium size enterprises. Egypt, in turn, unveiled a comprehensive $6 billion plan to combat the fast-spreading virus and to support economic growth [8]. Nonetheless, governments across the world have still failed to address how their economies and public health systems will prepare for another COVID-like storm in the future. This inherently includes the costs involved for any consequent crises and the subsequent recovery plans that will be rather enormous. Meanwhile, with examples readily in sight, evidence indicates that any government energy plan would greatly benefit from policies designed to facilitate and encourage transitions to renewable technologies.

In the meantime, some still fear the negative effects of the COVID-19 pandemic on international economic cooperation. This is readily seen to impart negative consequences upon the transformation of the energy sector, as it draws upon the power

of globalization in the exchange of scientific expertise and the huge capital necessary in this rather important field. This is not to underestimate the role of international trade in marketing renewable energy commodities and services. On the other hand, researchers have drawn particular attention to the increased role of electronic communications, as they played out hugely in helping impacted communities go about their work and study activities remotely, and under a seemingly natural setting right from the conveniences of their homes. Now, should such practices persist once the pandemic is past, it could lead to a reduction in the use of personal means of transportation together with an ensuing reduction in fuel consumption. This in turn may motivate sizeable groups of the global population to dispense with their cars, in the least, and to work from home. This certainly would lead to environmental advantages due to an anticipated reduction in harmful emissions. Further, modern enterprise video communications and innovation platforms will reduce the need for holding face-to-face conferences, webinars or seminars, and replace them by virtual versions, which could mean a reduction in air or land travel.

As such, COVID-19 would have created challenges and opportunities for energy transitions. Here, a call to invest in homes and residential buildings that leads to reductions and rationalizations of energy consumptions will help in providing the necessary momentum for a renewed reconstruction of the countries' economies together with the associated job creation opportunities. On the other hand, the rationalization of energy consumption in modern homes reduces fuel consumption and wards off harmful emissions. This readily places mounting pressures on adversely impacted economies to prioritize investment endeavors towards these rather essential areas.

Previous studies indicate that COVID-19 has readily drawn particular attention to the need for a successful electricity sector that meets the various requirements of society during disaster times and calamities [9]. Hence, when planning the development of the electricity sector, such matters will have to be taken more seriously into consideration. Here, it was observed during the early pandemic months that generating electricity from renewable energy sources performed quite well. This would, inherently, lead to more investments in these forms of energy in the years ahead, which, in turn, will also mean less pollution [10]. Studies have indicated many options and investment opportunities do, indeed, exist for petroleum companies [11]. With this, it is evident that governmental financial support has being channeled rather more intensely towards renewables as opposed to fossil fuels. Such type of government support will be offered to companies in the forms of tax exemptions or fuel price subsidies. Here, the COVID-19 experience will inherently serve to further investments in this direction, encouraging energy industries, including petroleum companies, to invest in renewables. Meanwhile, funding and investments in the current technologies of the petroleum sector are expected to continue, particularly that demand for petroleum-based commodities continues to exist. In the foreseeable future, we should, also expect to still see continuing public sector funding of low-carbon emitting work products.

In fully industrialized nations, certain industries, viz. automotive, airline, locomotive and other heavy industries would have to lag a bit, as other life-supporting ones would need to proceed in full force. In prioritizing this sequence, industries

that support the persistence of life on the planet, including food production and agricultural sustenance would need to receive top priority. Furthermore, other industries that would ultimately render the cure in the face of the spread, including pharmaceuticals, medical and safety equipment manufacturing, as well as innovative lab testing gears and gadgets must also be at the top of the list. Moreover, industries that had flourished by leaps and bounds over the past three decades, including the information technology (IT) and telecom industries must not be interrupted; this is essentially needed to render much needed services remotely, particularly that several countries around the world would continue to be inundated by the pandemic until an ultimate cure that would save life on the planet is attained. Further developments in these industries are direly needed, especially that large segments of society in most countries of the world would still need to exercise social distancing measures,; this applies particularly to the educational sectors, software development industries, banking outlets, all amongst many others, where much of the work required would need to be put in place through working from home practices. In due course, information, and communication technology (ICT) industries would be sought to contrive innovative solutions so that man-borne devices, for instance, may be invented to alert people to zones that may be contaminated by viruses and other microorganisms and guide them to move around safer paths during their daily activities.

3 Research and Development Priorities in the Wake of the COVID-19 Outbreak

Times of national hardships can be leveraged to kick off efforts at full length in support of various endeavors to combat the ongoing situation, moving forward towards better times in the process. In this regard, one could suggest priorities that can be substantiated in support of national efforts through government efforts. This would entail, amongst others: the medical and health sector, the agricultural sector, the industrial and IT sector, and the educational sector.

3.1 In the Medical and Health Sector

In the wake of COVID-19, various governments did, indeed, adopt strict containment measures due to the limited capacity of the health systems to handle such a large-scale outbreak. Nonetheless, the lack of compliance with preventive measures, as well as the difficulty in enforcing physical separation at large, has led densely populated cities to raise concerns about dire situations as this one in the future. As a result, hospitals, initially struggled to cope with an increasing number of COVID-19 patients, with some reaching capacity, as healthcare professionals pointed to a lack of medical equipment, doctors, medical personnel, and ICU beds to deal with a second wave of

this magnitude. As a result of the pandemic, Arab world economies found themselves in a situation requiring significant investments in healthcare; something that had not traditionally been a priority sector in the region. Governments, for example, had to boost their testing capacities by establishing new sites and drive-through testing stations. As a result, countries were able to improve case detection, tracing, and isolation measures [3]. Opportunities for the private sector to support the development of health care systems is bound to increase as more public and private investments are rendered towards healthcare support [12].

Short-term effects of COVID-19 on the health sectors and market dynamics were found to include demand changes, supply shortages, panic buying and stocking, putting in place policies and regulatory frameworks to facilitate the development of COVID-19 vaccines, and a paradigm shift in communication strategies and product promotions leveraging remote interactions via evolving IT technologies and R&D process changes [13]. Reduced health expenditures, shortages of human resources in the health care sector, and the lack of much needed medical equipment have all harmed the economies of Arab countries. In most Arab countries, overall reported health expenditures per capita were lower than the averages for other countries with similar income levels. Furthermore, the number of physicians per 1000 people in the region dropped to lower than the WHO-recommended threshold of 4.45 doctors, as the number of nurses and midwives per 1000 people was as low as 0.72 in Morocco and 0.79 in Egypt [14]. There were shifts in the communication, as well as the marketing and promotion of health-care products via telecommunications such as tele-medicine, which has been used flexibly and easily for both promotional and patient-support actions [15]. COVID-19 vaccine developments were expected to boost healthcare supply and infrastructure in some Arab countries rather quickly. The UAE, Saudi Arabia, and Morocco, for example, had partnered with foreign countries and private companies to support vaccine research and entered advanced trial phases. Phase III trials for vaccines developed by two Chinese corporations, Sinopharm and CanSino Biologics, began in the UAE in July 2020 and in Saudi Arabia in August 2020. Egypt had also formed collaboration with China for the development and distribution of two Sinopharm-developed COVID-19 vaccines. This inherently has led to stronger China-Arab partnership in the area [16]. More than 100 medicines, as well as 53 vaccines, were being developed or tested as therapeutics for COVID-19 patients around the world [15]. Overall, the COVID-19 crisis had, indeed, boosted the Arab countries' humanitarian outreach and medical diplomacy. The UAE quickly established itself as a major medical aid provider, delivering aid supplies (e.g., masks, gloves, personal protective equipment, etc.) world-wide in early March 2020 [15]. Other countries, including Jordan, Morocco, Qatar and Kuwait, adopted similar strategies. Morocco was particularly active, dispatching gloves, sanitary equipment, and other supplies via its national airline, mainly to its African continent neighbors.

Many countries implemented public awareness campaigns through radio talk shows, TV, and social media campaigns, to raise awareness about key hygiene-fostering rules and preventive measures to stop COVID-19 from spreading. Various countries started moving towards achieving some level of self-sufficiency in the

pharmaceuticals industries for fear of potential shortages because of export bans in some developed countries; many of them, in fact, were forced to issue protocols to avoid shortages under such a crisis [13]. The implications of supply considerations were also rather so vital for pharmaceuticals and medical devices, and, progressively, global value chains rose in importance. Investments in these sectors and the provisioning of sufficient supplies to combat the pandemic became a top priority for policy and decision makers in the region. The pandemic caused economic slowdowns in many countries in a manner that ultimately led to slowdowns in the growth of the pharmaceutical industry itself; something particularly rather too sensitive for countries leveraging the pharmaceuticals industry for their economic growth. Whereas the COVID-19 crisis has affected economic growth, it should be noted that the health sector has not caused any significant economic impact during previous recessions [17]. Environmental health concerns related to the COVID-19 pandemic have been especially important for Arab countries [18]. Water scarcity and the lack of access to clean water and sanitation, as well as poor waste management, particularly among the poorer segments of society, and in conflict-affected territories and refugee camps, could further amplify the impact of pandemics. Furthermore, containment measures may have resulted in increased exposure to indoor air pollution; particularly for those in poorer Arab countries relying on polluting fuels for cooking and heating and living in buildings with inadequate or poor ventilation systems, and consequently, increasing vulnerabilities of certain communities in the face of pandemics.

Some of the key priorities in the medical and health sector would entail the following: (1) to initiate patient demographic data collection related to COVID-19 collected on a per region/city basis and which would encompass collecting and analyzing blood samples, vital signs, number of recoveries, number of deaths, and number of overall cases in general; (2) to collect data on administered drugs, methods, and protocols adhered to in treating patients and seeing to their recovery; (3) to establish a national database accessible by all stakeholders involved to support all ongoing endeavors; (4) to avail data to researchers in the fields of pathology, immunology, epidemiology, pharmacology, disease control, and stem cell research, amongst others; (5) to establish research groups that would involve researchers from the fields of medicine, pharmacology, engineering, and IT to use data and conduct research on the various facets related to the pandemic; (6) to incentivize medical and pharmaceuticals researchers to work intensely to contrive medications (treatments, medicines, injections, lab procedures, and vaccines) to prop-up national efforts moving forward in a direction to recovery. Here, governments must re-allocate all essential funding, like no other time prior to COVID-19; (7) to work closely with both the IT and manufacturing sectors in ways that would contribute towards introducing patient-oriented devices and gadgets including respirators and ventilators; (8) to shore up R&D efforts in a direction that would lead to fruition in introducing the necessary cures for diseases and much-needed vaccines; (9) to boost production of medicinal and pharmaceutical products in ways that would serve the imminent needs across society and ensure self-sufficiency.

3.2 In the Agricultural Sector

A growing global population and the ensuing demand for food will continue to increase. Meanwhile, food price spikes in recent years have intensified global concerns about current levels of agricultural production [19]. These trends have resulted in a spotlight on food security and agricultural development, and on the role of financial institutions in increasing agricultural producers' access to finance. In the Arab world, many small-scale farmers live in rural areas and depend on agriculture as the main source of income and employment. These small-scale farmers also play a key role in increasing food supply, and increasingly supply large conglomerates and corporations with inputs for their production lines. Despite their socioeconomic importance, small-scale farmers tend to have little access to formal credit and financing, which consequently limits their capacity to invest in the technologies they need to increase their yields and income and consequently reduce poverty [20]. In most Arab countries, the government is the only entity that provides financial services to farmers in rural areas and makes important contributions in financing small and medium enterprises in rural areas.

Food security is achieved when all people have physical, social, and economic access to sufficient, safe, and nutritious food which meets their dietary needs at all time (during normal and emergent circumstances) [21]. Four embedded factors which control food security have been characterized by the Food and Agriculture Organization; these include: (1) the availability of food, which focuses on the "supply side" of food security and is determined by the level of food production, stock levels and trade; (2) access to food, which requires adequate livelihoods allowing people to have the economic means to purchase food taking into account food prices; (3) the use of food or food quality, which focuses on nutrition and safety; (4) the stability of supply, which deals with the fact that availability, accessibility, and quality should be ensured at all times [21]. Unfavorable climate conditions, political instability, economic factors including unemployment and rising food prices, as well as pandemics, such as the current COVID-19 pandemic, can be important factors of food insecurity. The effects of the pandemic have gone beyond the health aspects to other aspects of life and have extended to agricultural production and food security through the disruptions in the global and domestic supply chains and, hence, inflicted severe impacts in terms of access to and availability of food [22]. The COVID-19 pandemic has uncovered the fragility of food systems in the Arab world and posed a challenge that may hinder real and concrete achievements in the sustainable development goals (SDGs) by 2030. On the other hand, the COVID-19 pandemic has unveiled the importance of agricultural research and the vitality of investing in this strategically important field that could turn crises and risks into opportunities.

Agricultural research and development have constituted an innovation hub that is fundamentally altering the way we create, manage, and govern innovation. From ending poverty and hunger to responding to climate change and the conservation of natural resources—two key challenges the Arab world is facing—food and agriculture sit at the forefront of the 2030 agenda for sustainable development [23], and, as of

late, the COVID-19 pandemic has taken that matter center stage. In fact, agricultural research in the past and in the post COVID-19 era, has been suffering from a clear deficiency and lack of support in all Arab countries. Furthermore, the COVID-19 pandemic posed daunting challenges in the ways that our food is produced, transformed, and consumed. Therefore, this necessitates a transformation of existing agriculture and food systems to achieve the SDGs, which readily require major changes in the approaches, technologies, practices, and policies associated with agriculture and food systems. Innovation is and will continue to be at the core of this transformation. In the context of agricultural innovation systems, the Food and Agriculture Organization (FAO) defines agricultural innovation as "the process whereby individuals or organizations bring new or existing products, processes or ways of organization into use for the first time in a specific context in order to increase effectiveness, competitiveness, resilience to shocks or environmental sustainability and thereby contribute to food security and nutrition, economic development or sustainable natural resource management" [24]. In this, not all types of innovation would contribute to achieving sustainable development objectives in the same way. For innovation to contribute to the SDGs, it will need to bring progress in productivity, use resources efficiency, land and water in particular, and adapt food systems to climate change, equity, and, of course, sustainability. Furthermore, it would need to contribute to a reduction in losses and wastages, and lead to improvements in the production and consumption of more nutritious foods. It would also need to help lift small-scale farmers out of poverty, reduce their vulnerability, and build their capacity to participate actively in their countries' economic lifecycles. Innovation should provide women and youth with new and more rewarding careers offering decent employment opportunities in agriculture servicing the active food supply chains. While the commercial sectors in some developing countries have adopted innovation and precision agriculture technologies, the challenge has, in fact, been that transformative innovations and modern tools for making agricultural systems more efficient and sustainable, are often not designed for small-scale farmers use [25].

New post COVID-19 priorities should aim to produce specific and factual knowledge on the different types and facets of innovation that is readily applicable to agriculture, food and the rural development sectors in the Arab world, and, in the process, foster sufficient dynamism to readily identify pathways on how innovation and technology can be used effectively in agriculture and food systems across the region. This would foster and scale up innovations through the exchange of knowledge and best practices, adaptation of enabling policies and incentives, and the development of partnerships and action plans as illustrated in Fig. 1. Innovation in agriculture is essential but it goes well beyond the common understanding of the terminologies. This requires involving different social, organizational or institutional processes, ranging from access to markets, as well as credit or extension services to marketing products in totally new ways. Here, agribusiness incubators and accelerators are considered a major landmark of the transformative change required in agriculture and food systems in the region, and these would need to be designed specifically for young people and professionals interested in agri-entrepreneurship. The adoption of these initiatives in the agricultural sector empowers women and the

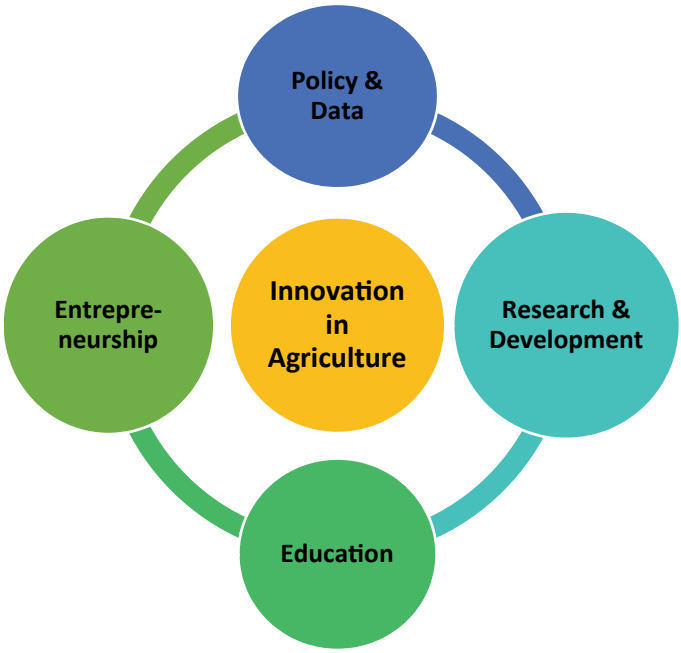

Fig. 1 The key drivers and pathway for investment in innovation and technology in agriculture

youth; it creates jobs and raises the participation of women and youth in the realms of entrepreneurship. The role of disruptive technologies in enhancing rural youth entrepreneurships and in transforming food systems is a key priority for the region. As such, entrepreneurs are producers and translators of innovations (technical and institutional), the contributions of whom would facilitate and accelerate changes that lead to development. Transformative change is all about power dynamics. There are ample opportunities for women and men who can deliver and there are various assumptions about what women and men can do. There is a need to rebalance power relations and the representation of stakeholders' voices within the discourse about food system transformations and the provisioning of solutions.

The Arab world faces a series of challenges related to food and nutrition security, and the degradation in the situation of already scarce natural resources. Conflicts, migrations, and climatic changes all are bound to exacerbate these challenges still further, especially during testing times; in particular, as the one we are currently witnessing due to the COVID-19 pandemic. Current trends are clearly unsustainable and if not adequately addressed, they will lead to the aggravation of the problems addressed herein and, consequently, hinder the achievement of the SDGs. New developmental approaches are needed, commensurate with innovative policies, technologies and organizational processes and practices, as well as cooperation among the countries of the region on common issues involving economic development,

food security, development of inclusive food value chains, the fight against transboundary animal and plant diseases, and the leverage of innovations for an overall improvement of the agriculture and food systems. Actions are required to remove barriers and address the constraints that stifle the capacity of farmers and other stakeholders to innovate along the food value chains. Scaling up the innovation ecosystem would require that various stakeholders and decision-makers develop a common understanding of impact pathways as well as new partnerships and business models involving the public and private sectors, civil society, and farmer associations.

Some countries in the Arab regions have been adversely affected by limited food production and access, leading them to become food insecure. High unemployment rates, income losses, and high food costs are all factors that endanger access to food in the Arab world and that will sustain long-term impacts in food security. The Arab world should have taken urgent measures to mitigate this impact on the food systems to warrant food security for the populations involved. To avert food emergency, there is an urgent need to protect the most vulnerable people, maintain food supply chains, mitigate the effects of the COVID-19 pandemic throughout the food system, boost food production, and build more resilient food systems. Investment in agricultural research, development, and innovation is in order. This requires that actions are readily taken to accelerate the pace towards more productive, sustainable, efficient, and equitable value chains. This would entail facilitating and providing finance and loans to small and medium enterprises operating in the agri-food industries. On this note, there has been pronounced stagnation in food commodities because of the pandemic; something that has particularly impacted small-scale farmers who rely mainly on selling their agri-food products daily. To build resilient and prospering food systems in emerging markets over the years, there should be some focus on: (1) agri-food system innovations including market linkages, food traceability, trust, and agricultural waste management; (2) youth and women employment in agriculture including start-ups, business incubators and accelerators, and some seed supply chains; and (3) the convergence of current and emerging technologies for agriculture including precision, hydroponics/aquaponics, vertical farming, imagery and sensors, drones, bio-pesticides, and gene technology to improve seed traits and control pests and diseases. Indeed, changes in farming practices and leveraged technologies will continue to increase proficiencies in seed technology, fertilizing practices, and crop protection products. There is an urgent need to enhance the role of agricultural research, development, and innovation in finding solutions to problems facing society. It has become clearer that most Arab countries have suffered noticeable weaknesses in the components and tolls that can be leveraged in the path of agricultural research. As a result, there is a dire need to harness the potential role of digital innovation and technology in agriculture such as the internet of things (IoT), artificial intelligence, and big data to contribute to more efficient and sustainable practices.

Food systems and agricultural economies in the Arab world are not sufficiently researched and the agri-food value chains and smallholders' interactions within these value chains remain poorly understood. However, there is broad consensus on the need for agricultural research and development to focus on the cultivation of strategic and industrial crops as an alternative to the cultivation of certain vegetables

(produce) that have long suffered competing marketing forces for decades. Introducing and planting new strategic crops that bear with them ample opportunities for food processing, alternative feed, fuel, and chemical production technologies can improve food security and income generation. For example, in Morocco, there was a shift of policy focus to agricultural trade balance in value terms. Morocco has reduced the agri-food trade deficit by increasing export of high value agri-food commodities. This shift implies an uplift in existing value chains and/or the creation of new ones. That would raise a key question: how could smallholder farmers in the region living under fragile ecosystems benefit from this shift of policy focus to enhance their resilience to climate change, improve their food security and nutrition and, in the process, increase their income? This would entail the following: (1) to introduce modern methods and digital technology that increase the efficiency of water use and expand the use of waste water for agricultural use; (2) to facilitate and support the endeavors of investors in the field of the agriculture sector; (3) to expedite the resolution of agricultural marketing crises and take all necessary measures to improve the production value chain of agri-food products; (4) to develop new procedures to encourage the export of agri-food products, expand the use of modern technology, and foster innovations in agriculture; (5) to facilitate the use of information technology and smart agriculture to solve problems and reduce post-harvest losses; (6) to honor the principles of decent work according to the International Labor Organization (ILO) for workers in the agriculture sector; (7) to expand the production of fodder for livestock; and (8) to focus on applied agricultural research at public research institutions including research centers and academic institutions.

Meanwhile, noting that the flow of climate finance to the region has been rather low. it would only be of strategic importance to use and expand on the leverage of renewable energy resources in the agriculture sector as a primary access point to available finance. This leads to another key priority question: “how to integrate renewable energy in food systems research to benefit small-scale farmers?” Added to that, there is an imminent need for some major effort for capacity building to access climate finance, region wide. Small-scale farmers often lose out in the convoluted supply chains of modern food systems and end up receiving only a small portion of the final price paid for their produce. Nonetheless, using recent advancements in mobile technologies and various forms of information and communication technology (ICT), producers and purchasers can connect directly. This model is already helping farmers in high-income countries and increasing their profits, as consumer preferences have shifted in favor of locally sourced foods. There also exists ample opportunities to bring these sorts of models to emerging markets, where populations are burgeoning and incomes are rising, including online or mobile phone-based platforms that connect farmers to food purchasers, and, thereon, to end-consumers that also entail restaurants and hotels. Now, as the world becomes increasingly interconnected with a continued increase in smartphone usage, the potential for farmers to market connection allows for more efficient and timely supply chains. Information and communication technology platforms offer apps that connect farmers, aggregators, wholesalers, and processors interested in stable business and reliable business partners. Farmers and aggregators can use these apps to offer deals on their

produce; wholesalers and processors can use them to search for suppliers, and both can benefit from the logistical support entailed therein. This would inherently support research priorities in ways that ultimately lead to the development of ICT and innovation platforms, aiding and encouraging research, development, and technology in agriculture.

3.3 In the Industrial and IT Sector

Prior to the COVID-19 era, the industry had already been working on technologies that were primarily meant for tele-conferencing and tele-class applications. Indeed, technology giants like Microsoft, Google, and Cisco had things already in place to stage team and group work meetings using the internet, while in the comfort of their living rooms, home offices, and office offices, traversing geopolitical boundaries. With little tweaking and twitching of existing technologies, these technology giants shortly thereafter were ready to help the rest of the world surmount the consequences of the global lockdowns. Following the mid 70s and early 80s, several universities in the developed world had directed students across other communities, particularly where academic institutions possessed more than just a single campus, to leverage existing forms of crude technologies and to disseminate the taught material across such large geographical stretches. As they did that, the first thing that occurred to them was to find ways to mimic another classroom environment set at some remote location. In so doing, academic institutions with the right financial means were able to set up a classroom replica of the one that existed at the primary location by establishing another classroom location with similar attributes to the first (original) one and used the same class instructor to lecture across two classrooms at totally different geographical locations. They also had to leverage very early forms of TV broadcast technologies to bring the taught material from one place to another and avail them to their beneficiaries who might be spaced out across hundreds or thousands of miles. With the use of such teleconferencing capabilities, people across various organizations (businesses and governments) now have the means to teleconference together on daily basis reducing the burdens and expenses of long-haul travels. Towards the late 80's into the early 90's, various institutions (both industrial and academic) started to have at their disposal enhanced legacy broadcast systems such as TV and radio stations, some newly introduced technologies, and the very early versions of packet switched networks like ISDN. This is when academic institutions started becoming enticed with benefiting from the new era that carried with it great potentials for the dissemination of taught material across distant geographical areas. Nonetheless, the leverage of such paradigms was targeting groups of people as opposed to targeting individual clients.

The sheer presence of enhanced broadcast technologies by both leading industries and academic establishments, of educator's enablement constituted a lynchpin to start exploring ways of targeting individuals disbursed across different geographical areas, as opposed to the immediately preceding logic of thought that prevailed

in targeting augmented groups of people for same matter. With such a paradigm shift in thought, people started exploring means and ways of introducing some viable forms of technology that would make it possible for individuals operating out of the conveniences of their workplaces to reach out to academic institutions to acquire the taught knowledge right in the convenience of their living rooms or from their disk spaces in a proper office operating environment. Nowadays, the use of computers, internet, data shows, together with various electronic resources, started becoming available together with much ease of use. In the early days of the 3rd millennium, various readily packaged resources started to emerge, which included technologies like Skype, Moodle, Blackboard, all amongst others. This, inherently, had to be propped up with the availability of high-end communications technologies that leveraged the internet and upscale wireless technologies for their operation. With an ongoing effort to advance the state-of-the-art in communications gear as supported by a more reliable and capable internet, the trend again was shifting to a new regime of distance learning all culminating into what is being referred to as Online Learning; this inherently includes synchronous lecture broadcasts, sturdy electronic resources, more user-friendly interfaces, as well as recorded lecture materials put to the service of the recipients accessed on their convenient times. Here, the advent of COVID-19 has had its toll on bringing about further developments to this regime of education.

Some of the key priorities in the industrial and IT sector include the following: (a) to maintain and enhance collaboration with academia to contrive cutting edge solutions that would help both the industrial and academic sectors; (b) to work closely with the IT sector to build robots and smart devices and sensors for monitoring and rescue purposes, including smart robots, drones, patient handling and evacuation etc.; (c) to ensure that industrial research and development leverages innovative paradigms in ways which would warrant that national industrial work products would compete regionally and globally; (d) to ensure that manufacturing paradigms directly address the dire needs of nations suffering the consequences of the COVID-19 pandemic; (e) to ensure that R&D efforts in the industrial sector are well oriented to serve the needs of a sector that may get isolated from the rest of the world because of the prevailing circumstances; (f) to ensure that R&D endeavors in the industrial sector can serve the imminent needs of the medical and agricultural sectors to achieve self- sufficiency in manufacturing; (g) to orient R&D endeavors towards contriving smart applications to serving the needs of the educational sector, the medical sector and first responders, (h) to orient R&D endeavors towards exploiting the communication infrastructure effectively and more efficiently such that it can serve all sectors involved during a crisis; (i) to work closely with the industrial sector to build robots and smart applications for monitoring and rescue purposes, including smart robots, drones, patient handling and evacuation, etc.

3.4 In the Educational Sector

Never has it been so imminent that technology adoption for classroom use to disseminate the taught material to students remotely, became a commodity that could not possibly be overlooked than in the days that followed the outbreak of COVID-19 pandemic. Since then, various governments around the world, at the recommendations of the WHO, found themselves compelled to stage various levels of lockdowns to curb the spread of the disease. Schools and institutions of higher learning had no options but to yield to the governments' directives in staging these imperatives. Amongst the notions sitting across the areas of "Distance Learning" and that of "Online Learning", various typologies started to emerge; this can readily be explained in the schematic form as illustrated in Fig. 2.

This works with a highly reliable internet infrastructure in place together with an available repository of electronic resources and the enabling technologies that would bolster the efforts of an educator in the classroom beyond the sheer boundaries of a traditional classroom environment. The educational resources block involves the resources that are leveraged to render the taught material and stage it to its recipients. These can be in the form of electronic books, class notes, pictures, videos, graphical presentations, etc. Such resources can be deployed in service of the Distance Learning, Online Learning, as well as the In-Person learning paradigms. The Distance Learning paradigm block involves a paradigm in which the taught material is delivered across remote distances to the student recipients. This paradigm is intended to

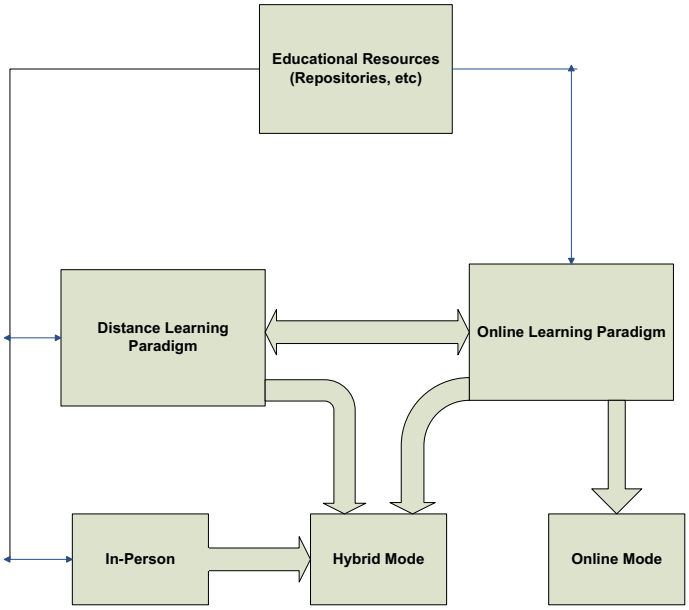

Fig. 2 Schematic diagram illustrating the various learning paradigms currently in place

place more emphasis on a student's own efforts plus some help from the instructor to acquire the taught material. The Distance Learning paradigm offers material in electronic form, recorded videos, electronic class notes, etc., all of which can be accessed at the convenience of the learner, and at their own pace. Material offered as such is also supplemented with various assessment methodologies which often make use of artificial intelligence to ensure that students get exposed to adequate levels of the curricular offerings and can be adapted with the student's learning capabilities. The Online Learning paradigm, where the taught material leverages a synchronous mode of faculty lecturing (in real time) together with various pieces coming in from the Distance Learning paradigm, readily feeds into the Online Learning mode and that of the hybrid mode. In the in-person learning block a student is expected to get the taught material under a traditional classroom setting. And in contemporary learning environments, this mode of learning is commonly enhanced with technology-in-the-classroom enablers that an educator uses to enhance the learning experiences of students. The hybrid mode block is where a student has the benefits of both worlds; in-person learning and in a traditional classroom setting augmented with the benefits levied from the Online and Distance Learning modes.

Some of the key priorities in the educational sector include the following: (a) to ensure that the educational sector does not slacken in the process. Instead it must go on a path where the educational process is rendered uninterrupted using novel online and other innovative approaches; (b) to ensure that R&D efforts along these lines follow out-of-the-box pursuits; (c) to ensure that the telecom sector stands in support of the educational process; by offering promotions for instance to students, teachers, and researchers, and enhancing the underlying communication infrastructure; (d) to ensure that novel mechanisms are in place so that students can take online exams uninterrupted; (e) to ensure that all research endeavors are openly shared across the scientific/research community; (f) to ensure that researchers stretching across the academic community including basic sciences, specialized sciences, and applied sciences, which all come together to contribute their joint efforts towards a common goal.

Many families around the world have experienced severe short-term interferences; for instance, home schooling has become a huge shock to parents' productivity, as well as to children's social livelihoods and learning practices. On an untested and unprecedented scale, education and students' assessments were moved online, resulting in a lot of trial and error and uncertainty for all the parties involved. Many evaluations were merely cancelled as a result. More importantly, these disruptions will not just be a short-term issue, but can also have long-term consequences for the affected cohorts and are likely to increase inequality.

Distance-learning solutions such as online classrooms, TV broadcasts, and computer-assisted learning were being applied on a massive scale during this time to connect teachers and students. The exact impact of school closures on students' learning ("learning loss") has yet to be determined, and it will vary by subject, age, and other factors. It will be worst for those students from low-income families and those dwelling in underserved localities. According to recent estimates, a learner could have lost one-third of a school year of learning during the current

crisis, implying significant learning losses and economic consequences as this could reduce the learners' lifetime earnings by about 3% and reduce a typical country's GDP by about 1.5% over the next century [26]. Countries have been on the run to prepare schools for reopening while also expanding and improving on remote and blended learning delivery methods. This could readily help the systems involved be better prepared in the future. It can also improve on long-term performance and resilience. Physical distancing measures, establishing hygienic protocols, revising personnel and attendance rules, and investing in staff training on appropriate virus-fighting measures are just a few of the steps that can be taken to manage the risks and trade-offs of reopening schools and institutions of higher learning.

Harnessing the lessons learned from remote learning, education systems should not only strive to ensure that disadvantaged learners have access to remote resources, but also to strengthen the engagement between schools and parents to provide better information and guidance to parents on how to support their children's learning experiences. Investing in the continued development of the young learners' digital skills, competencies, attributes, and behaviors that enable them to participate safely, effectively, critically, and responsibly in the digital world is critical to online learning success [27]. The impact of COVID-19 on youth's education is likely to have aggravated educational inequalities, as the transition to e-learning opportunities has been particularly difficult for those youth who did not have easy access to the internet, did not have a personal computer, and did not have a quiet space at home. To support disadvantaged learners with online and blended learning, countries will also need to maintain and improve teacher professional development in the use of digital resources for their pedagogical practices. Teachers require assistance in effectively incorporating technology into their teaching practices and methods that respond to technological changes.

To curb the spread of the COVID-19 pandemic, several governments around the world temporarily prolonged the closure of educational institutions. In their efforts to mitigate such repercussions, universities found no other alternative but to teach remotely. Distance learning provides opportunities in circumstances where conventional education has trouble functioning. However, this was particularly difficult in applied science colleges, particularly those having to focus on teaching and project work in small classrooms. In the aftermath of COVID-19, strategic steps must be undertaken to overcome any similar situation in the future with the goal of promoting e-learning. The academic set-up must be re-evaluated and ameliorated following an initial assessment of the learning targets (outcomes); lecturers would need to determine which part/s of the learning material are to be taught online, what part/s of the material should be addressed on campus for in-person classes, and what kinds of activities are expected to take place, etc. On their part, individual universities ought to propose suitable models to incorporate e-learning into their course offerings. Policies, the technological dimension, the didactics, the financial and organizational dimensions and finally the socio-cultural dimension should be considered in this model. Any e-learning strategy should describe why e-learning should be used, and with what goals in mind. Effective instructional designs for e-learning projects are central to their success. E-learning can add value to conventional learning models, such as

improved learning incentives, better access to learning resources, or enhanced cost-efficiency. On the one hand, e-learning programs are more likely to be successful when teaching staff believe they are given adequate time and receive support for their work. So, an institutional strategy must understand that e-learning is essential and should ensure that it does not generate unnecessary workloads for faculty. Unfortunately, however, this is not always the case under many circumstances.

The COVID-19 pandemic may have already taken its toll on the careers of recent university graduates. Impacted graduates have had major teaching interruptions in the final stages of their studies, major assessment interruptions, and are about to graduate (or may have already done so) right at the start of a major global recession. Evidence suggests that poor labor market conditions cause workers to accept lower-paying jobs at the start of their careers, and that this can have long-term consequences for some [28]. The global lockdown of educational institutions resulted in major and unequal disruptions in students' learning experiences, in internal assessments, and in the cancellation or replacement of assessments for qualifications. Now, considering the foregoing, what can be done to lessen the negative consequences of the pandemic? For one, once schools reopen, they will have to requisition resources to account for the lost learning. The question of how these resources will be used, and how to target the children who have been particularly hard hit, remains unanswered. Given the evidence of the importance of assessments for learning, schools should consider deferring internal assessments rather than skipping them. To avoid longer periods of unemployment, policies and regulations should support new graduates' entry into the labor market.

4 Conclusions

Governments and the private sectors in the Arab world regions should have stepped in early and supported universities, scientific research centers, and laboratories to create an alliance that would rapidly develop specific tests for the COVID-19 virus and develop new vaccines, in partnership with the World Health Organization and a global network of laboratories. At the national levels, countries should establish their own national centers for communicable disease forecasting in order to support decision-making in the field of public health. In the wake of a prevailing pandemic situation, there exists a dire need for modernizing and strengthening the health care systems. Governments must improve hospital capabilities in terms of the number of beds and ICUs to accommodate such large flows of patients through public–private partnerships and by strengthening hospital preparedness for public health emergencies. They must also strive to expand the supply chains of personal protective equipment and develop standards of care in crisis situations. To reduce the burden on future critical care systems, Arab governments also need to support primary care capabilities to identify populations at high risk, detect cases early, and manage them at home more effectively. This requires financial and logistical support for all health agencies. Medically, governments must support the administration of serological surveys to

determine population immunity levels. When a large part of the population becomes either naturally immunized or by ways of vaccines, then the remaining restrictions can be lifted. The contribution of the industry sector is so vital in this regard. Hence, there is dire need to form national committees from the private sector (particularly the industrial sector) and the public sector, charged with the task of developing plans and implementing them towards achieving self-sufficiency in equipment for isolation rooms, respirators, disinfectants, masks, and protective clothing, provided that such plans also entail alternative production strategies for existing factories that produce materials other than those mentioned above. They should be able to retool themselves properly and switch their production lines for new purposes under similar unlikely emergency situations.

Ultimately, every country ought to develop a "risk management plan" that leverages virtual mock exercises and seek new ideas to transform in-person curriculum to accommodate virtual experiences. Countries should ensure that the educational sector does not slacken in the process. Instead, it must go on a path where the educational process is rendered uninterrupted using novel online and other innovative approaches. Furthermore, they must ensure that R&D efforts, along similar lines, follow out-of-the-box pursuits. Meanwhile, countries should also ensure that their telecommunications sectors are on their marks to stand in support of the educational processes involved by offering promotions to students, teachers, and researchers, and, in the meantime, do the needful to enhance the underlying communications infrastructures. The governments involved must also ensure that first tier researchers (in multifaceted multidisciplinary areas) are rallied to warrant that pandemic-related research is fostered, nourished, and maintained.

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Implications of the Recent Financial and Health Crises on Institutions of Higher Education in Arab Countries: Revisiting Existing Financial Models

Simon Neaime and Jamal Saghir

Abstract The effects of the recent financial and debt crises, as well as the effects of the more recent sanitary crisis have had widespread and devastating consequences on institutions of higher education worldwide. Higher education in the US, as well as, in the Arab World have been particularly affected, with many institutions having either to adapt quickly to external pressures or shut down. No one knew what the full effects would be of what is now being called an economic and sanitary meltdown. In this chapter, we will first analyze the impact of the recent financial crises on higher education in the US, followed by an examination of the COVID-19 pandemic on Arab universities, drawing parallels with the impact on US universities. Initial data indicate that real wages for full-time faculty in the US has been on the decline for the first time since the Great Recession, and average wage growth for all ranks of full-time faculty was the lowest since 1972. In the Arab world, the situation is not that different, with data indicating that full-time faculty real wages have also been on the decline since the onset of the pandemic. Universities in the Arab region have implemented a wide range of actions/measures in response to financial difficulties stemming from the financial and debt crises and the COVID-19 pandemic. Under these measures, a new financial model is now emerging under which Arab Universities are now adapting to the new realities. Moreover, and in response to the pandemic, many Arab institutions that were already struggling to balance their budgets had to immediately lower their expenditures by implementing hiring freezes, salary cuts, fringe benefit cuts, furloughs, and layoffs. Finally, and under the new financial model, the newly implemented university budgets had to change various items under their expenditure and revenues sections in order to adapt to the new financial realities as dictated to them by the pandemic.

Keyword Financial crisis · Health crisis · COVID-19 · Higher education · Arab countries

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1 Introduction

The effects of the 2008–2009 global financial crisis, the 2012 European debt crisis, and the more recent COVID-19 pandemic have been widespread and devastating on the world economy in general and the education sector in particular. After the 2008 global financial crisis, higher education in the US was especially affected, with many institutions having to adapt quickly to external pressures. No one knew what the full effects would be of what was being called an "economic meltdown." However, college boards and senior leaders had to make their best guesses as to how their institutions would be affected. The COVID-19 pandemic has led to the greatest disturbance to education that the world has ever experienced since the Second World War. According to the Global Partnership for Education, the COVID-19 pandemic shut down schools across the world, disrupting education for 1.6 billion children and young people [1]. At its peak in 2020, 9 out of 10 students in the world were out of school [1]. More than 80% of the students are in developing countries, where school closures have compounded an already urgent learning crisis. In Arab countries, all universities have been closed or semi closed since early March 2020. Over 100 thousand tertiary education students and 800 thousand teaching staff were affected across the region by the closures [2].

Arab governments have mobilized quickly to mitigate the immediate impacts of the pandemic in general and on the education sector in particular. They have initiated and delivered university online learning initiatives at a large scale, trained professors, and provided assistance to students on how to adapt. However, the impact of the COVID-19 pandemic on students has been devastating, with concerns about financial and physical health, as well as augmented isolation. In addition, according to the World Bank, evidence shows that in many universities across the Arab world, student dropout has been rising, with many students leaving university for good, and the highest dropout concentrated in disadvantaged families [2]. Moreover, the economic shock and recession associated with the COVID-19 pandemic is likely to be significantly larger than anything observed since the global financial crisis of 2008/09. The International Monetary Fund (IMF) projected that the global economy will shrink by 3% in 2020, which constitutes a much bigger drop than what was observed during the global financial crisis [3].

According to the March 2021 American Association of University Professors' (AAUP) Faculty Compensation Survey [4], real wages for full-time faculty decreased for the first time since the Great Recession, and average wage growth for all ranks of full-time faculty was the lowest since the AAUP began tracking annual wage growth in 1972. Moreover, the number of full-time faculty decreased at over half of the surveyed institutions. More importantly, US colleges and universities have taken a wide range of actions in response to financial difficulties stemming from the COVID-19 pandemic. At a time when many institutions were already struggling to balance their budgets, many lowered their expenditures by implementing hiring freezes, salary cuts, fringe benefit cuts, furloughs, and layoffs.

This chapter argues that the recent financial and debt crises, and the COVID-19 pandemic will have severe consequences on public and private universities, governments, and households, and will continue to hit both the supply of and demand for higher education, as well as the financial sustainability of universities in most Arab countries. The chapter will be divided as follows. After a general introduction in Sect. 1, Sect. 2 will briefly overview the current Arab macroeconomic situation. Section 3 will analyze the effects of the recent financial crises on US universities and colleges as well as their impact on two prominent universities in the Arab world. This section will also highlight the lessons learned from those crisis-drawing parallels with the current health crisis. Section 4 will analyze the impact of the COVID-19 pandemic on university financing by revisiting existing financial models. This section will also include an analysis of the impact of COVID-19 pandemic on university financing and on how to prepare for future shocks by building up sustainable operational and financing schemes. We will conclude the chapter with some policy recommendations.

2 Overview of the Arab Macroeconomic Situation

Over a year into the COVID-19 pandemic, the sprint between vaccine and virus entered a new phase in the Arab world, and according to the IMF the path to recovery in 2021 is expected to be long and divergent [5]. The year 2021 will be the year of policies aiming at saving lives and livelihoods and at promoting recovery, while balancing the need for debt sustainability, financial resilience, and ensuring that the educational system does not collapse. In fact, the dual challenges of the COVID-19 health crisis and the collapse in oil prices in 2020 and 2021 will continue to negatively impact all Arab economies and will thus likely limit available public and private funds for higher education in the foreseeable future.

Figure 1 summarizes all exogenous shocks that Arab countries have experienced since 2000 and their impact on economic activity and gross domestic product (GDP) growth rates. It is clear that the region was negatively affected by the 2008 Global Financial Crisis, lowering average GDP growth rates to 1%. Arab countries were also negatively affected by the Arab Spring and the Syrian and Yemeni crises in between 2011 and 2018, and by the 2019 COVID-19 crisis, turning GDP growth rates into negative numbers after 2019. Low GDP growth rates have meant lower government revenues, higher budget deficits (close to 10% in 2020), and the accumulation of significant public debts. This translated into lower public transfers and lower support to the education sector. In this difficult economic situation, governments in Arab countries are confronted with uncomfortable tradeoffs in the coming years. They need to keep spending on health care as long as the pandemic continues. However, it will also add to an already high debt burden, which will spell complicated policy decisions after the pandemic recedes. Eventually Arab countries will have to deal with an accumulated debt and its costs, and will have to bring debt down to more sustainable levels. Thus, any decisions that Arab governments will take now in terms of accumulating additional debts will have huge consequences in the future. Without

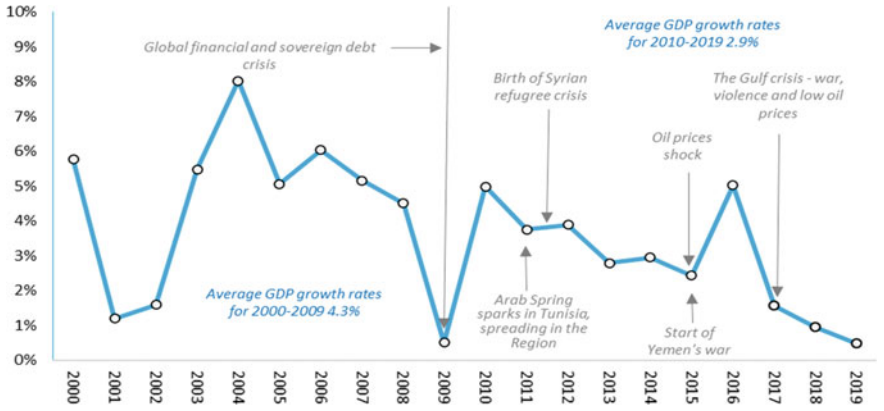

Fig. 1 Exogenous shocks & GDP growth rates in Arab countries: 2000–2019. *Source* World Bank World Development Indicators

sound control on debt levels, total financing for higher education will be seriously affected in the coming years. From here emanates the need for the emergence of a new financial model in the education sector to adjust to the new tough economic realities.

According to World Bank estimates [6], regional GDP growth rates were estimated to decrease by 4.08% in 2020 (see also Table 1). Expected macroeconomic losses due to the crisis have surged since March 2020, reaching 7.6% of Arab countries' 2019 GDP. Lebanon is by far the most severely affected Arab country by both a financial and debt crises coupled with a health crisis, with its GDP forecasted to contract by over 19%. Egypt is the only Arab country, which seems to have avoided negative economic growth with a decline from a real GDP per capita growth forecast for the fiscal year 2021 to about 2%. Arab government revenues are expected to diminish by about 25–50%. Public debt is expected to increase significantly in the next several years, from about 45% in 2019 to 55.68% of GDP in 2020 (Table 1). And unemployment rates are expected to remain above 10% and gross central bank reserves will continue with their declining trend since 2019 (Table 1).

3 Similarities Between the 2007–2009 Financial Crisis and the 2019 COVID Pandemic and Their Effects on Higher Education

Between 2007 and 2009, the world economy was hit by a series of overlapping crises. The first was financial, a crisis in the subprime mortgage market in the US. This gradually extended to the financial sector of other developed countries, and then turned into a global financial crisis. This global economic crisis has affected most

Table 1 Arab countries macroeconomic indicators: 2010–2020

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Real GDP (%)	5	3.75	3.89	2.79	2.95	2.43	5.02	1.55	0.95	0.47	− 4.08
Inflation (%)	4	4.52	3.73	2.96	2.35	1.49	1.85	1.49	2.00	1.09	1.02
Unemployment rate (%)	9	10.03	10.23	9.89	9.97	10.07	10.11	10.22	10.14	9.83	9.64
Government net lending/borrowing (% GDP)	1.5	3.81	4.47	2.37	1.53	7.29	8.88	5.28	2.08	3.43	9.56
Gross official reserves (months of imports)	25.8	30.9	29.2	28.6	25.9	24.2	26.2	24.0	22.5	19.7	16
Public deficit (%of GDP)	1.53	3.81	4.47	2.33	1.56	7.31	8.90	5.30	2.10	3.45	9.57
Government Gross Debt (% of GDP)	27.2	24.77	25.91	26.12	26.35	36.44	42.83	44.21	43.58	47.31	55.6

Source World Bank World Development Indicators and IMF

countries, both developed and developing, with varying degrees of intensity. Prior to the financial crisis, and partly in parallel with it, there was a period of global food and fuel price increases. This increase in commodity price worsened the subsequent recessionary impact of the financial collapse.

The global financial crisis adversely affected the Arab region. Countries largely depending on exports and relying on remittances and tourism were affected the most. According to the World Bank [7] economic growth for the more diversified countries declined by about 2% in 2009, from a strong 6.5% GDP growth in 2008 to 4.7% in 2009. The crisis in Europe, and the collapse of key export markets provoked sharp declines in the exports of Arab countries including Egypt, Jordan, Morocco, Lebanon, and Tunisia. At the same time, remittances, and tourism revenues (important sources of foreign income that support household consumption and job creation) declined by 5%. According to the World Bank [7] despite, continuing infrastructure development programs, the growth rate of developing oil exporters and Gulf Cooperation Council (GCC) countries declined by 3% in 2009 (from 4.6% in 2008 to 1.6% in 2009).

According to the IMF World Economic Outlook [8], after growth experienced an unprecedented sharp decline worldwide in 2009, all regions of the world experienced a return to positive growth in between 2010 and 11, supported by strong stimulus packages and countercyclical government fiscal and monetary policies. Because economic circumstances and developments differ from one country to another, the optimal policy responses were not uniform across emerging and developing countries.

The World Bank, IMF, and the European Central Bank (ECB) assisted countries in addressing these policy challenges and complemented their efforts. One of the main conclusions of the IMF report [9] on the assessment of the 2008 global financial crisis is that "Ten years later, the sequence of aftershocks and policy responses that followed the Lehman bankruptcy has led to a world economy in which the median general government debt-GDP ratio stands at 51%, up from 36% before the crisis. Central bank balance sheets, particularly in advanced economies, became several multiples of the size they were before the crisis; and emerging market and developing economies now account for 60% of global GDP in purchasing-power-parity terms (compared with 44% in the decade before the crisis), reflecting in part a weak recovery in advanced economies."

Given its limited integration in the global economy, the Arab region was able grow out of the 2008–2009 crisis rather swiftly as of 2010. Regional real GDP grew close to 5.0% in 2010, 3.5% in 2011, and 4.0% in 2012 [9]. Increased commodity prices and external demand improved production and exports in many economies in the Arab region. In addition, government stimulus packages in some countries played a key role in boosting the recovery quickly. However, the Arab region did not sustain a sustainable growth: real GDP growth was 1.2% in 2018 [9].

3.1 Impact of the 2008 Global Financial Crisis on US Universities

The 2008–2009 global financial crisis affected higher education in the US and the Arab region with many institutions having to adapt quickly to external pressures. It was difficult for these institutions to project the full effects of the economic meltdown. This section analyzes the impact of the 2008 financial crisis in the US, followed by an examination of two case studies: The American University of Cairo (AUC) and its reactions to Egypt's economic crisis, and the American University of Beirut (AUB) in the context of Lebanon's financial and debt crises. A comprehensive study by Chabotar [10] focused on the impact of the 2008 financial crisis on US universities in general, and identified the impact of the crisis on the education sector in particular. The following is an extracted assessment from Chabotar's study of US institutions with interesting lessons learned for the Arab region.

3.1.1 Falling Enrollments

Tuition, fees, and boarding generally account for two-thirds or more of the revenue at small to medium private colleges in the US. Admission officers in US universities saw enrollment numbers for spring 2009 decline. This triggered subsequent worries for the fall 2009 enrollment figures. The fear was that students would either postpone college or switch to less-expensive public institutions. According to Chabotar [10], worry turned to panic when deposits to reserve places in many small private or public colleges for fall 2009 badly lagged the numbers from previous years. For instance, at Guilford College (a small liberal arts college in North Carolina accounting for around 1700 undergraduate students), fall deposits received by February 2009 were 40% behind the February 2008 amounts.

3.1.2 Financial Aid

A related concern was that enrollment could be maintained but only by doling out much more financial aid. The problem was exacerbated to the extent that financial aid was funded from a falling endowment, putting pressure on the operating budget to make up the loss through more unfunded aid.

3.1.3 Sinking Endowment and Fund-Raising

According to Chabotar [10], in fiscal year 2008–09, Harvard university depended on its endowment for about 30% of its budget, whereas at Wabash College the endowment comprised 54% of the budget, and at Carleton College 25%. The fear

was that falling revenues would occur when endowment losses and fund-raising drops were coupled with lower enrollments and higher financial-aid discounts.

3.1.4 Deteriorating Debt Markets, Growing Budget Deficits and Cutbacks

As the 2008 crisis unfolded, colleges and universities became anxious that new debt would not be available, given the sudden conservatism of banks in giving loans. This created additional pressures on the universities to accelerate the review of their financial projects. College managements worried that their budgets would be affected as collateral in these circumstances and that they would have to slash expenses to match falling revenue. Because employee compensation accounts for half or more of most budgets, faculty and staff pay and positions were mostly threatened.

According to Chabotar's [10] assessment, much to the surprise of many institutions, many of the 300 US colleges surveyed in July 2009 by the National Association of Independent Colleges and Universities (NAICU) projected enrollment gains. Even institutions with lower enrollments did better than they had expected. Chabotar's analysis indicated that while unemployment continued to rise, many families made the decision that a private college education with small classes and close student–teacher relationships was worth the investment. In addition, many of the students were too advanced in their college-choice process by late 2008 or early 2009 to change their preferences easily. The economic uncertainties which kept students closer to home also helped. While unemployment continued to rise, many families made the decision that a private college education with small classes and close student–teacher relationships was worth the investment. Financial aid did increase at many private colleges, but less than anticipated in the worst-case scenario envisaged by many universities. According to Chabotar [10], as the financial crisis unfolded in 2008–2009 and the US economy worsened, staffing costs became a primary concern of boards and senior administrators. Constraints on hiring and compensation, including freezes, were prevalent. Colleges cut faculty and staff as well. A survey conducted by the National Association of Independent Colleges and Universities (NAICU) and summarized in Table 2 indicates the following budgetary responses: (1) About 54%

Table 2 Results from responses to the NAICU survey

• 53.5% froze salaries
• 46.8% froze new hiring
• 28.5% gave smaller-than-usual salary increases
• 27.5% increased tuition less than anticipated
• 19.0% laid off staff (non-faculty)
• 16.9% cut salaries/benefits
• 7.0% percent laid off faculty

Source Chabotar [10]

of the surveyed universities froze academic salaries; (2) 46.8% froze new hiring; (3) 28.5% gave smaller-than-usual salary increases; (4) 27.5% increased tuition less than anticipated; (5) 19.0% laid off staff (non-faculty); (6) 16.9% cut salaries/benefits; and (7) 7.0% laid off faculty [10].

Our analysis shows that US colleges and universities not only reacted and adapted quickly to the short-term crisis but also reexamined basic orientation and strategy, and tried new ways to fund-raising, financial management, financial aid, and budget. Many colleges and universities have even accelerated implementations of structural changes that had begun prior to the financial crisis. According to our review of the literature and Chabotar's [10] study the changes included:

- Reconsidering basic strategic directions and implementing fundamental changes in mission, programs, and services aligning them with priorities.
- Making budget reductions selectively and strategically, based on cost benefit analysis.
- Maintaining enrollment by improved persistence and retention.
- Using financial aid strategically, targeting the most affected segments of the population by the crisis, and reexamining policies for tuition and financial aid.
- Trying different approaches to fundraising and asking donors of existing endowed scholarships to contribute more money in order to restore the market value of the scholarships so that colleges could continue to offer the same level of support to needy students.
- Communicating on campus, about the fiscal situation and need to adapt to evolving environment in an open and transparent manner.

According to Altundemir [11], US institutions implemented a combination of short and long-term solutions for managing financial crises (Table 3) including budget cuts, freezing salaries and bonuses, and cutting courses and/or programs, laying off staff, and reducing scholarships and student aid. One obvious step was to also increase student tuition. However, in currency-volatile economies this is a highly controversial move and has widespread consequences. These issues will be further expanded upon in the case studies of the AUC and AUB, detailed below.

Table 3 Institution strategies for approaching a financial crisis

Short-term strategies	Long-term strategies
• Reducing positions • Laying off staff • Reducing purchasing • Adjusting air-conditioning/heating levels • Increasing incidental fees • Limiting or freezing travel • Eliminating courses • Mandating staff furloughs	• Investing in energy efficient systems • Conducting strategic reviews • Permanently changing support/professional staff levels • Seeking exemptions from state regulations that limit options and increase costs • Outsourcing operations/services • Increasing enrollment in specific areas

Source Extracted from Altundemir [11]

3.2 *Impact of Financial Crises on the American University of Cairo*

A relevant case in point in the Arab world is AUC, which suffered from a currency devaluation and capital controls and was forced to use the black market to cover its financial needs in US dollar (USD) during Egypt's debt and currency crisis. AUC received tuition fees denominated in Egyptian pound (EGP) and disbursed faculty members' salaries in USD as per their contractual agreements. Specifically, the agreement stipulates that AUC disburses faculty members' salaries, 2/3 denominated in USD and 1/3 in EGP at the monthly prevailing exchange rate. For its staff, the pay depended on their grades within the institution. High-grade employees were paid in USD, and had a similar treatment relative to faculty members, and the remaining employees were paid in EGP. To compensate for the loss of purchasing power, AUC adjusted their salaries annually.

Moreover, being unhedged during the crisis period, AUC had to buy USD from the black market to pay the salaries of faculty members. AUC tried to force students to pay the tuition in USD, and legally failed. Students demonstrated and even sued the university claiming that being located in Egypt, the tuition fees should be denominated in local currency. The university had thus to buy US dollars in the black market and decided to freeze salaries to avoid any additional costs. The university adopted bonuses to compensate faculty members for their outstanding achievements. Following the presidential election in 2014, the devaluation of the Egyptian pound continued, which further exacerbated the overall economic conditions and forced corporations in general, and AUC in particular, to undertake some extraordinary adjustment measures. AUC moved in 2013/2014 to a tuition formula where half of the tuition for Egyptians was denominated in USD but that could be paid in EGP equivalent at the prevailing official exchange rate, while the rest was denominated in EGP.

Few years before the 2016 steep devaluation, AUC had introduced measures to reduce costs. It consequently succeeded in absorbing some of these cost increases by implementing pay freezes and other budget cuts. From 2012 to 2016, AUC reduced costs in salaries and allowances by 13%, supplies and services by 14%, utilities by 4%, and depreciation by 13%. However, the increase in fees has remained inevitable because of high inflation, operating costs incurred in USD—including faculty and administrator salaries, imported equipment, university contributions to pension schemes,—and the devaluation of the Egyptian pound.

Following the significant devaluation of the EGP in November 2016, AUC undertook serious measures to promote the affordability and accessibility to families hit by the crisis by keeping the tuition fees without any changes for one semester and by creating an emergency fund to increase financial aid to needy students. The US and wealthy Egyptians contributed to this fund. In the following semester, and in line with best practices for inclusion, AUC moved away from merit-based scholarships towards a need-based model for newcomers [12].

3.3 Impact of the Current Crisis on the American University of Beirut

The effect of the current financial, economic, and COVID-19 crisis on institutions of higher education in general and on AUB in particular been significant. It is well known that tuition fees generally account for two-thirds or more of the revenue at small to medium private colleges in the US equivalent to the size of AUB. While it was expected enrollment numbers would not to be affected much in spring 2020, the administration needed to worry more about student enrollment in the next semester. The administration should be apprehensive that an even more acute liquidity squeeze, a devalued Lebanese pound (LBP), rising unemployment, and diminished access to student loans and grants due to looming bank failures might well lead to massive enrollment shortfalls. The fear is that students would either postpone college or switch to less-expensive public institutions. A related concern is that enrollment could be maintained but only by doling out much more financial aid. The problem will be exacerbated to the extent that financial aid was funded from a falling endowment, putting pressure on the operating budget to make up the loss through more unfunded aid. AUB's administration reported during the senate meeting of 29 November 2020 a significant decline in the value of endowments received. While USD 101 million were received in 2016–17 and USD 108 million in 2017–18, the amount received during the academic year 2018–19 was less than USD 38 million. This trend continued in 2020.

The American University in Beirut (AUB), one of the oldest private universities in the Middle East, has been struggling to survive financially due to the dual impact of Lebanon's deep economic and financial crisis, compounded by the pandemic, and the aftermath of the Beirut port blast in August 2020. The university only accepted payments at the platform exchange rate; LBP 3900 per USD. Therefore, it may seem like increased tuition fees at the platform exchange rate effectively doubled the cost of tuition in local currency.

At the official exchange rate, annual tuition fees of approximately USD 24,000 is equivalent to LBP 36 million. With a monthly minimum wage of about LBP 675,000 or LBP 8.1 million annually, this has made AUB inaccessible to a large number of prospective students and made it difficult for a considerable number of current students, many of them from previously middle-class families, to finish their studies. However, and in return AUB increased significantly financial aid to needy students.

The portion of the tuition fees that will be mostly affected by a potential devaluation is the USD 148.5 million paid in Lebanese Pounds (Fig. 2). Our preliminary analysis indicates the following. First, a potential 100% devaluation of the LBP will lower AUB's revenue from tuition fees by USD 74 million. We also expect the other portion (16.5 million) paid in USD to decrease by about 25% or the equivalent of USD 4 million. Second, we also expect a significant drop in patient related revenues by about 20% or the equivalent of USD 55 million. So far, the reported losses incurred by AUB's Medical Center since the onset of the crisis in October in 2019 were estimated at USD 20 million in just three months and have tripled by June 2020. The

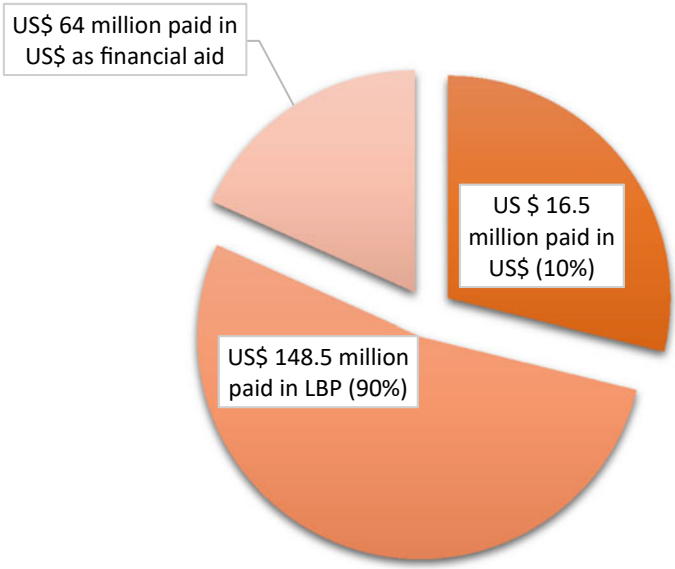

Fig. 2 Denomination of AUB revenues from student tuition fees total US$ 165 million, 2018. *Source* AUB's Finance Committee Report

forecast figure for patient related revenues declined to about USD 217 million down from USD 272.2 million in 2020 (Fig. 3).

According to the AUB's *Finance Committee Meeting Report, 2020*, indicates that AUB's main expense components are the university's staff salaries and benefits amounting to USD 272 million (Fig. 4). This is where the administration should

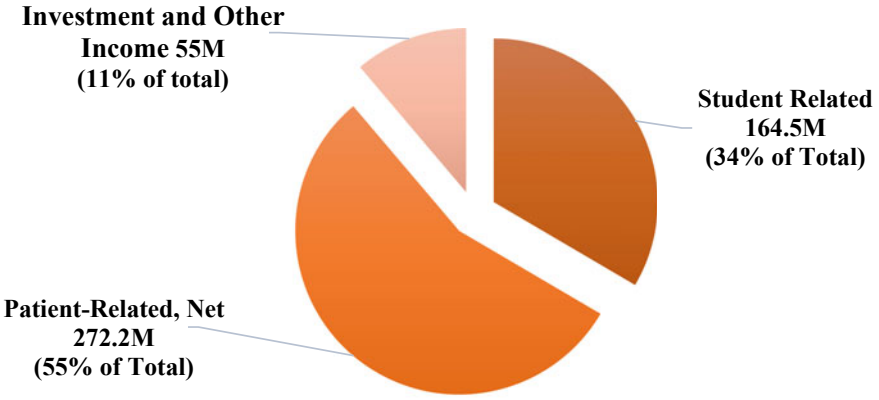

Fig. 3 AUB's budget revenues components: 2019–2020 (in US$ million). *Source* AUB's Finance Committee Report

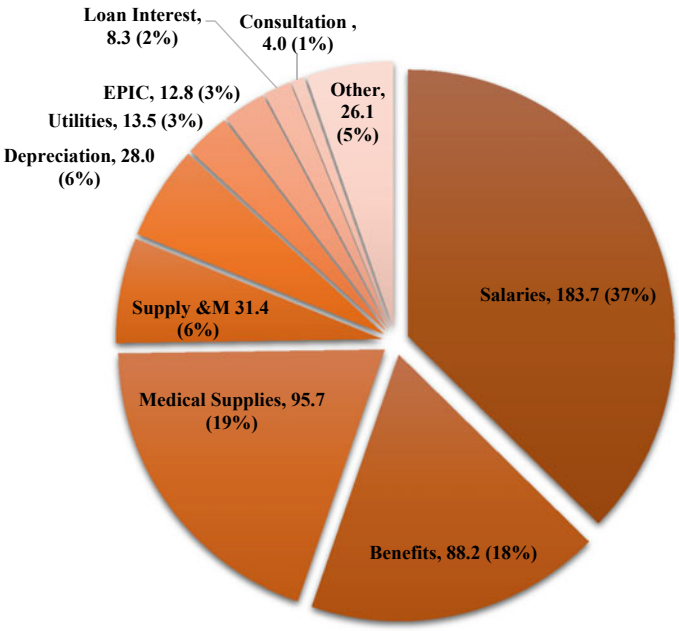

Fig. 4 AUB's budget expense components: 2019–2020 (in US$ million). *Source* AUB's Finance Committee Report

devote efforts to reduce those expenses in the next 3–5 years in order to match declining revenues. Based on our review of best practices, the number of faculty members devoted to teaching has traditionally been regarded as a good way to indicate whether or not a university will provide tailored instruction to a student. A student-to-faculty ratio is a simple calculation that determines how many faculty members are present on a university campus to teach students. Class sizes may vary, so even if the student-to-faculty ratio is very low, you could enroll in a large lecture class or required courses with a higher number of students than average. Shares of good student-to-faculty ratios vary around the world, but a good student-to-faculty ratio in US Colleges and universities would meet or exceed the national average of 18 students per faculty member, calculated by the National Center for Educational Statistics. For instance, based on information collected by the authors, the student-faculty ratio at University of California, Los Angeles is 18:1, and the school has 50.6% of its classes with fewer than 20 students. The faculty-student ratio at Harvard University is 13:1. The student-faculty ratio at Purdue University–West Lafayette is 13:1, and the school has 38.3% of its classes with fewer than 20 students. Princeton stands out with a ratio of 5 students to each faculty member and 70% of classes with fewer than 20 members.

4 Impact of the COVID-19 Pandemic on University Financing: Revisiting Existing Financial Models

The policies put in place by governments to slow down the transmission of COVID-19 have led, in many countries including Arab countries, to massive demand and supply shocks. This has led to significant declines in commodity and oil prices, trade disturbances, and the contraction of financial environments in many countries. According to the World Bank [13], these effects have already led to large increases in unemployment and underemployment rates, and will continue to threaten the survival of many corporations worldwide.

The economic crisis brought about by the pandemic and the oil price shock during the COVID crisis in Arab countries in 2020–2021 is likely to have a considerable impact on public and private higher education financing. Though no figures on sub-sector allocations are currently available for the 2020 or 2020/21 fiscal year(s), in view of the still unfolding economic crisis, public financing for universities is likely to be constrained for at least the next three years. However, it appears that the pandemic-related closed or limited campus operations can also result in some cost savings for government financing to the sector. For example, according to the World Bank [13], in Iraq students before the pandemic needed transportation and living stipends, which have now been saved due to online classes and students' returning home to their families.

At the onset of the COVID-19 pandemic, there have been concerns about the financial impact on universities worldwide as countries around the world reacted in different ways. In 2020, the British Government introduced a "bailout" university package and bought forward £100 million of quality-related research funding for providers in England as immediate help to ensure research activities can continue during the crisis. The Government has also allowed eligible universities to apply for the Government support schemes, including business loan support. Providers could also access the Coronavirus Job Retention Scheme to safeguard staff jobs, including those with short-term contracts [14, 15].

4.1 Impact on Students and Household

The pandemic-induced recession in the Arab region is already being felt at the household level, resulting in a reduction in overall expenditures, including expenditure on education. In many households, particularly poor households, these declines in household income will certainly reduce their investment in education and the likely impact will be obvious on university attendance due to lack of financing and reduced financial aids in many Arab universities. For example, in the fall of 2021 more than 1000 students dropped out of AUB because of lack of funding and the overall combined economic and pandemic crises. Public financing of additional student assistance might be difficult, given the decrease in government revenues in many

Arab countries and greater spending on health-related services. According to the World Bank [16], some private universities, for example in Jordan, offered deferred tuition payment or discounts to support and attract students.

4.2 Impact on Learning

To mitigate the impact of school closures, learning in Arab countries has moved online where connectivity and IT can be established. Countries like Egypt, Jordan, Lebanon, and Morocco were among those leading the change, employing multi-modal approaches and building innovative partnerships to deliver learning in a new set up. Most Arab countries had their own distant learning networks or are members connected to regional distance learning universities. Through earlier investments in electronic platforms and content, some private universities in the region were well equipped for online teaching. However, the majority of public Arab universities are still struggling with the abrupt and quick need of providing large-scale online learning. This process has not been straightforward, and the transition was far from easy. Across the region, telecom and IT infrastructures are inconsistent.

The key challenges governments and universities in the Arab region faced with regard to moving courses online could be summarized as follows:

- Lack of access to reliable internet connectivity and lack of sufficient bandwidth in many student households, as well as lack of online platforms for teaching.
- Limited availability of online course content and limited possibility of moving some courses online such as lab work in medicine, physics, or chemistry.
- Limited digital and pedagogical skills of teachers for online teaching, student assessment, etc., and limited digital skills of students to access and learn online in addition to lack of focus due to other distractions.
- Limited face-to-face and social interaction with teachers and classmates, which can lead to decreased student motivation, interest, and learning.

Despite these substantial challenges, Arab countries have invested enormous efforts, and have largely succeeded in implementing distant university education. They moved most of their courses online, almost from day one and are providing as many students as possible with course content through various channels. This enormous commitment by all stakeholders to work together gives hope for enhanced future coordination in higher education, if sustained beyond the crisis. According to a World Bank 2021 survey [16], in Tunisia, an estimated 110,000 students have already signed onto the Virtual University of Tunis online learning platform to take classes. Similarly, 18,000 professors are involved in online teaching activities. In Saudi Arabia, universities have achieved unprecedented results with over 1,200,000 users attending 107,000 learning hours in over 7600 virtual classes.

4.3 Issues and Challenges Facing Arab Universities

The university system worldwide has experienced significant challenges and changes in the last twenty years, including its financing arrangements. The economic fallout from the pandemic and the forecast decrease in private and public funding of Arab universities has affected and will continue to severely impact public and private universities in the region. The issues and challenges include:

- The possible impacts of the COVID-19 pandemic are public funding and university budget cuts. There are no figures yet on how much public funding has been undertaken in 2020–2021 in the Arab world. In the longer term, government budget cuts due to the economic shutdown and resulting revenue shortfalls could reduce significantly public funding for universities, leading subsequently to staff cuts at public universities. Private universities as well may cut their staff due to the significant loss in tuition revenue. Substantial reductions in funding and staff are likely to impede the universities' operations and expenses and will negatively impinge on the quality of teaching and research. Institutional budget cuts will result in staff freezes and early retirement packages to cuts in operating expenses. Some private universities also seemed to have suspended staff salary payments due to financial constraints. In addition, we foresee that nonpermanent teaching and research staff on short term contracts will be the most vulnerable and could be terminated easily. For instance, while in Jordan and Iraq some private universities already cancelled contracts of some faculty members or reduced faculty salaries, in Lebanon, the AUB has laid off about 800 of its staff [17].
- Shifts in enrolments from private to public universities are expected for the next academic year. It is not clear how the COVID-19-related closures of universities will affect enrolment, especially in the next academic year, as factors that would result in a decline in enrolment could counterbalance other factors that could boost enrolment. Moments of crisis are also moments of opportunities. The lack of financial resources to pay for tuition fees and/or cost of living, or the need to work to help support the family could be important factors for enrolment or not. On the other hand, we might see an increase in enrolment as Arab students currently studying abroad may return to local or regional universities, since some families will no longer be able to afford the higher cost of studying abroad. We might also observe a shift in enrolment from private to public universities because of financial constraints. Students currently enrolled in local private universities may have to transfer to lower-cost or no-fees public universities. For instance, in Lebanon, transfers of students from private to public universities are more likely to occur due to the recent fiscal challenges, subsequent purchasing power reductions, and hikes in tuition fees at private universities. According to the World Bank assessment [2] some private Arab universities have provided tuition discounts or reimbursements, as classes took place online instead of in-person. In addition, the number of international students in the Arab region and in the rest of the world has decreased due to the pandemic, further reducing tuition income of Arab universities. For example, Egyptian universities mobilized USD 120 million in

income, as international students pay USD 5000–9000 for annual tuition [18]. In any event, in the short term a greater number of students may need financial support in the form of student loans and grants to continue or begin their studies due to the current recession [2].

4.4 *Safeguard Education Spending and Prepare for Future Shocks*

The immediate priority must be to safeguard education spending, which in the face of a potentially severe liquidity crisis in the Arab world, could exacerbate even further an already precarious situation. For many Arab countries, this means facing issues of debt servicing and potential public debt defaults. As budgets in all Arab countries have been negatively impacted by the current recession, many governments may have to borrow even further to meet their financing gaps. The G20 has delayed debt servicing on bilateral loans for eligible countries, and the IMF has offset repayment costs for 25 vulnerable economies until December 2020. While these measures are sound, they are not enough since the issue of Arab debt sustainability is present in all Arab countries, including GCC countries. Relieving, postponing, and restructuring debt for low and -middle income Arab countries must be part of the solution to create the fiscal space needed for countries to reinvest in education. "Every dollar spent on debt servicing is one less dollar spent on education" [19]. It is imperative that we not only recover from the COVID-19 pandemic, but that we use the current experience to become better prepared for future crises by putting in place the appropriate mitigation plans.

Arab universities need to become more entrepreneurial than ever before in developing innovative, and new revenue streams, as well as new financial instruments to raise funds. Moreover, they need to build their capacity to provide blended models of education in the future. Universities should be better equipped to switch easily between in-person and remote learning when needed. This will create opportunities for more individualized approaches to teaching and learning. Additionally, teachers need to be better equipped to manage a wide range of IT devices in the event of future university closures. This mitigation approach will protect the education of students during potential shocks that might cause university closures, such as wars, natural disasters, or adverse weather events.

4.5 *Crises as an Opportunity for the Transformation of Arab University Funding*

Overall, Arab countries' expenditures on education as a proportion of GDP are relatively high, and even higher on a GDP per capita basis, despite low expenditures on research and development compared to OECD countries [20]. However, in the

last few years, public funding in many Arab countries became less generous, more demanding, and competitive. The COVID-19 pandemic and associated economic and financial crises have exacerbated even further these issues, with growing concerns over the sustainability of university funding regimes, coupled with increased pressure to explore new sources of income. In fact, according to the IMF, most of the Arab countries have low to medium fiscal space, with significant challenges related to expansion, quality, relevance, and equity [21].

In principle, it will be imperative to increase financial resources and use the current funding in ways that are better suited to obtain sustainable results. However, given the financing needs for recovery and the need for more investments in health, this is not likely to happen in the short term. The crises also provide an impetus and opportunity to accelerate much needed university reforms in the Arab world to address systemic issues and to modernize higher education in line with the region's current and future human capital and skills needs. Traditional financial models of university funding need to be transformed and enhanced. While it is quite difficult to increase taxes, most Arab countries will be confronted with finding alternative sources of financing, such as cost-sharing mechanisms, promoting private provision of higher education (e.g., philanthropic resources), and revenue generating.

4.6 Online and Blended Courses

Despite the above-mentioned challenges, a positive impact of the crisis could be that several Arab universities that previously were reluctant to formally recognize and move toward online education are now setting up online platforms. We are seeing across the Arab world a significant shift towards online and blended learning courses and programs, as well as building and enhancing digital skills of students and teachers. For instance, about 45% of Saudi adults interviewed in an international survey indicated that higher education in the future would be entirely or mostly online and another 30% of those surveyed indicated that it would be about half online/half in-person [22]. Universities in the future will likely rely more on hybrid delivery modes for their programs, combining online and in-person delivery of course content. This is a trend, which has already started and was accelerated by the pandemic. We expect it to persist in the near future because of its efficiency.

4.7 Suitability and Sustainability of the Financing Model

Generally, the main financing of higher education comes from the public purse. UNESCO estimates the student enrollment's share of private university in education to vary between 5 and 40%, the overall average in the Arab region being 35% [23]. The two major arms in financing higher education in Arab countries are public funds, and tuition fees in the private sector. An important question that addressed equity as

well as efficiency is whether the financing of higher education has to remain the sole responsibility of the state, or is it fair to share this responsibility with individuals as their personal investments for their own good and indirectly also for the benefit of the state.

The private higher education sector is strong in the GCC countries, which are generally wealthier by per capita income considerations, and by their GDP. The resource allocation to Arab universities is usually a rather straightforward process, whereby universities get an annual lump sum in support from various governments for public, and in some case private universities, in form of support. It is worth noting that some 80% or even 90% of the total budget for public universities is spent on academic and staff salaries. There are therefore little financial resources left for investments in the learning environment, in infrastructure development, in further education, in research, or in student services [23].

Clear criteria for the budget allocation process are clearly lacking in almost all Arab universities. According to UNESCO's analysis and our own assessment, budget allocation often seems to be based on the numbers of students and on the number of staff only, or on some other input-type criteria but usually there is no explicit policy for guidance [23]. Some Maghreb countries adopted measures of performance-based financing. However, overall funding of the Arab institutions of higher education in general is usually not based on performance or on outputs. The funding pattern is mostly strictly computed on annual basis, and not covering several years. This impedes the budgetary process and the funding allocation for the longer-term planning of activities or multi years "business plans."

It should be noted that there are three university funding approaches possible in Arab countries: (i) increasing efficiency in using limited resources; (ii) linking funding to performance; and (iii) better targeting of public subsidies. In this context and post COVID-19 crisis and economic recession, Arab governments with limited fiscal space and revenues need to decide between difficult policy options, namely:

- Increasing public funds through augmented financial participation of students. This will however call for a tradeoff with other priorities, such as investing in health, social safety nets, housing, and infrastructure.
- Providing some incentives to help universities attract and increase private donations or build private endowments for universities. For instance, in the last fifty years, public US colleges and universities have relied on philanthropic support. This is not yet well developed across Arab countries, but one way would be to tap into the Arab diasporas to build and fund such initiatives. Savings of the Arab diasporas are estimated to be more than USD 42 billion. Some of those savings could be used for philanthropic contributions to Arab universities [20].
- Spending resources in a more cost-efficient way, linking funding to performance through performance-based contracts, competitive funds, or any form of results-based funding. In the last few years, we have witnessed a move towards linking funding to institutional performance in the form of performance-based funding of higher education providers. This is mainly implemented in several European and US universities and in a limited number of Arab countries [24, 25].

With the above in mind, while options are individually important, the overall strategy and mix of policies and instruments, and their suitability in the context of each Arab country and university, relative to a given country's goals, aspiration, and preparation of future generation will matter the most.

5 Conclusion

In the post pandemic era, revisiting existing financial models and restructuring the Arab university educational system to make it more resilient and financially more viable and sustainable should be a priority. In the past twenty years, higher education systems worldwide have experienced tremendous transformations in the pattern of financing with a predominant shift in higher education costs from the government to private sources: financial markets, philanthropy, and households. While the rationale for change varies from one region to another, it is mostly emanating from the challenges to respond to pressures of growing university funding demands, limited fiscal space, and heavily constrained public budgets, in addition to the need for better use of the scarce resources.

The Arab region is not an exception. The challenge is even more acute as the demand for higher education has drastically increased, putting the sector under tremendous pressure for massive expansion [23]. Policy makers, funders, and universities leaders in in the Arab region should take a holistic approach on university financing mechanisms, and develop new financing strategies that include performance based and cost recovery for reaping its benefits while mitigating its risks. At the same time, it is important to build a future university educational platform that can make better use of blended learning models to reach all learners at all levels and to provide more individualized approaches to teaching as needed but in a more cost-efficient way.

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Shaping the Future: North African Universities After COVID-19

Wail Benjelloun

Abstract The COVID-19 pandemic has impacted in one way or another all sectors of activity, rapidly moving from a sanitary crisis to become a socio-economic one. Higher education has been particularly affected, due to social distancing imperatives and the need to develop alternate ways of delivery relying on technology and distance learning. When the pandemic hit, it highlighted the digital unpreparedness of North African (NA) universities, as they responded quickly so as not to lose what remained of the academic year. They needed to provide resources for distance learning, ensure that faculty and staff were committed and dedicated to the success of the endeavor, and develop student support mechanisms. But the pedagogical challenges faced by all NA universities also pointed to opportunities for improvements in teaching and research. As many were to point out, COVID-19 did not introduce distance learning, it simply accelerated an ongoing process. Leading world universities were already on a trajectory towards the incorporation of technology into pedagogy, for the advantages it offers in terms of data access and processing, wider access to resources, cost of education, shared coursework and competencies, collaborative research, and interactivity at all levels. On a strategic plan, the pandemic also drew the attention of NA universities to the larger question of preparedness for the fourth industrial revolution, digitalization, and digital transformation. As international higher education shifts toward science, technology, engineering and mathematics (STEM) and data science programs in order to face the ever-increasing mass of data now available, NA universities and educational decision makers are now also realizing the eventual costs of being left behind. Digitalizing course offerings is but a small part of the role universities have to play in promoting innovation and socio-economic development, through upskilling the current workforce, appropriately training that of tomorrow, and orienting research towards artificial intelligence. Recent initiatives taken in the region may be good indicators of what life after COVID-19 will look like in NA universities.

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Keywords North African universities · Post COVID-19 · Distance learning · Digital transformation · Skills gap · Health research

1 Introduction: COVID-19, A Global Pandemic

On 25 March 2020 the United Nations Secretary General (SG) launched a global initiative to raise USD 2 billion to support the coordinated humanitarian fight against COVID-19 to limit the spread of the pandemic, and to counter its negative impact worldwide. On 26 March, the World Health Organization reported 416,686 cases and 18,589 deaths. In three months' time, the pandemic had affected more than 200 countries. On March 31, in his report on shared responsibility and global solidarity in the face of the pandemic, the SG considered the COVID-19 pandemic as a "decisive moment for human society, where history will judge us…on the basis of the degree of coordination demonstrated in all sectors, in the interest of the great human family" [1]. In his conclusion, the SG considered the pandemic as the greatest challenge the world has had to face since the creation of the United Nations. It quickly became evident that the planet was facing a major crisis that was going to influence the way we live, how we behave in our societies, and how we interact with others in other regions of our globe.

The lockdown put in place by many countries significantly slowed the production and distribution of many products and services, and increased the uncertainty about the possibility of rapidly producing and distributing an efficient vaccine. Higher education was particularly affected, due to the need to minimize social contact (which led to school closings that continue to occur even today), but also to develop alternate ways of delivery relying on technology and distance learning. When the pandemic hit, it highlighted the digital unpreparedness of North African (NA) universities, and they had to quickly respond so as not to lose what remained of the academic year. They needed to provide resources, ensure that faculty and staff were committed and dedicated to the success of the endeavor, and develop student support mechanisms. Neither faculty nor staff were prepared for this transition. But the pedagogical challenges faced by all NA universities also pointed to opportunities for possible improvements in teaching and research, and in social responsibility.

2 COVID-19 in North Africa

The NA countries generally deployed significant financial and human resources in face the COVID-19 pandemic. The pandemic hit at a time of economic uncertainty, with climate change, drought, and falling oil demand, along with a change of government in Tunisia and continued unrest in Libya.

Morocco registered its first case of COVID-19 on 2 March 2020, and it quickly moved to protect the health of its population and economy. A state of emergency was declared on 20 March at a time when the country reported only 10 cases. The effects of a near-complete lockdown were mitigated through compensatory measures meant not only to protect production lines and service industries, but also to launch important lasting economic reforms, including the digitalization and generalization of social security and health coverage. Thus, the immediate response was based both on tactical and strategic approaches [2]. The Moroccan Ministry of Health provided a daily bulletin concerning the COVID-19 situation since the start of the pandemic. On 9 January 2022, it reported reaching the symbolic level of one million contaminated persons since 2 March 2020. A vigorous vaccination campaign ensured a first vaccine dose for 24,591,296 persons (over 68% of the population of 36 million), with a second dose for 22,974,065, and a third booster dose for 3,431,636, placing the country in the top 5 on the African continent. The COVID-19 recovery rate was placed at 94.9%, with a death rate of 1.5%. On the same date, 10 persons were under respiratory intubation, and intensive care bed occupancy rate was 5.6%. The country's borders were again closed in late November with the appearance of the Omicron variant, and were still closed on 9 January 2022 [3].

At the end of the 2021, Algeria seemed poised for a COVID-19 peak. On 10 December 2021, 210 persons were reported contaminated during the 24-h period, with 22 patients in intensive care and 6 deaths [4]. This was the highest daily contamination rate since September. The total cumulative number of contaminated persons was thus 212,434, with 6132 deaths and 146,006 cases of recovery [4]. The Ministry of Education closed all schools on 9 December 2021 for all school levels, advancing the winter vacation by one week, following the appearance of COVID-19 cases. Schools have been sporadically closed since then. Health specialists have warned of another possible infectious wave, complicated by the population's refractory stance towards COVID-19 vaccination. Although recommended by the government since October 2021, masks and distancing requirements are not being generally respected in public spaces.

The cumulative infection rate in Egypt from 3 January 2020 to 18 March 2022 was 495,373 persons, with 24,277 deaths reported. A total of 75,368,174 vaccines have been administered, for a population of 105.4 million [5, 6].

Mauritania recorded 40,083 confirmed cases of COVID-19, 853 deaths and 38,741 recoveries, from March 2020 to December 2021 [7]. The national immunization strategy, developed with UNICEF support, has been at the center of the government's efforts to combat the virus. Four mass vaccination campaigns against COVID-19 were organized, resulting in 714,954 people fully vaccinated, which represents 27% of the target population (2,690,855). Mauritania ranks 22nd in terms of vaccinated population out of 52 countries on the African continent and first in the West African sub-region.

In July 2021, the Tunisian Health Ministry described the situation as catastrophic, with the health system near collapse. On only one day of this month 9823 cases were reported, with 134 deaths. Tunisia reported a cumulative total of

1,029,762 cases by 14 March 2022, with 28,065 deaths. The rate of vaccination did however increase and, as of 14 March 2022, 13,025,166 vaccine doses were administered in the country of 12 million [8].

As for Libya, the first official confirmed case of COVID-19 was identified on 24 March 2020 and the first death was recorded officially on 3 April 2020 [9]. Libya is poorly equipped to manage and control any pandemic due to the unrest in the country since 2011. Libyan health-care infrastructure has deteriorated and a shortage of health-care supplies and qualified personnel impaired the ability of the health system to respond adequately to the outbreak. The Libyan population thus remains particularly vulnerable to COVID-19. On 12 May 2020, there were 64 reported cases of COVID-19 in Libya, a number to consider with caution due to the fewer tests being conducted. As of 16 March 2022, 500,760 confirmed cases were reported with 6365 deaths. The number of vaccine doses administered as of March 16, 2022 reached 3,390,125 [10].

3 COVID-19 and North African Higher Education

COVID-19 affected education worldwide, significantly disrupting schools and universities and impacting, according to UNESCO, an estimated 1.52 billion students [11], of which 220 million tertiary students across the globe [12]. Governments quickly moved to provide alternative methods of instruction following the closing of schools, but these distance learning solutions were frequently of questionable quality because of inequitable access to technology to more than a third of the world's student population [13]. In five of the Maghreb countries, the COVID-19 challenge was faced at a time of continued "massification" in the educational systems, including higher education. The public universities in Egypt Algeria and Morocco had just traversed a decade of annually increasing student registrations, with no end in sight, a situation becoming increasingly challenging in terms of infrastructure, equipment, budgets, and human resources. Morocco transited from 400,000 university students in 2011 to 990,000 in 2021 [14]; Algeria's university student population grew from 400,000 in 1999 to 1.6 million in 2021 [15]; while Egypt went from 1.7 million in 2012 to 3.15 million in 2021 [16]. As COVID-19 hit, the three most populous NA countries boasted nearly 6 million students in higher education.

It is estimated that by 2 March 2021 an average 95 school days were lost (complete school closures) globally. In North Africa the average was 78 days of closure, ranging from 67 in Algeria to 92 in Mauritania, as compared to a world average of 95 days [17]. In addition to the impact on learning, the closure of schools compromised the social and behavioral development of nearly 25.3 million students and the interruption of schooling led in some cases to vulnerability, violence, poverty, and mental health problems. In Egypt, for example, UNICEF reported that children and youth, who represent 52% of the population, were most vulnerable to developing health complications due to the spread of COVID-19, and

suffered most from its socio-economic impacts [18]. Additionally, economic slowdown due to the pandemic led to slower integration of youth into the job market [18].

At the onset of the pandemic, the Moroccan higher education system had already made some headway with distance learning. The process was significantly accelerated to face the unexpected conditions as the universities set about reinforcing their platforms. Students were provided institutional accounts allowing them to access these platforms, as well as information and document exchange hubs. At several universities, students were already initiated to platforms such as Moodle or Google Classroom. Even before the pandemic, faculty were already accessing and using such platforms to record their courseware. At most universities, public and private, teachers could record their courses in MOOC format in studios especially set up for the purpose. Many teachers however remained either unfamiliar or refractory to the new approach, but one advantage of COVID-19 was to mobilize all parties, students and teachers, to ensure the success of distance learning to save what could be saved of the school year. Social media and television were frequently put to good use to provide support for those who needed it [19].

In Tunisia, several studies point to the relative success of distance learning and to the general perception of its added value to the educational strategy during the crisis. In one report, 41.5% of faculty surveyed recognized that distance learning improved their teaching outcomes [20]. As was the case in all the NA nations, a major problem with the use of digital tools remained the unequal access to technology, a situation that must be faced if distance learning is to be of any use as a complementary educational tool in the future. Students generally recognized the utility of distance learning, but also pointed to the fact that those from underprivileged social strata who did not, or could not, benefit from it would be left behind those for whom such learning was accessible. Perhaps even more of a challenge was getting all faculty to accept the change and sign on to the new technology [20].

On 20 September 2020, the Algerian authorities announced that higher education in the country would be oriented towards distance education, following the positive feedback from faculty and confirmation of their ability to adapt in spite of the limited internet capability [21].

The interest in distance learning expressed by all NA higher education decision-makers during COVID-19 may also be linked to potential benefits such type of learning presents in facing the challenges of massification.

While it is too early to reliably evaluate the digital experience during COVID-19 in the NA region, it is true that the use of television stations to carry out coursework was by and large useful in areas where access and economic means were limited. But even then, not all students had access to internet or television sets were able to learn without pedagogical supervision [22]. In short, NA countries have yet to achieve global parity in terms of access and exploitation of broadband connectivity and performance on distance education. The main technical challenges are related to poor campus networks as well as the relatively limited individual access to computers by students and staff.

Although the available internet infrastructure has significantly improved over the past few years, the extent of NA national networks and fiber coverage vary widely from one country to another, largely influenced by geography, level of competition between providers and investment by public- and/or private-sector operators, and business environment. Furthermore, the presence of an extensive internet infrastructure, in some cases, has not necessarily led to adequate provision of broadband connectivity to universities.

4 North African Universities Facing the Future

The challenges that must be faced by NA universities in the post COVID-19 era are fundamentally similar to those that generally confront other universities worldwide, but must be dealt with in the context of the specific higher education environments in the region. Not only must NA universities prepare to better confront other similar crises in the future but they must also deal with the international trends in higher education, notably those related to curriculum and skills development. The post COVID-19 challenge thus revolves to some extent around the upgrading of internet preparedness and health, but also extends beyond these domains to measures focused on distance and hybrid learning, facing the skills gap to ensure better youth employability, digital transformation, and better support for research and innovation in health and related disciplines.

4.1 North African Universities and Post COVID-19 Pedagogy

As they establish their strategies for the future, NA universities should address education and educational reforms in general, with particular attention to the restructuring of university organization to facilitate appropriate management of online and face to face pedagogies, as well as hybrid formulas. This is probably a good opportunity to advance university autonomy in NA higher education, an area where much remains to be done. Needless to say, the legal framework governing these different pedagogical approaches needs to be defined. During the current pandemic, NA universities found themselves teaching online in violation of existing legal in-class requirements.

After the initial emergency responses during the 2019–2020 academic year, NA Ministries of Higher Education and universities began instituting more permanent measures for future years. An example is a program launched by the Moroccan Ministry of Higher Education in September 2021, *Connected Campus*, meant to provide universities with better connectivity to facilitate both in-class and distance learning, as well as teaching quality, and to allow pivoting from face-to-face courses into web-based instruction as needed [23].

The program was introduced in the spirit of the general higher education reform adopted through Law 51-17, the national framework law for education, training, and research in Morocco. It provides access for students, faculty, and administrative staff to a high performance Wi-Fi 6 internet network, available in all universities and residential campuses. This system allows students to remotely access their universities' intranet and digital resources. The project also integrates and further develops the longstanding MARWAN (Moroccan Academic and Research Wide Area Network) program facilitating universities' access to appropriate bandwidth and advanced network services, linked via the GEANT network to European higher education institutions [24]. The opportunities for setting up a regional NA network to interface with the European network should be seriously explored, particularly given the existence of other platforms such as the Egypt Data Portal, as they open interesting possibilities for regional and inter-regional sharing of technical resources, experiences, expertise, and course content.

The issues related to equitable access to technology (smartphones, tablets, computers) remain problematic, as does the training and preparation necessary for students, faculty, and staff in order to maximize academic return on investments. It should not be lost on educational decision-makers that any progress made on the technological front not only contributes to the ability to deal with crises of various types, but can also present eventual solutions to the massification problem and the sustainable demand for education in the region. In short, in preparing for the future, universities should devote serious efforts to:

- Upskill teachers and students in pedagogical technology in general and distance teaching technologies in particular;
- Ensure equitable access to communication equipment (smart phones, pads, computers) and internet;
- Facilitate the legal framework for both distance learning and startup platforms;
- Orient curricula towards professional requirements of the job market;
- Add social value to professional and technical training;
- Orient university education towards the required skills of the next decade;
- Encourage innovation and the production of new knowledge;
- Participate in public–private entrepreneurship initiatives;
- Participate in internationalization and mobility initiatives;
- Coordinate development activities with research and innovation initiatives.

4.2 North African Universities and the Digital Transformation

The information and communication technologies (ICT) are transforming our relational concepts in all fields. Digital transformation has become unavoidable in the development of any credible administrative, entrepreneurial, health and

educational framework. The technology ensures the optimization of both time and money through the automation of tasks of increasing complexity, contributing in critical ways to increased effectiveness and competitivity.

It was estimated that 59.9% of the world's population had access to internet in January 2021 [25]. In Morocco that number was 93% thanks to a concerted effort to generalize and democratize internet access [26]. In the past few years, Morocco had made considerable strides in digital transformation largely thanks to mobile internet telecommunications. Moroccan businesses have had to embrace this trend in order to guarantee growth. This development in the private sector has in turn impacted the Moroccan administration and public services.

In spite of the progress realized, the digitalization of Moroccan businesses and government services remains short of the objectives set in the National Plan for Administrative Reform of 2018–2021, and the lag also handicaps the competitivity of other sectors in many ways. In spite of this, Casablanca remains a leading continental digital center, associating both the public and private sectors. The city has encouraged international partnerships to advance the e-Madina cluster, an association of enterprises using technology in public–private collaborations to render the city more attractive and more competitive, with a smart city perspective [27]. Similarly, CasaNearShore Park hosts 80 businesses operating in offshore mode in an area of 53 ha, thus constituting the biggest business park in Africa with projects ranging from e-government to digital services [28].

The Moroccan Ministry for Digital Transformation and Administrative Reform launched a new campaign in January 2022, Morocco Tech, in collaboration with a selection of private national business federations, including those in information technologies and telecommunications, offshoring, computer science, private business corporations, and technoparks. As described by the Ministry, this ambitious plan will reinforce the transformation of the Moroccan digital transformation ecosystem to serve Morocco's international economic competitivity by increasing the share of digitalization and consolidating its positive impact on society. An important role is reserved for universities as hubs for training, research, and innovation to support these developments.

In a climate generally favoring digital transformation and innovation, NA startups have succeeded in attracting significant investment. The Tunisian Start-Up Act of 2018 is a model for the continent and has encouraged startups of various sizes to set up businesses in the country. Additionally, NA innovation benefits from various risk capital opportunities for innovative enterprises. These are complemented by several other contributors including incubators, personal capital, "business angels", and non-profit funds.

In 2019, it was estimated that 15 NA startups, active in the fields of financial technology, mobility, artificial intelligence, e-commerce, clean technologies, culture, and cybersecurity, were able to drain 64.1 million dollars in risk capital. Some of these startups in Tunisia and Egypt were able to raise millions of dollars, resorting to both local, European, and Gulf financing.

These startups have also benefited from active encouragement from the region's governments, including Algeria [29] and Egypt [30] which contributed to the

development of technological ecosystems supporting innovation. Morocco and Egypt are classed among the five African countries with the highest growth in the number of developers. In the MENA region, Morocco has the highest GDP expenditure (0.71%) for research and innovation [31], while Egypt has the second highest share of MENA startup launches in 2021 (24.6%) [32].

4.3 North African Universities Facing the Skills Gap

COVID-19 impacted the NA universities' ability to accomplish their mission and further complicated their ability to deal with the multiple challenges they were already facing before the pandemic, and that were taking their toll on the quality of education and their continued inability to adapt to the requirements of the job market.

To put this in an international context, a recent report estimated that the combined impact of artificial intelligence, automation, changing demographics, and globalization will lead to a USD 8.5 trillion loss in global GDP by 2030 [33]. Both developed and developing economies could suffer from a talent crunch that could cost trillions of dollars in unearned revenues and shift global economic equilibria if left unaddressed. The necessary upskilling will require major efforts in reinforcing ten important skills by 2025. These are analytical thinking and innovation; active learning and learning strategies; complex problem solving; critical thinking and analysis; creativity, originality, initiative; leadership and social influence; technology use, monitoring and control; technology design and programming; resilience, stress tolerance and flexibility; and reasoning, problem-solving and ideation. Along the same lines, the OECD has clearly stated that "there is a growing consensus that formal education should cultivate the creativity and critical thinking skills of students to help them succeed in modern, globalised economies based on knowledge and innovation" [34].

Unfortunately, these skills have not been an important concern in NA higher education programs and objectives until recently. A look at the rankings of the NA countries on the 2021 Global Innovation Index, places Tunisia and Morocco, at ranks 71 and 77, respectively, but still in the top 10 rank of their income group. Egypt is ranked 94 and Algeria 120 [35]. The skills gap facing NA universities is thus serious, multi-faceted, and must urgently be addressed in any strategy for higher education development.

Universities normally play an important role in technology innovation environments through the production of knowledge, skills training, and entrepreneurship. They are encouraged by society and government to engage in entrepreneurial initiatives and to commercialize the knowledge they produce. This will represent perhaps one of the major challenges facing NA universities post COVID-19.

4.4 Research

Research in health and related disciplines was found particularly inadequate in NA universities in the face of the pandemic. Other than the development of a preliminary COVID-19 test and the production of respirator prototypes in Morocco, no major research result concerning vaccines, tests or equipment was reported in the region. NA countries thus remained dependent on imported COVID-19 vaccines. With a world total vaccination average of 52.3%, Morocco (62%), Tunisia (52%) and Egypt (25.15%) reserved important budgets to ensure vaccine availability and were continental leaders in this regard [36].

The difficulty in obtaining vaccines, as producing countries prioritized their own citizens, left other regions lagging far behind in vaccination rates. This led to the strategic policy of "health sovereignty" adopted in Morocco, through the launch of a major vaccine research and production zone in January 2022, operated by the Moroccan company SENSYO Pharmatech in collaboration with the Swedish Recipharm, and set to start production in July 2022. The company will develop and produce vaccines to meet local and regional needs [37], with production set to attain 116 million doses of different types of vaccines in 2024. In collaboration with Sinopharm, Morocco has launched the production of 3 million doses per month, set to attain 5 million in 2024 [38]. Research on vaccines and testing needs to be supported in NA universities through public–private coordinated efforts that take certified laboratory results directly to production lines, adding value and ensuring national autonomy. The infrastructure and expertise exist in NA universities and, once more, this may be a good opportunity for regional cooperation.

Support for research should also extend beyond the medical field to other related disciplines ranging from philosophy, psychology and social science to mathematics, computer science and artificial intelligence, among others. All of these disciplines contribute in significant ways to technological advances necessary for medical breakthroughs, and to dealing with the traumas that patients, their families, and society at large are subjected to by such pandemics. This is certainly an important aspect of the strategic approach in crisis management, especially when the crisis is long-term in nature.

5 Conclusion

The incorporation of technology into pedagogy offers advantages in terms of data access and processing, wider access to resources, cost of education, shared coursework and competencies, collaborative research, and interactivity at all levels. As the NA universities face the challenges of massification in a post COVID-19 world, technology and upskilling of faculty, staff, and administration in distance and hybrid learning technologies will prove to be invaluable in dealing with an ever-increasing demand for higher education in systems with limited resources.

Beyond the pedagogical paradigm and research in health and related disciplines, technology and digitalization have become determinants of socio-economic development in general, as they impact all research, innovation, and production. NA universities are well-placed to become locomotives for such development and lead the advancement of artificial intelligence and innovative technology training and research in their region, if they can overcome organizational challenges (e.g., autonomy, modernization, and adaptation of curricula). Ambitious government projects can succeed only if higher education systems produce appropriately trained human resources.

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E-Learning Quality Requirements for the Post COVID-19 Era in the Arab World

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Abstract This study analyses the challenges that face the higher education sector in the Arab World in light of the overwhelming COVID-19 pandemic that struck the world in 2019 both on national and institutional levels. It takes into consideration the internal/on-campus challenges, which include the infrastructure, staff skills and attitudes, facilities, learning resources and applications, as well as smart solutions, in addition to off-campus challenges such as technology infrastructure, the culture of Arab families, students' attitudes, and the labor market and employers' appreciation of online learning. The study also investigates the different approaches and modes of e-learning that vary from complete distance to the blended and technology supported modes. A survey was conducted in a few Arab countries from the Gulf Council countries (GCC), North Africa and East Mediterranean countries, targeting faculty members at public and private universities, where 354 faculty members and administrative staff (including leadership) responded. Both quantitative and qualitative analysis were conducted. In addition, a review of 27 academic articles were on the students' voices regarding used tools and e-learning environment was carried out. This chapter then argues the quality of e-learning, including accreditation systems and their recognition by formal higher education sectors, as declared by the ministries of education and higher education in the selected countries. Then a proposed framework for the e-learning quality requirements in the Arab World is provided to help higher education institutions satisfy quality parameters towards reliable intended learning outcomes.

Keywords Higher education · E-learning · COVID-19 · Arab world · Challenges · Quality · Crisis management · Contingency planning

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1 Introduction

The higher education system in the Arab world reached a gross enrollment ratio of (GER) of 33.4% during the academic year 2019/2020 [1], at a time when provision was interrupted due to the outbreak of the COVID-19 pandemic, causing the closure of universities for several weeks and that has not returned back to normal until today, due to the emergence of new strains and outbreak cycles, making it unsafe for students to crowd in classrooms and study halls, where social distancing including small groups on-campus teaching are still considered. The complete and partial closure of universities has placed a persisting challenge on higher education institutions to achieve several goals that were not included into their original plans which include: (a) sustaining the provision of higher education services using unconventional means; (b) compensating for the learning loss caused by the closures and lockdown measures; (c) providing emotional, technical, medical, and logistical support to students, faculty, and staff during the pandemic, and (d) developing content and learning resources in different formats to accommodate for remote teaching and learning. Hence, going online and using e-learning was the main alternative for this time, which does not only rely on the institutions' capacity, but also on the out-of-campus infrastructure and capacity, as well as students' access to internet and other technology tools. This situation made it clear that external factors do affect the use of online education, and are related to the students' socioeconomic backgrounds, which also exacerbate other problems related to equity and equal opportunities for students. Nevertheless, no clear policies or strategies was regarded ideal because the level of preparedness of universities varied from one university to another. Hence, technology became the sole possible solution during the global COVID-19 pandemic lockdown.

Despite the immediate reaction of higher education establishments to alternate face-to-face lectures with online education, this suspension of educational activities affected education and assessments, as well as the wellbeing and the legal position of foreign students in their host country, whose stay was threatened by the campus complete or partial closure during the pandemic period and which had to be extended in order to complete their study programs, affecting visa extension and financial liabilities. But more importantly, the pandemic questioned the value of a university education that considers interaction and social opportunities as well as learning substance. To continue being of relevance, universities need to reconsider their learning ecosystems so that builds on technology and integrates connections between students and instructors as well as students with other students [2].

By August 2020 a very limited number of universities had resumed their operations. Shortly after, the majority of schools and universities around the world banned face-to-face teaching, and several implemented alternative modes of education provision, using online learning and relying on radio, television, mobile applications, and printed materials [3].

Some of these alternative education arrangements comprised the innovative uses of existing technologies, resulting from cooperation and alliances among different types of organizations.

Reimers and Marmolejo [3] argue that inadequate choices for learning during the pandemic led to increasing worrying about the effect of the outbreak on "learning loss, student mental health, student disengagement with learning and potential dropout, and over the long-term impact of these conditions on students and societies, as well as concern over growing disparities in opportunity to learn" [3].

2 Higher Education in the Arab World Before and During COVID-19

2.1 Higher Education Sector Size and Development

An overview of the higher education sector in the Arab World before COVID-19 shows that the share of higher education provision represents 5–6% of the global share of enrolments in 2018, a share that has remained stable since 2008, whereas the global share of enrolments in Central and Eastern Europe and North America and Central Asia decreased during the period 2008–2016 [1]. Figure 1 shows the higher education share of enrolment in a few regions.

Looking closer at the higher education provision at the Arab world, a challenge could yet be spotted where the system is far from a "Universal" system where admission to higher education is a requirement for individuals from the middle and upper classes. According to Trow's model for the classification of higher education institutions [4], the majority of higher education provision in the Arab states are classified as "Massive" systems, where enrollment capacity is restricted between 15 and 50% of the age group (18–23 years old for higher education), meaning that there is a persistent need for the expansion in higher education provision to move from the "Massive" to "Universal" system [4] as indicated by Fig. 2.

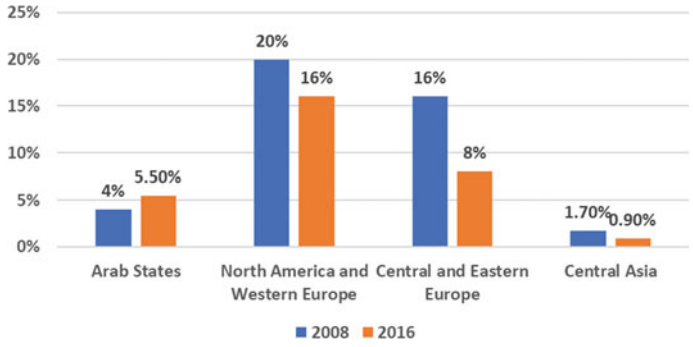

Fig. 1 Global share of HE enrolment in selected regions. *Source* Adapted from Calderon [5]

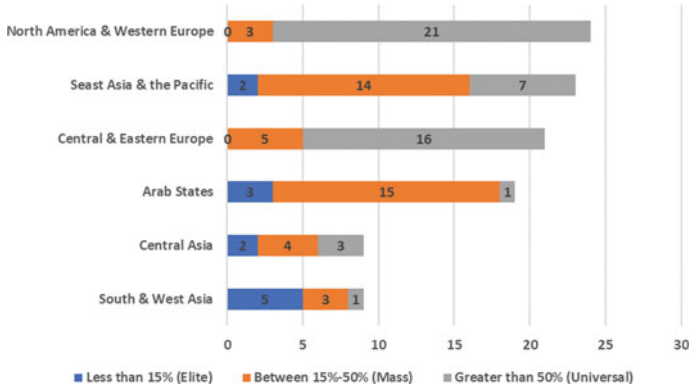

Fig. 2 Number of countries by region according to Trow's elite, massive and universal systems. *Source* Adapted from Calderon [5]

2.2 Quality Assurance and Accreditation Systems

The issue of accreditation of distance and e-learning credentials and certificates is still a controversial issue in Arab countries where governments are still skeptical about the quality and validity of e-learning and whether program intended learning outcomes (ILOs) are verified by higher education institutions relying primarily on this mode of learning. The government of the UAE for example has devised a law regulating the equivalence and recognition of online higher education certificates awarded "outside" the UAE only as early as 2013 but has not yet approved so far distance and/or e-learning certificates granted by higher education institutions in the UAE [6]. In Saudi Arabia, distance education is not a recognized mode of learning for certificates awarded outside Saudi Arabia, and locally recognized distance education institution are very few, among which is the Saudi Electronic University (SEU) [7], and are subject to strict quality assurance regulations. In Jordan, online education is not a recognized mode of learning inside or outside the Kingdom unless the higher education institution is listed in one of the following recognized international ranking systems: (a) Academic Ranking of World Universities (ARWU), (b) Times Higher Education World University Rankings, or, (c) QS World University Rankings [8]. In Egypt, all higher education institutions offering e-learning or distance education programs need to submit a request to the supreme council of universities for approval. Moreover, they are required to apply for accreditation following the standard accreditation regulations used for traditional modes of learning [9].

Hence, it could be noted that the issue of recognition, equivalence and accreditation of programs and degrees offered using distance education or e-learning modes is still and issue that needs closer attention by governments of the Arab world in a way that does not jeopardize the quality of higher education provisions.

3 Empirical Study for E-learning Requirements Post COVID-19

Reviewing literature was not enough to identify the quality of higher education provision on both the national and institutional levels given the very recent nature of the pandemic and that not enough research was conducted so far to provide a comprehensive picture about the use of e-learning as a basic mechanism to sustain higher education provision in the Arab World. Hence, an empirical study was conducted online following a mixed method, where both quantitative and qualitative methodologies were followed examining the diverse methods and modes of e-learning that vary from complete distance to blended and technology-supported modes. A survey was conducted in a few Arab countries representing the Gulf Council countries (GCC) and North African and East Mediterranean countries, and targeting public and private universities, where 354 faculty members and administrative staff, including leadership.

Figure 3 illustrates the targeted study locations and number of participants.

Satisfaction rates about the quality of the current distance/e-learning practices employed at higher education institutions in the Arab World varied from on country to another, from only 44% in Iraq and reaching 80% in Saudi Arabia (Fig. 4).

The availability of institutional policies that guided e-learning provision at higher education institutions in the Arab World was then investigated (Fig. 5).

The question about "institutional policies" had the lowest rating among the survey questions, indicating the lack of institutional policies for crisis and contingency management, and henceforth on e-learning provision by higher education institutions in the Arab World during the pandemic. Another reason was due to the lack of belief from faculty members and administrative staff about the importance and effectiveness of e-learning as a learning mode in an environment where the focus was primarily on face-to-face and on-campus teaching with e-learning used on a limited scale for

Country	#
Algeria	23
Egypt	94
Jordan	42
Iraq	44
Libya	18
Morocco	32
Oman	19
Saudi Arabia	58
Tunisia	24
Total	354

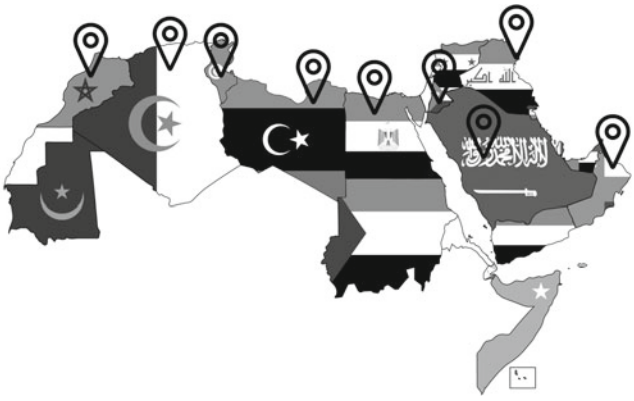

Fig. 3 Survey targeted locations at the higher education sector in the Arab World

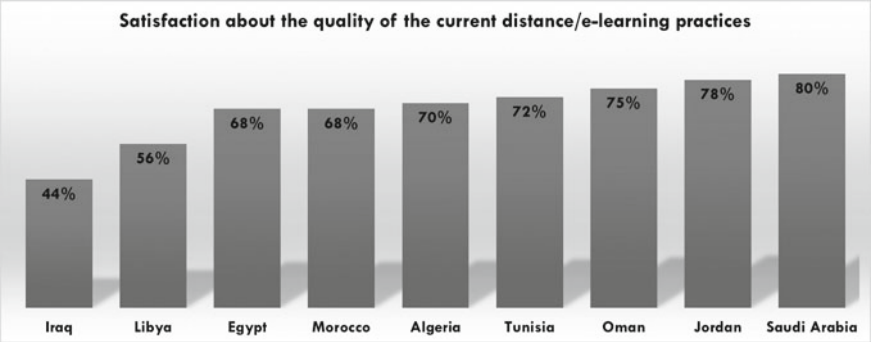

Fig. 4 Satisfaction rates about the quality of the current distance/e-learning practices at the higher education sector in the Arab World

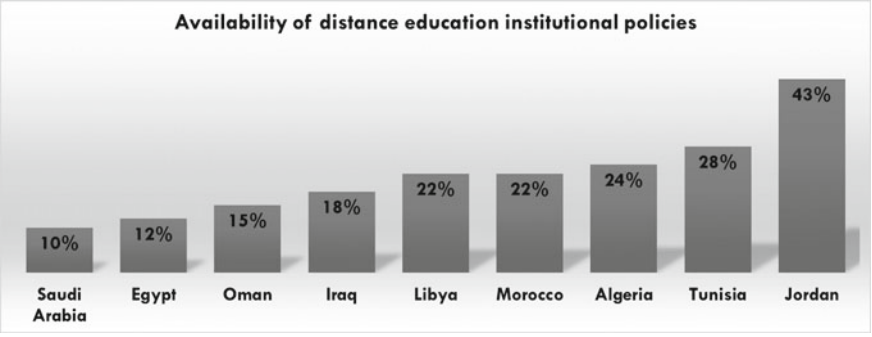

Fig. 5 Availability of institutional policies that guide e-learning provision at the higher education sector in the Arab World

sharing knowledge resources and minor learning related activities like submission of assignments and logistical support.

Another aspect that the survey looked at was the availability of human and technology resources needed to support e-learning provision at higher education institutions in the Arab World. Results were very diverse and varied from one country to another, where the least kind of support was observed in Libya, Iraq and Egypt, and the highest was in Tunisia, Oman, and Saudi Arabia (Fig. 6).

This was mainly due to the availability of trained staff and e-learning systems already installed. Universities that had these systems already in place found it easier to survive during the pandemic lockdowns. Higher education institutions that struggled to find the appropriate technology tools witnessed a period of chaos, where faculty members took the lead to adapt and reach out for their students. Some had used social media, YouTube channels, free apps like Zoom for 40-min free sessions, or campus related apps like Google Classroom and Microsoft Teams for those who had licenses.

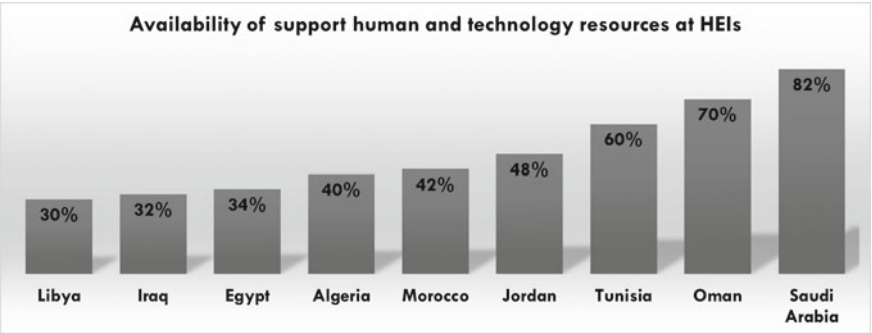

Fig. 6 Availability of human and technology resources needed to support e-learning provision at the higher education sector in the Arab World

Concerns about "equity" in the ability of higher education institutions to reach out to students at their homes were also examined in the selected countries. Results were extremely diverse, where the least equity potential was observed in Egypt, Algeria, and Iraq, and the highest in Tunisia, Oman, and Saudi Arabia (Fig. 7).

This was due to several socioeconomic factors beyond the capacity of higher education institutions, mostly related to the availability of ICT infrastructures across the whole country, particularly the availability of reliable internet services to students in remote areas. Moreover, some students could not afford technology tools (hardware and software) necessary for distance learning. They had to use their mobile phones, where numerous e-learning features were not available (file sharing, logging on to exams, screen sharing, etc.).

Another similarly important challenge was the capacity of faculty members and staff to deal with distance education modes of learning. Therefore, efforts exerted by higher education institutions regarding training and capacity building to empower

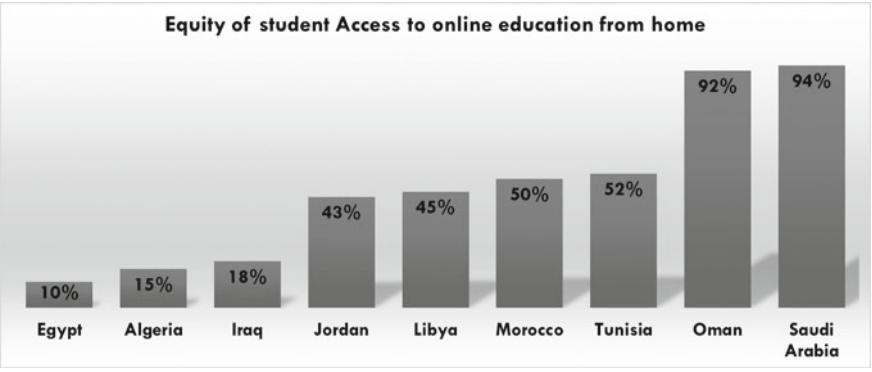

Fig. 7 Equity of student access to online education from home in the Arab World

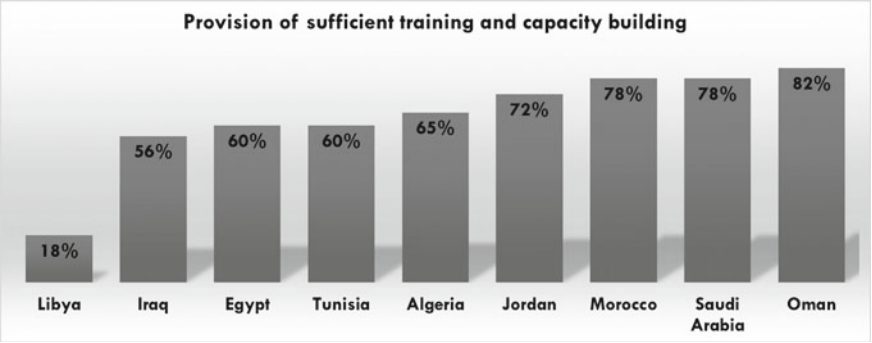

Fig. 8 Provision of sufficient training and capacity building at higher education institutions in the Arab World

faculty and staff was inquired. Results showed that most countries scored high on this component (Fig. 8).

Faculty members and staff just noted that the training did not start early enough, as a period of chaos took a while until systematic training was provided. This had significantly affected the quality of teaching and learning during the first six months of the pandemic. Hence, they advised that training packages for different teaching and learning skills are to be made ready as part of a contingency and crisis management plan.

Having looked at the opinions and experiences of internal stakeholders (students, faculty members and university leaderships), a question dedicated to the involvement external stakeholders (employers and members of the community) in the counter measures that were taken by higher education institutions during pandemic outbreak (2019–2021) was also addressed. Astonishingly, it was the least factor taken into consideration by higher education institutions in the Arab world except for those in Saudi Arabia (Fig. 9).

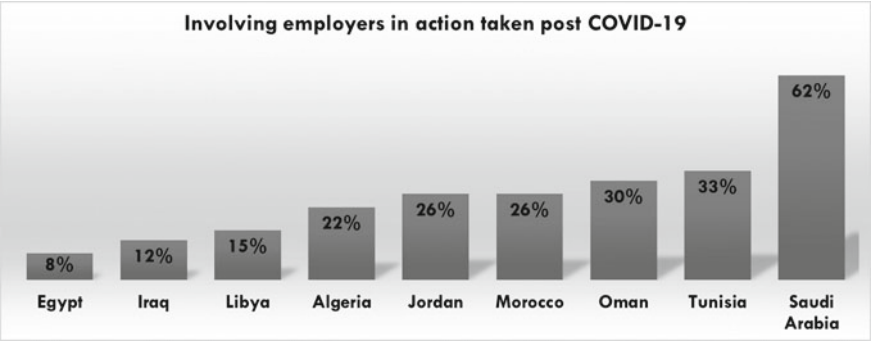

Fig. 9 Involving employers during COVID-19 at the higher education sector in the Arab World

This was justified by the priorities set for action during pandemic, as the most urgent focus was on getting teaching and learning activities ongoing, while the employers' involvement was not seen as too critical for the "survival" of higher education institutions. Other views indicated that the involvement of employers in the governance and decision-making processes were not that influential before the pandemic, and this is why it continued to be negligible during the time of crisis.

In addition to the survey, an analysis of 27 academic articles was conducted to integrate the students' voices regarding the tools used in an e-learning environment.

The students' voice was inferred from research conducted on universities during the pandemic to reflect their learning experience and needs in relation to technology management within distance and online education. This was retrieved from research papers in Egyptian and Arab academic journals using the Egypt Knowledge Bank (EKB) and "Dar al Manzuma" databases. For instance, a study on the perspectives of students about using the Microsoft Teams software for online/distance education during the COVID-19 lockdown indicated that 81.2% of students prefer that teaching remains online during the outbreak [10]. Nevertheless, they have indicated that online learning procedures require enhancement and need to be offered in more appealing ways using interactive and engaging methodologies. Moreover, communication between tutors and students, and between students ought to be enhanced. The implementation of appealing learning approaches is required to boost student motivation in learning and acquiring competencies. Students expect that there will be guiding materials considering the use of software and criticized that using online education consumes a lot of data, and that students from disadvantaged backgrounds suffer from poor internet connections [11].

A study by Abramov et al. [12], advised integrating virtual reality technology, that is capable of decreasing expenses (facilities, infrastructure, staff, and travel costs) and that help students to learn autonomously with the guidance and support of university teaching staff. The use of modern and digital technologies in universities enables the integration of distance education into the learning process, which necessitate a shift in teaching and learning methodologies. This requires regular capacity building and training for teaching staff in order to deliver quality online and distance learning [12]. Other studies expressed the importance of an interactive learning environment, reliable infrastructure, sufficient internet quota, and guidance through tutorials and technical support as important factors that students wish to integrate into an online learning model [13, 14].

On the level of leadership, a global survey was conducted with leaders of higher education institutions by the International Association of University Presidents and Santander Universidades on leadership responses to COVID-19 in 2020 and has indicated that the majority of universities considered their institutions were not ready for COVID-19 [15], as summarized in Table 1.

The results of leaderships responses to COVID-19 survey gives an insightful contribution to the technology management framework that is described later in this chapter.

A thematic analysis approach of the survey results was conducted by authors where data was coded and combined into themes and sub-themes. Codes that did not

Table 1 Global survey on the higher education institution leaderships' responses to COVID-19 in 2020

Required intervention	Percentage (%)
Investing in technology infrastructure	83
Preparation of a blended mode of learning	73
Virtual mobility	63
Faculty training and technology needs	58
Maintain academic standards for online/distance modes of learning	54
Internationalization at home	47

appear very often in the data were discarded. Comments by faculty members focused on the conditions and constraints of the use of online/distance learning modes at the Arab higher education institutions.

Based on which, the following themes have been generated:

(a) **Learning environment**

Learning environment was a main concern for faculty members. The awareness of stakeholders (parents, students, employers, and local communities) and their active involvement in planning and governance components is a critical requirement for the validity of the framework. The out-of-campus infrastructure and internet service is another factor determining the comprehensiveness of the framework.

(b) **Learning approaches**

The used learning approaches were seen to be another factor that affects model implementation, where for instance student-centered learning would have requirements that will differ from teacher-centered learning approach. In student-centered learning, technology tools are used, and content is designed in a way that gives students more autonomy and freedom for their own learning. Self-learning and programed learning are used also as content design strategies that requires the use of learning platforms, and universities would need to fulfill this requirement. Moreover, interactivity features are required to increase the student's engagement in discussions and online sessions with teaching staff. Similarly, online competency-based assessments also required extra features and capabilities that need integration with hands-on real-life skill-based learning objectives. Moreover, the integration of learning theories and policies will reflect on content design and interactivity. For example, the multiple intelligences' theory requires integration of multimedia, text, interactive content that caters for the visual, logical, kinesthetics, and linguistic learners both in teaching and assessment.

(c) **Sustainability**

Both financial and administrative sustainability were highlighted by faculty members in comments where they questioned the integration of flexible financial mechanisms that allow for the payment of costs related to cloud hosting, software licenses, upgrading of hosting quotas and software features to cope with the everchanging nature of technology. In addition, developing staff (academic, technical, and administrative) capabilities and skills by establishing a pool of young leaders should be considered. Young leaders at universities should have the chance to contribute to the establishment of the technology infrastructure, engage in decision-making process, and develop needed leadership competencies that are in turn will provide sustainable support for the integration of online and distance modes of learning within the universities' structure and management systems.

(d) **Quality**

Emphasis was put on the compatibility of quality requirements in university review processes for the implementation of online learning and distance education. This would require indicators and standards different to the ones used for traditional modes of learning, and should include those related to the quality of hardware and software used for online learning experience, the competencies of teaching staff at delivering online material, the quality of curriculum, digital content, and learning resources used.

(e) **Labor market**

Employers have given feedback about their own points of views regarding the quality of graduates as well as research and services. Employers were asked if they felt a difference between graduates' competencies before and after COVID-19 and whether they suffer from the lack of applied skills and professional attitudes as a direct impact of the distance learning. They indicated that it was too early for them to reach a conclusion about this, since the COVID-19 experience is relatively new to them and that the higher education system did not produce graduates yet that could represent these facts.

4 A Proposed Framework for Post COVID-19 E-learning Requirements for the Higher Education Sector in the Arab World

Based on the results of the empirical study and the consolidated requirements (Sect. 3) that were proposed by stakeholders in the Arab World, a framework was proposed for the post COVID-19 e-learning requirements to be considered in the higher education sector in the Arab World. The framework is meant to guide stakeholders on the needed considerations HEIs need to satisfy while integrating e-learning, either blended or

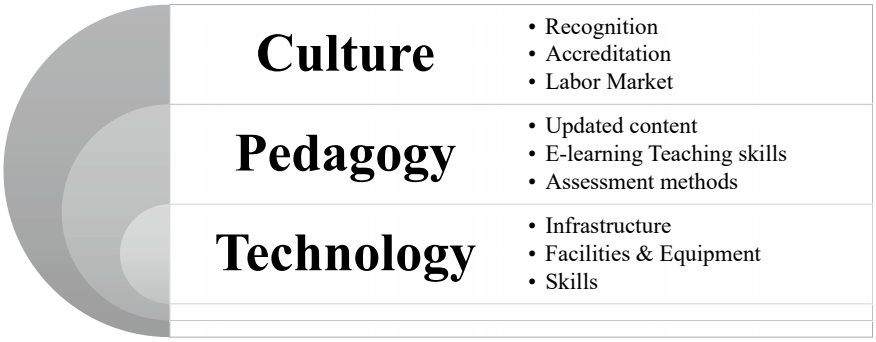

Fig. 10 A proposed framework for post COVID-19 e-learning requirements for the higher education sector in the Arab World

distant, into teaching and learning practices at the Arab higher education institutions as indicated in Fig. 10.

Given that the goal of any educational service is the development of students' competencies, an e-learning framework should be developed beyond curricula and examinations and evaluation processes that validate the accomplishment of the program intended learning outcomes. In light of the COVID-19 crisis, the proposed framework relies on distance learning with some possibility of face-to-face on-campus teaching.

The framework elements were constructed based on the frameworks described in the literature in addition to the authors' personal experience using e-learning for quiet sometime in university teaching and administration. Consequently, some elements and items were added or modified, based on results of the survey. For example, some faculty members found that the proposed framework taking into consideration the questionnaire elements is an inward-looking framework that does not consider the involvement of external stakeholder and employers. Thus, A component was added to governance and administration component assigning roles for external stakeholders in the decision making and taking process.

The proposed E-learning Quality Framework is an integrated framework that applies to both blended and distance modes of learning, and is composed of three main elements: (a) culture, (b) pedagogy, (c) technology, with three subcomponents under each element, as elaborated below.

(a) **Culture**

The higher education institutions, as well as the community shared culture and beliefs, define the success of the proposed framework during its planning and implementation phases. The following are the sub-components of the culture as a framework element:

- ***Recognition***

  The recognition of distance and online education is a factor that affects community trust. If education institutions, syndicates, and employers can recognize credentials offered by distance and online modes, students and parents would find it as attractive as traditional modes of learning and would accept to invest in it. Recognition needs to be done through explicit announced messages to the community about the list of credentials that are regarded as equivalent to those issued by traditional modes of tertiary education in the Arab countries. Recognition of untraditional modes of learning is an integral part of the national qualifications' framework employed by governments of the Arab countries and is to take into consideration each and every set of experiences that students go through and competencies that they manage to acquire based on the National Quality Framework.
- ***Accreditation***

  Accrediting bodies play a vital role in public and private institutions in recognizing the quality of online and distance modes of learning, where standards and indicators could be specifically tailored and differ from the face-to-face and traditional modes of learning, where the focus is on the outcomes of learning not inputs, activities, and procedures of learning. i.e. verifications that competencies are acquired by students and graduates after they undertake a learning experience not by the resources and inputs injected in the learning process regardless of the learning outcomes. This would require quality assurance and accreditation agencies to revisit their system of work and procedures to allow for a level of flexibility that enables them to consider non-traditional modes of teaching and learning.
- ***Labor market***

  Labor market is a key player in this regard, and whether employers and labor market institutions regard online and distance education modes as valid modes of tertiary education. The private sector worldwide is now considering what graduates can do rather than the papers they have as a proof for their qualifications. Thus, the reputation of online and distance education within labor market organizations should be based on the actual quality of graduates and their competencies that meet labor market needs. Hence, the focus should be placed on students' competencies with emphasis on the promotion of programs of study deliverables and intended learning outcomes. Trust in these modes of learning is to be formed over a period with evidence-based efficiency. This would pave the way for the next component of the framework (Pedagogy) and means of conducting teaching and learning activities and procedures that achieve this aim of a trustworthy graduates' competencies and programs of study deliverables and impact .

(b) **Pedagogy**

The pedagogy element of the framework focuses on the factors that relate to the teaching and learning activities within higher education institutions delivering online, distance, and hybrid modes of tertiary education. This is illustrated through a few sub-components as follows:

- ***Updated content***

  The content used for traditional face-to-face and hands-on activities would not be adequate for the online, distance, and hybrid modes of learning. Several adaptations need to be carried out at universities in the Arab World to achieve the foreseen program outcomes, among which are interactive content, student centered content, and multiple learning resources.

  Interactive content needs special design that caters for skills and professional attitudes enhancement not focusing on static knowledge. Technology tools and its applications in teaching and learning has provided a rich set of alternatives in this regard. The use of augmented reality, virtual reality, and simulation models, and equipment could partially supplement hands-on and lab work in many fields of specializations. Further investments need to be placed in this regard to enrich the learning content for enhancing students' experience and prepare them for dealing with modern technology in their own fields.

  Student-centered content also needs to be designed, where students take the lead and responsibility of their own learning, with the support of career guidance services that enable them during phases of transition. Increasing the chunk of electives and control over their pace of learning is a critical requirement in this regard.

  The provision of rich and diverse learning resources is another critical requirement for enhancing the students' learning experience, including memberships in international academic databases and digital libraries. Resources sharing would help universities in the Arab World overcome the expenses associated with this feature. The example of national subscriptions at the Egypt Knowledge Bank is a valid example for resources sharing among educational institutions (both pre-university and post-secondary) [16]. And the Arab Open University offers students in nine different countries access the same platform for the multi-campus subscriptions that address the factor of affordability for students and that does not overload students' tuition fees.
- ***E-learning teaching skills***

  The skills of teaching staff need enhancement in a way that enables them to carry out the new assigned roles. E-learning design is a skill that needs to be included in the capacity building framework, where teaching staff learn to use storyboards for planning, student-centered teaching, and learning using

technology. Due to the lack in technical staff at some universities in the Arab World, teaching staff find the need to supplement needed technology skills to cater for requirements of the e-learning design. Training plans offered at universities at the Arab World nowadays include various courses related to e-learning that emerged during COVID times.

- ***Assessment methods***

  The traditional means of assessment need revolutionized interventions not only in the form shifting from paper based to electronic forms of assessments, but also interactive assessment designs verify learning and acquired competencies. Online quizzes and digital question banks are commonly used nowadays at most of universities in the Arab World, yet further investment is still needed. Test validation and standardization practices need to be seriously taken into consideration.

(c) **Technology**

- ***Infrastructure***

  The factor of infrastructure was mentioned many times in the survey responses, being one of the most discouraging factors in the Arab World that stand between learners and learning using online and distance education. Hence, universities in the Arab World dealing with students from diverse socio-economic backgrounds need to plan for alternative and cost-effective ways to mitigate the adverse effects of the lack of reliable technology infrastructure out of campus. This might include the option for discounted bundles and quotas for internet access for university students in collaboration with internet and mobile phones service providers. In addition, reliable learning centers scattered along geographic regions, can provide hosting for university students' scheduled sessions in collaboration with schools, for those who cannot have internet access at home. Moreover, on-campus computer labs and library facilities should also be available for student or team access to facilitate learning while keeping physical distancing measures. A comprehensive online and distance education framework cannot survive in the Arab World without secure, affordable, and reliable means of access for the planned learning experience.
- ***Facilities and equipment***

  The availability of facilities and equipment is as important as the infrastructure. Within survey responses, students and teaching staff have indicated that a great deal of students try to use their mobile phones, as being the only available technology tool they have, to access online sessions. But these lack many features (file sharing, download and upload, some java and software compatibility) that affect their ability to fully engage in learning. So, technology design should keep into consideration the types of devices used by students and the provision of alternative learning sites that students can

access from their devices. On-campus and off-campus mapping of alternative learning sites must be allocated for 24/7 access, including weekends and holidays for self-study and individual student activities. Learning guides should also indicate the minimum requirements for being able to fully engage in a learning experience.

- ***Skills***

  The technology related skills both for staff and students should not be taken for granted, where guides, tutorials, and training sessions should be allocated to build the capacity of every individual who is engaged in the learning process. Capacity building should focus on the specific types of software used by the university and opportunity should be given to competent staff and students to act as resource persons for other staff and students on-campus as well as out-of-campus. Technical support should also be available 24/7 to help troubleshoot challenges faced by learners at any time. The use of artificial intelligence in responding to frequently asked questions is used now on many university campuses worldwide, which could be replicated at universities in the Arab World. And because software is everchanging, prompt upgrading and retraining should be frequently done by technology stakeholders.

5 Conclusion

The university level e-learning framework offered is based on feedback given by higher education stakeholders in the Arab World and targets the persisting challenges for online and distance education modes of learning, which is considered relatively new in the region. It requires the integration of efforts and resources sharing among universities for a more cost-effective implementation and customized design that caters for the needs of young people in the Arab World. Accreditation agencies, syndicates, and labor market organizations need to work together on the assessment of e-learning outcomes and graduates' competencies to assist higher education institutions in capitalizing their efforts to reach a satisfactory return on investment and gain community trust and lay the foundation for a more responsive and adaptive modes of learning that could not only be used in times of contingency, but also in everyday learning practices. A unified platform, probably with the help of the International Association of Universities, can host massive open online courses developed by universities in the Arab World and provide a rich content for sharing among institutions and students. Cross validation for question banks and certification exams is another front that needs collaboration between universities in the Arab World in the very near future. It is well believed that the COVID-19 worldwide crisis resulted in a number of innovations and breakthroughs that rose from difficult times and that could be built upon in the future for a better higher education provision in the Arab World.

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Opportunities in Disruption: Higher Education in the Post COVID-19 Era

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Abstract Due to its ravaging impacts, the World Health Organization (WHO) declared COVID-19 as a global pandemic on 11 March 2020. Higher education institutions were not spared, as the pandemic and associated lockdown measures disrupted traditional knowledge transmission, leading to the quick adoption of online learning to protect students and ensure the continuity of education. The disruption proved challenging to higher education institutions, forcing instructors and students to quickly adapt to online education and its challenges during lockdown and isolation. However, and despite the challenges of online education, early evidence suggests that hybrid and blended modes of education will become the post-COVID-19 new normal for higher education. This chapter provides insight into some critical impacts and inherent opportunities in the disruption caused by COVID-19 in the higher education sector. Higher education institutions can capitalize on digitalization to enhance the students' access to education, provide flexibility, and transform higher education in a technologically advanced, competitive, and unpredictable global environment.

Keywords COVID-19 · Online teaching and learning · Higher education · Digitalization · Student assessment · Student engagement

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1 Introduction

The 2020 coronavirus (COVID-19) outbreak took the entire world by surprise, impacting all societal endeavors at a global scale, including the lives of billions of people [1]. Within six months, the virus had spread globally, as credible authorities reported more than 34 million cases of COVID-19 and more than 1 million deaths [2]. Due to its rapid spread and severe impact, the World Health Organization (WHO) declared the disease a global pandemic on March 11, 2020. During the early months of the pandemic, authorities around the world imposed stringent lockdown measures to limit the spread of the virus [3]. Salmi [2] reported that the initial lockdowns, closure of campuses, and disruption of school activities affected more than 200 million students worldwide.

Given the importance of education, the lockdown measures did not stop most educational institutions from continuing their teaching and learning activities. Many citadels of learning, including institutions of higher education, transited to virtual and online platforms using advanced technologies to continue teaching and learning with limited or absence of face-to-face interactions [2]. The disruption of traditional educational activities due to the COVID-19 and the shift to online learning environments was not without challenges as many institutions did not prepare for such emergencies. As time progressed during the pandemic, various models of learning were used by these institutions. Basic definitions of the various models are presented in Table 1, which include:

1. On-campus learning, which is the traditional face-to-face model
2. Blended learning, which involves supplementing the traditional face-to-face model with online material to enhance students' learning
3. Hybrid learning, which involves a combination of face-to-face and synchronous online education
4. Hybrid flexible learning, which involves combinations of face-to-face learning, synchronous, and asynchronous online learning
5. Online learning, which includes either (i) distance learning, or (ii) online learning activities while students attend classes in-person.
6. Traditional distance learning, in which the instructors and students are separated geographically.

Figure 1 presents the daily and cumulative cases of COVID-19 in the UAE together with the approximate dates of academic semesters (Fall, Spring, and Summer) [4]. Soon after the declaration of COVID-19 as a global pandemic and despite the low initial number of cases, schools and higher education institutions in the UAE were closed, and education switched online during the Spring semester of 2020. Distance education online continued during the following two semesters, Summer 2020 and Fall 2020. The number of cases continued to increase during Fall 2020 and peaked nearly at the start of the Spring semester 2021. Despite the high number of cases, hybrid flexible education models were partially practiced in Spring and Summer 2021. The number of cases declined to a low level towards the end of Fall 2021, and

Table 1 Main course delivery models and related terminology

Delivery mode	Nature	Main features
On-campus	Face-to-face learning	• Maximum in-person interaction among students and instructors
Blended	Supplemented face-to-face learning	• Maximum in-person interaction among students and instructors • Supplemented by online learning material
Hybrid	Combination of face-to-face and synchronous (simultaneous) online learning	• Learning opportunities possible for some students who attend on-campus classes: in-person; online; and combination of in-person and online • Personal interaction limited to those attending in class
Hybrid flexible (HyFlex)	Combination of face-to-face learning and synchronous (simultaneous) and asynchronous (not at the same time) online learning	• Various learning opportunities possible for all students: in person; online; and combination of in-person and online • Personal interaction limited to those attending in class
Online	Includes either (i) distance learning, or (ii) online learning activities while students attend classes in-person	• Students with online access can learn anywhere and anytime • May include in-person interaction
Traditional distance	Instructors and students are separated geographically	• Can be delivered online or using other means of delivery (i.e., by mail) • No in-person interaction

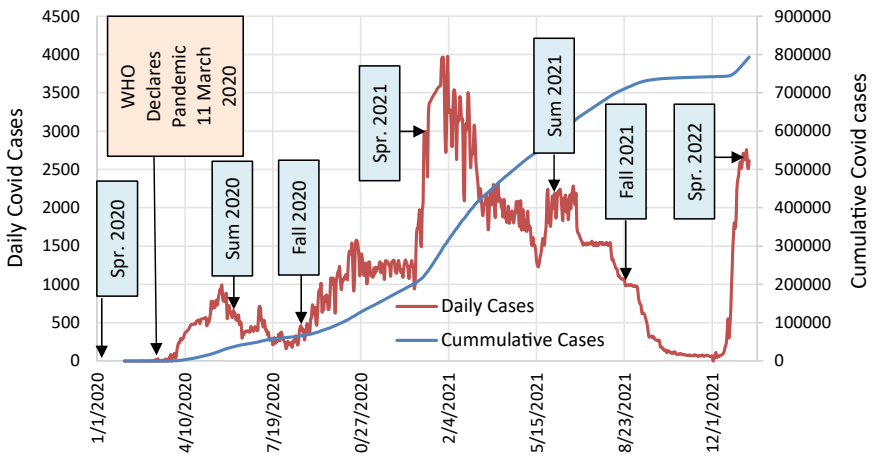

Fig. 1 Daily and cumulative cases of COVID-19 in the UAE together with approximate dates of academic semesters (fall, spring & summer) in the UAE (adapted from [4])

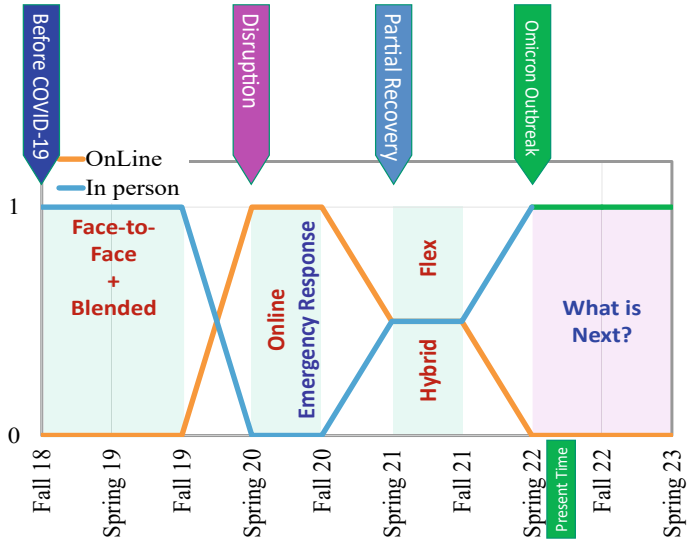

Fig. 2 General depiction of the impact of COVID-19 on the modes of learning during the stages of disruption and partial recovery. The outbreak of the Omicron variant of COVID-19 started in December 2021 (just before the start of Spring 2022)

by the end of December 2021, the number of cases declined to a point that hopes became high for going back to the pre-COVID normal situation. Unfortunately, and in November 2021, the new Omicron variant of the COVID-19 virus was discovered in Botswana and South Africa, and within a few weeks, the virus started to spread on a global scale resulting in unprecedented infection rates. It had reached the UAE in December 2021, which had achieved near full vaccination of the population at that time, and was spreading at an alarming rate.

Figure 2 presents a common example of the delivery modes practiced in many higher education institutions before and during the pandemic, which parallels the numbers of COVID-19 infections in Fig. 1 (Adapted from [4]). Before the pandemic, for instance, in 2018 and 2019, face-to-face learning and blended learning were commonly practiced. However, in March 2020 and shortly following the start of the Spring semester in the Northern Hemisphere (typically January/February to May/June), most schools and higher education institutions switched to online learning in response to the COVID-19 lockdown. Online learning also continued during the summer of 2020 (June to September) and Fall 2020 (September/October to December/January). However, as vaccination rates increased and experience increased with personal precautionary measures, the official lockdown measures in many countries were eased or completed removed. Following the initial lockdown, private and public establishments were expected to implement self-imposed preventive measures or apply official mandates to protect their customers and workers and control the spread of the disease. As such, and during the Spring and Fall semesters

of 2021, many higher education institutions opted for partial or full hybrid or hybrid-flexible learning models to manage the numbers of students within available spaces in order to avoid overcrowding maintain social distancing.

Towards the middle of the Fall semester in October and November of 2021, the world witnessed a significant decline in the number of COVID-19 infections and people started to feel hopeful. In the UAE, the numbers of daily infections dwindled to even below 50 and as such, local universities, such as the University of Sharjah, planned the return to a combination of hybrid-flexible learning for large classes and face-to-face learning for smaller ones. However, the outbreak of the Omicron variant affected earlier plans of higher education institutions to increase the degree of face-to-face interaction starting the Spring semester of 2022, as lockdown measures were being increasingly implemented in the UAE at the time of writing this chapter (January 2022), while decisions on delivery modes of learning were taken on daily basis.

Despite the significant disruptions caused by COVID-19, the situation appears to provide important opportunities for higher education institutions, including faculty and students. In the following subsections, the impact of COVID-19 disruptions in the higher education context and the potential opportunities from the situation are discussed. In doing this, the presented material should complement different empirical data on the need for education stakeholders to keep exploring opportunities in difficult educational climates to strengthen resilience and institutional transformation.

2 Disruption in Higher Education

This section presents the impacts of the COVID-19's disruption on institutions, faculty, and students.

2.1 Impact on Institutions

The coronavirus outbreak impacted and disrupted the activities and services of higher education institutions on many fronts, including teaching and learning, research, community engagement, finances and operations. QS Quacquarelli Symonds reported that universities had to change policies, affecting their modes of operation, admission, and service delivery [5]. For instance, higher education institutions had to invest in digital resources to rapidly transition to online platforms with fewer issues [6]. The immediate concerns during the initial phase of the pandemic included:

- Maintenance of educational activities satisfactorily and credibly
- Reaching and engaging students effectively
- Responding to emerging policy and operational issues

- Making available needed resources to manage the disruption and cover additional costs of the transition.

Al Lily et al. [7] discussed the impact of COVID-19 on higher education institutions, including reductions in students' enrolments and related financial concerns, disruption of professional activities, disruption of in-person research activities, and decline of interaction with the community. Some students opted to cancel or defer enrollment in higher education institutions, as travel bans restricted international students' mobility. Observations based on the local UAE experience also suggest potential changes in the students' choice of fields of study. Questions also emerged on the cost of online education and the need to reduce tuition fees, with some higher education institutions opting for fees reductions. As a result, some institutions suffered financial difficulties, and spending was limited to the essentials. Moreover, income from external research grants and contracts declined, and community engagement activities were canceled or postponed.

Higher education institutions were able to manage the disruption with varying degrees of success, with flexibility being the primary mechanism to absorb the numerous variations of situations that relate to staff, students, and systems [8]. With time, and as the COVID-19 restrictions started to ease, access to campuses was increasingly allowed, hybrid learning models were adopted, and higher education institutions became responsible for managing on-campus access of staff and students to prevent the spread of the virus. In many institutions, officers were dispatched to ensure compliance with vaccination, masking, and testing requirements. The capacity of on-campus attendance was limited, classroom disinfection activities were activated, and policies were developed to deal with on-campus COVID-19 infections.

In terms of delivery of educational material, practical activities such as laboratory and fieldwork, were initially suspended due to the virus, thereby affecting the process of equipping students with hands-on and practical skills, especially as the readiness for an all-online environment was not equal across countries and institutions [2]. Other reported impacts of COVID-19 on higher education institutions [9–11] included:

- IT infrastructure and internet access and speed problems
- Inadequate cloud storage capacities due to increased documents and videos
- Equity concerns students with different capabilities and needs
- Concerns about the quality of teaching and learning

One of the main areas of concern for higher education institutions, that required attention during the disruptive shift, was students' assessment and how technology could transform the conventional assessment without comprise. This was faced with various challenges, including:

- Academic dishonesty/problems with adequate supervision
- Online content and delivery inconsistent with assessment
- Technological disruptions and glitches affecting assessment
- Lack of access (not enough computers, lack of Internet, low internet speed, etc.)
- Family and personal challenges for students, including illness.

Based on the observed negative issues to the shift to online assessment, the requirements for hybrid educational models became clearer [12]. For example, online assessment methods need to be accessible to students in their various settings, automated to reduce instructors and tutors' workloads, continuous and appropriate to reflect progress in learning, supported by adequately designed and delivered content, and secure to minimize/prevent academic dishonesty. However, traditional higher education institutions could not effectively deal with academic dishonesty practiced by some students during online assessment, despite the deployment of available educational technologies that involved security measures such as locking down browsers, randomizing assessment items, and using single or dual cameras [12].

The engagement of students proved to be a major challenge of distant online education [13–17]. During the transition to online learning, instructors used traditional lecture material and methods to deliver courses contents. Students were generally not highly responsive to the traditional methods that instructors used in face-to-face settings to engage students, such as asking questions and seeking feedback. At the same time, many students logged in to register their attendance and appear present while they were absent. Students however were more responsive to online quizzes, instant polls, targeted games, and interactive exercises, social discussions, praise and rewards, and other methods. Students also needed more empathy and affirmations from their instructors to enhance their engagement.

The online experience also demonstrated the importance of effective delivery as well as presentation styles in the digital education era. The experience also demonstrated the importance of social media for students, who used such platforms positively to create virtual communities and collaboration spaces to support each other, without excluding the possibility of cheating [18]. Social media platforms were also used to air dissatisfaction and vent frustrations with negative experiences related, for example, to poor presentation styles and skills as well as poorly presented educational material. Lectures, educational materials, and assessment items were widely shared, with positive and negative comments filling the social media platforms. Therefore, higher education institutions must take into consideration the positive and negative opportunities presented by social media platforms in planning the future of higher education.

2.2 Impact on Students

As salient stakeholders in higher education institutions, the students were massively affected due to the COVID-19 pandemic and the measures introduced to reduce its spread and impacts. Due to the virus, the changes in the modes of operation put students from low-income backgrounds and those living in remote areas or with a disability under challenging situations. Some institutions did not have enough resources to support students as they struggled with access to high-speed internet and the availability of hardware such as laptops and tablets at home [2, 9].

Students were impacted by the limited interactions with instructors and classmates, leading to decreased student motivation and an increased sense of isolation and anxiety [19]. Jassim et al. [20] reported that the separation and restriction of individuals from their usual routines, interactions, and engagements, affected them psychologically. Other ways by which the virus impacted students included:

- Disruption of engagement and study plans, including the opportunity to study abroad
- Lack of readiness of higher education institutions to deal with such emergencies, which affected the quality of education
- Missing the school-to-university transition for new students
- Impact on academic assessment integrity
- Disruption of international students' mobility

Students who enrolled in higher education institutions for the spring semester of 2020 lost the opportunity to experience a normal school-to-university transition. The transition varies according to many factors, for example, whether students move away or abroad to study or stay home, and is challenging on the practical and emotional levels [21–23]. However, the transition offers immense personal development opportunities for students. For example, students who entered higher education institutions starting March 2020, began their studies online and may have continued online till the present time, depending on the COVID-19 policies followed by their intuitions. To illustrate the issue, Fig. 3 shows two scenarios indicating the percentage of campus experience for students affected by the pandemic in a traditional four-year program. Estimation of the campus experience in Fig. 3 was based on the following assumptions and scenarios:

- Semesters involving fully face-to-face education are considered as providing 100% campus experience

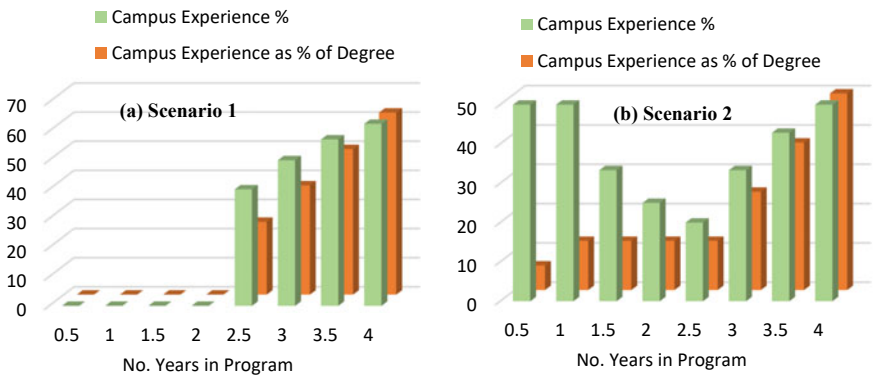

Fig. 3 On-campus experience of students enrolled in 4-year programs during 2020–2021. Scenario 1 involves online learning in 2020 & 2021 for freshmen and sophomores, and online in 2020 and hybrid in 2021 for juniors and seniors. Scenario 2 involves online learning in 2020 and hybrid in 2021 for all students

- Semesters involving hybrid education are supposed to provide 50% campus experience
- Semesters involving fully online education are deemed to provide 0% campus experience

Scenario 1 (Fig. 3a): online (off-campus) learning practiced for all students during 2020 and in 2021 for students in years 1 and 2 (freshmen and sophomore), with hybrid learning offered in 2021 for students in years 3 and 4 (junior and senior). In this case, the freshmen and sophomore students would have no campus experience during 2020 and 2021 (half of the duration of their degrees). If COVID-19 restrictions continue in 2022 and beyond, such students may end up with a very limited or no campus experience. On the other hand, the juniors and seniors would have achieved by the end of Fall 2021 about 40–65% campus experience on a semester basis, with the juniors accumulating 25–40% campus experience, and the seniors accumulating 50–65% campus experience.

Scenario 2 (Fig. 3b): online (off-campus) learning practiced for all students during 2020 and for students in years 3 and 4 (junior and senior) with hybrid learning offered in 2021 for students in years 1 and 2 (freshman and sophomore). In this case, the freshmen and sophomore students would have achieved by the end of Fall 2021 about 25–50% campus experience on a semester basis, with the freshmen accumulating 6–15% campus experience and the sophomores accumulating 15% campus experience. On the other hand, the juniors and seniors would have achieved 20–35% campus experience on a semester basis, with the juniors accumulating 15–25% campus experience and the seniors accumulating 40-50% campus experience.

The above two scenarios in Fig. 3 illustrate the importance of institutional policies regarding balancing students' on-campus experience during extended emergencies. Interviews with new students who had no campus experiences during the past two years of COVID-19 reflected their sense of loss regarding not having the chance to meet and interact with their instructors and classmates in person. Higher education institutions that opted to keep newcomers and sophomores off-campus during 2021 probably did not consider the extra impact on such students. On the other hand, junior and senior students who have already had experienced face-to-face on-campus education did not express the same sense of loss and generally indicated preference for the hybrid flexible learning model.

Despite the difficulties faced by instructors and students, especially during the early stages of the pandemic, some instructors and students found the flexibility offered by the hybrid flexible learning model preferable compared to conventional face-to-face interaction. Figure 4 shows the initial results of a quick ad-hoc survey conducted by the authors on the preferences of various categories of students and instructors (less than 40 respondents per category) in the UAE regarding traditional versus potential future modes of delivery. Only first-year students (freshmen) preferred face-to-face learning over the flexible hybrid learning combinations. In contrast, fourth-year students (seniors) and part-time and full-time graduate students preferred the hybrid model varieties. The preferences may be explained by the desire

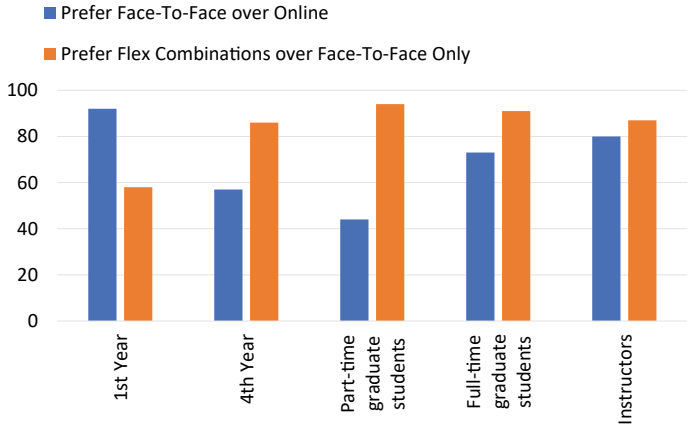

Fig. 4 Sample preferences of students and instructors for hybrid flexible or traditional face-to-face educational models following the COVID-19 experience (results from an ad-hoc survey with less than 40 respondents per category)

of first-year students to experience first-hand the transition from high school to university and the social aspects of what campus life offers.

2.3 Impact on Instructors

The coronavirus pandemic and associated academic disruption affected instructors in many ways, some of which are discussed in this sub-section. Instructors suffered from increased workloads and extra expectations from management and students and their families, as they needed to master new technical skills and manage consequences of technical difficulties, all the while facing increased isolation and emotional stresses [9]. Some instructors were unprepared and needed training to effectively deploy tools in the new online environments for enhanced students' engagement and motivation [24].

In terms of research, the pandemic disrupted practical work, shifted focus, and impacted funding, and collaboration and engagement with stakeholders. The American Geosciences Institute [25] reported that the impacts on research activities included deferring or canceling ongoing and planned research projects and shifting activities to conducting literature reviews and virtual/computational work. In a 2020 survey by Vitae of researchers in universities and research institutions in the United Kingdom during the initial wave of the pandemic, there was a near-complete cessation of research activities that could not be done from homes, 44% reduction in academic networking and dissemination activities, and 37% reduction in commercialization and business commercialization activities [26]. The survey also indicated

a significant increase of 20% in article writing activities, a 16% increase in preparing grant applications, and a 14% increase in desk-based research.

Instructors were also affected in other ways due to the lockdown and disruption caused by COVID-19. From our personal experience and direct discussions with colleagues, in addition to issues raised in media reports, challenges and concerns that instructors had to face included:

- Inadequate online platforms and resources for teaching and learning
- Limited digital skills for online teaching and student assessment
- Challenges in selecting appropriate assessments to minimize academic dishonesty
- The need to redesign teaching material for online delivery
- Increased expectations and demands from management and students
- Increased workload and stress levels
- Disruption of work-life balance
- Deferral/cancellation of professional projects/plans/activities

In addition to the above-mentioned impacts, a significant change to the instructors' work was the shift to online professional meetings due to restricted gatherings and imposed lockdowns [27]. Online professional meetings had some advantages, such as reduced cost of participation, reduced preparation efforts, reduced attendance approvals, and more selectivity and flexibility in paying attention. On the other hand, online meetings allowed participants to switch off while appearing present, resulting to a large extend in loss of professional and social interactions with colleagues to catch-up, network, collaborate, and negotiate. It also reduced opportunities to take a break from routine activities and familiar settings. The negative health impact of sitting while attending long online meetings also increased.

Having discussed the impacts of the COVID-19 pandemic on higher education institutions and the main stakeholders, the following section focuses on the opportunities made available by the pandemic.

3 Digital Transformation

The early stage of the COVID-19 pandemic made many higher education institutions face a paradigm shift—closure or 100% online teaching and remote work. Before the pandemic, higher education institutions were gradually going digital in response to advancements in educational technology and market demand. However, the pandemic required immediate digital transformation within weeks or even days.

Bower and Christensen [28] wrote in Harvard Business Review an article titled "Disruptive Technologies: Catching the Wave". Citing examples of companies that used to dominate the markets then lost their share, such as IBM, the writers stated that "companies like these invest aggressively—and successfully—in the technologies necessary to retain their current customers but then fail to make certain other technological investments that customers of the future will demand". They also stated

that "One of the most consistent patterns in business is the failure of leading companies to stay at the top of their industries when technologies or markets change." So was the state of many higher education institutions that had no clear digitalization plans and relied on the gradual integration of educational technology for problem solving rather than forward looking planning. However, the COVID-19 pandemic offered massive opportunities for these institutions in this regard.

Before the pandemic, higher education institutions were facing significant issues related to the employability of graduates of many traditional disciplines. In addition, major international employers started to focus on potential and skills in making employment decisions as they no longer considered academic qualifications a barrier to employment. In fact, such employers began to offer tailored education and training programs that match their needs and market demand for skilled employees. Furthermore, virtual education technology companies, such as Massive Open Online Course (MOOC) providers, started to change the way people learn. The data suggest that within a few months of the pandemic, many MOOC platforms witnessed massive enrollment surges in classes of various disciples [29].

During the early stage of the pandemic, higher education institutions resorted to online learning as a precautionary measure to ensure continuity and assure students and their families. During the past two years of the pandemic, many institutions successfully adapted the necessary technological tools and systems to ensure continuity and maintain quality. The disruption presented important opportunities for systems/infrastructure upgrades as institutions invested in their ICT systems to leverage the capabilities of modern technology [30]. The disruption and changes in operation models offered the stakeholders and employees of higher education institutions, including instructors, students, and administrative staff, unprecedented opportunities to develop new skills necessary for online engagements [31]. These include skills for establishing an experienced online learning community to successfully enhance teaching, learning, research, and services.

Additionally, the disruption provided opportunities for increased funding and opened new areas of research in some fields, such as the medical, clinical, and educational technology fields. It also increased the potential for researchers' communication and collaboration without the need to travel [32]. Opportunities for higher education institutions due to the disruption and the subsequent adoption of the online platforms are summarized in Table 2.

4 Future Educational Technologies

Towards the end of 2021 and just before the spread of Omicron, many higher education institutions were optimistic that operations may go back to a high degree of normality starting Spring 2022. However, the Omicron variant rapidly changed the situation, with various precautions currently being implemented, including cancellation of travel, targeted lockdowns, and continuation of partial or complete online education. With potential formation and spread of new variants of the virus, it is safe

Table 2 Example opportunities offered through COVID-19 disruption

Impact area	Example opportunities
Internationalization	• Internationalization without the need to stay abroad for the whole program • Enhanced international collaboration aided by digital platforms
Students' opportunities	• Increased access to educational resources • Access to educational technologies • Increased learning flexibility
Professional meetings	• Increased accessibility and cost reduction • Reduced need for approvals
Inter-institution collaboration	• Sharing of online teaching and resources to reduce cost and cover shortages
Opportunities for instructors	• Enhanced digital teaching experience • Access to educational technologies • Increased work flexibility
Campus resources	• Reduced demand for on-campus facilities and resources • Potential for optimization of resources • Potential reduction of related operational costs
Models of learning	• High potential for hybrid flexible models

to suggest that higher education institutions and stakeholders need to be on guard, equipped with appropriate skills, and adopt flexible approaches. With these suggestions, teaching and learning processes must always be facilitated without compromising the health and safety of everyone involved. Doing that should also ensure that societies across the globe continue to educate future generations for sustainable growth and development.

The experience of higher education institutions with virtual education and various delivery models made many options available for continuing education in 2022 and beyond, for example those shown in Fig. 5. These options include going back to face-to-face learning, hybrid learning, hybrid flexible learning, synchronous or asynchronous online learning, or any combination of these options. Class size and nature (i.e., design, laboratory, theoretical), level of students in their programs (freshmen to seniors and postgraduate) are among the issues that need to be considered in deciding on the appropriate mode of delivery.

In addition to the virtual education possibilities offered by the available educational technologies, new disruptive technological advancements are currently being tested and optimized. Such technologies promise to transform the various aspects of our lives, including higher education. Virtual, augmented, and mixed reality technologies (referred to as XR), and related educational resources and platforms are currently available, but still need further development for successful application in education. These technologies promise to offer immersive experiences and extraordinary possibilities for learning in real and virtual settings in the metaverse [33] (Fig. 5). Such technologies are in use today in the gaming industry, with children

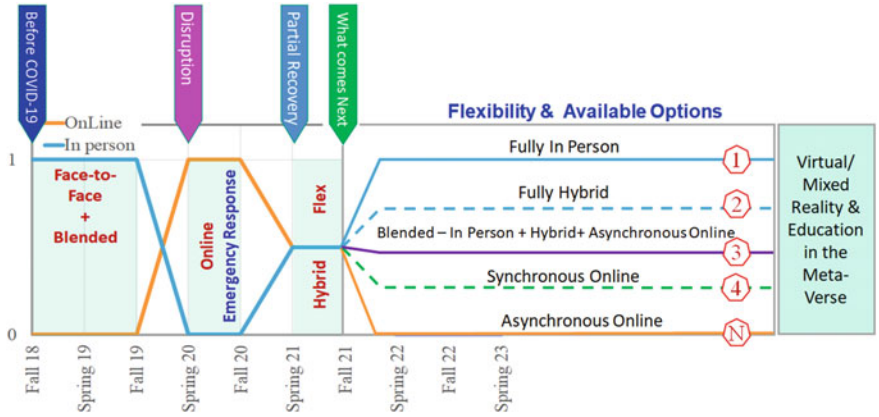

Fig. 5 Flexibility and available learning models at the start of Spring 2022 following partial recovery in 2021

and adults using them to play sophisticated online games in real-time with participants from all around the world. Major international companies, such as Microsoft and Facebook, are optimizing virtual and augmented reality platforms for business and education, with others developing specialized educational resources for students and professionals. The COVID-19 pandemic highlighted the potential of integrating educational technologies in education, but unfortunately many higher education institutions, especially in our region, currently seem to lack awareness of the potential of virtual and augmented reality platforms for education.

Integrating virtual and augmented reality in education is expected to disrupt the current educational practices and leave traditional higher education institutions behind. Such traditional institutions may find themselves in direct competition with online education providers, such as Coursera, Udemy, and others. Therefore, progressive higher education institutions should think beyond managing the COVID-19 disruption and seize the digitalization opportunity to venture into the coming virtual and augmented reality era.

Higher education institutions consist of communities of learners, instructors, managers, and support staff who work and study within physical and virtual spaces (Fig. 6). Such organizations develop complex interactions within their environment, and their cultures evolve with time. In the Middle East, educational authorities are directly involved in setting educational policies and requirements, as well as quality management through regulations and licensing. Furthermore, higher education institutions and educational authorities are influenced by local, regional, and global developments in higher education. For such institutions in the region to stay at the top of developments in higher education, they need to plan for catering to future generations rather than dwell on past successful experiences and the satisfaction of current customers. However, coordinated and aligned approaches by all stakeholders

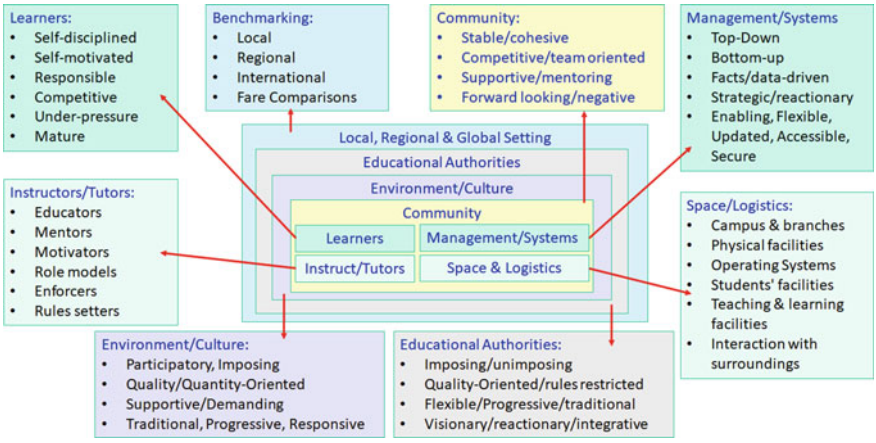

Fig. 6 Depiction of the components of higher education institutions and interactions with their environment, emphasizing on the need for coordinated and aligned approaches to implement the needed change

involved are essential for higher education institutions in the region to cope with the upcoming rapid technologically enabled disruptions in the higher education.

5 Conclusion

This chapter aimed to explore the impacts and inherent opportunities in the disruption caused by COVID-19 in the higher education sector. In doing this, salient issues and problems impacting higher education institutions, students, and instructors were discussed, along with the opportunities presented by the situation. Table 3 presents a synopsis of the critical points addressed.

The COVID-19 disruption offered the opportunity of bridging the technology gap in education and accelerated the adaptation of technology as the time for establishing and testing capacity for digital education was cut short by many years. In our region, the response of many higher education institutions to the disruption matched the approaches adopted by top institutions across the globe. They transited online within days in the region with teaching, learning, and administrative services supported with advanced technology and training. Therefore, it is also crucial for higher education institutions in the region to continue exploring strategies for keeping pace with the fluid situation and constant changes in the educational landscape. For this to be effective, higher education institutions in the region need more collaboration and sharing of resources for sustainable transformation of the educational systems.

Table 3 Synopsis of main impacts and opportunities

Impacts	Opportunities
• Affected educational quality and students' engagement due to lack of preparedness • Proved challenging in terms of controlling academic dishonesty • Proved stressful for instructors, students and families during the transition • Disrupted practical research, research commercialization, and professional gatherings • Brought attention to inequalities among students according to their means and access • Disrupted students' mobility and internationalization • Negatively affected social interactions and engagement with the community • Affected enrollment and the bottom line of many institutions	• Revolutionized digital higher education in a short period of time • Forced development of skills in digital educational technologies • Opened doors for innovation modes of teaching and learning and professional engagement • Proved that flexible work models can be effective • Enhanced access to education for students from various socio-economic backgrounds, challenges, and geographical locations • Proved the importance of fundamental research, which for example lead to the development of novel COVID-19 vaccines • Opened doors for inter-institutions collaboration • Helped in bridging the technology gap in education among nations

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The COVID-19 Teaching Experience: The University of Petra as a Case Study

Marwan Muwalla

Abstract The unprecedented health crisis resulting from the spread of the COVID-19 pandemic, has had drastic global consequences. Unprepared for the sudden and exponential rise in the number of COVID-19 cases, governments had to act quickly, and in no time, restrictions on mobility were imposed and entire sectors underwent closures and lockdowns. These measures have had far-reaching effects on the economic, societal, and educational circles, to name but a few. As far as the educational system is concerned, the pandemic and its ensuing repercussions, have played a significant role in disrupting the teaching process at schools, colleges, and universities, which in turn have impacted the students' achievements and the educational institutions' academic integrity. Higher educational institutions in Jordan, like their counterparts in other parts of the world, have witnessed the impact of COVID-19 on the educational system. This paper explores the strategies implemented at the University of Petra to overcome the educational challenges that accompanied the pandemic. It also looks at the post pandemic approaches that are currently being adopted to ensure the successful continuity of education.

Keywords COVID-19 · Online learning · Higher education · University of Petra · Jordan

1 Introduction

Information about COVID-19, a disease caused by a new coronavirus called SARS-CoV-2, started to circulate globally in 2019 "following a report of a cluster of cases of 'viral pneumonia' in Wuhan, People's Republic of China [1]. Before long, an astronomical increase in the number of coronavirus cases was detected globally, leading to the announcement of a worldwide outbreak of COVID-19; a development that prompted the World Health Organization (WHO) to classify the virus as a global pandemic on 11 March 2020 [1]. Almost two years after recording the first cases of

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the coronavirus in China, the WHO figures revealed on 1 April 2022 that over 486 million COVID-19 cases and more than 6 million deaths have been reported globally [2].

To control the outbreak of the virus, governments worldwide took diverse preventive measures that varied in severity. While some imposed partial lockdowns, others adopted full quarantine that dictated restrictions on movement, a ban on travelling, the closure of businesses, and a shift to online teaching and learning.

One of the countries that adopted "one of the strictest lockdowns in the world" is Jordan, which announced a total strictly-enforced curfew on 17 March 2020 [3]. This decision was coupled with that undertaken by the Ministry of Higher Education and Scientific Research that instructed all universities in the country "to suspend the teaching on campus and move to distance learning through synchronous online learning platforms" [4]. As a result, online teaching became the norm adopted at institutions of higher education, which was an unprecedented experience that posed a number of challenges on the education sector and all its affiliates.

This paper is divided into three sections. Section 1 briefly introduces online teaching and learning. Section 2 examines the research conducted on the impact of online learning on education. And Sect. 3 investigates the strategies implemented at the University of Petra to overcome the educational challenges that accompanied online teaching and learning during the COVID-19 pandemic. It also considers the post pandemic approaches that are currently adopted to ensure the successful delivery of knowledge and information to the students enrolled at the university.

2 Online Teaching and Learning

Online learning is defined as "education that takes place over the internet and is often referred to as "e- learning," among other terms. It is grouped under the umbrella term "Distance learning" which refers to learning that is conducted outside the confines of the traditional classroom [5]. This kind of teaching has shifted the focus of education from one that is teacher-centered to one that is student-centered. In this type of teaching/learning the process of learning is transformed into a collaborative and interactive activity that necessitates the participation and cooperation of the two parties involved in the educational setting, namely the instructors and the students. Therefore, instructors in an online environment are no longer the sole experts in the classroom who provide all the knowledge and information that their students need; rather, they provide their students with guidance and assistance, as the latter are given the opportunity to explore the subject-matter they are entrusted with. As such, students are no longer passive learners that memorize information with the aim of reproducing it on assignments and exams.

In the past few years, Learning Management System (LMS) softwares, such as Blackboard, Moodle, Angel, and WebCT, among others, have facilitated the implementation of online learning and the creation of "virtual classrooms" in educational institutions. These systems enable instructors to design and deliver course content,

communicate with students, and evaluate students' performance with the help of tools that allow instructors to create and post syllabi, conduct discussions and group work, administer quizzes and exams, and grade student work, to name but a few.

Online learning is not a new trend in education; early attempts at distance learning date back to 1840, when Isaac Pitman employed mail and a shorthand procedure to teach students [6]. The gradual improvements in information technology led to the development of this teaching technique, and hence its application in academic institutions in countries where information technology had gained prominence. Before long, this mode of teaching attracted the attention of many scholars interested in educational technology who conducted research that covered a wide spectrum of topics, like online teaching models, standards, evaluation criteria, and online course design and implementation [7].

The studies conducted on online teaching and learning indicate that there are diversified merits and demerits associated with its implementation, which affect the students and the instructors involved in the teaching/learning process; indeed, the most discussed advantages can be summarized under the following headings [8–11]:

(a) *Convenience and flexible hours*

Online teaching and learning allows for easy access to the platforms used in the teaching process anywhere and anytime. It saves time and takes into consideration the students' busy schedules.

(b) *Innovative teaching methodology*

The traditional role of the instructor, which is generally associated with lecturing and the dissemination of information and knowledge, is transformed to a more rewarding endeavor whereby instructors become facilitators of learning responsible for providing their students with guidance. Also, instructors introduce a variety of learning activities to cater for the students' needs and learning potential. In such a scenario, the teaching approach becomes student-centered; students are no longer passive participants in the classroom.

(c) *Enhanced learning*

The innovative teaching methodologies help in achieving a deeper understanding of the course content, and hence a long-term retention of the information and knowledge studied. Since the course content consists of a variety of activities, students acquire a number of skills that include soft skills and technology skills.

(d) *Minimal usage of physical space and expenditure*

Online learning is implemented off-campus, which means that the institutions' expenditure on electricity, water supply, and infrastructure decreases and is spent on other educational aspects.

As for the disadvantages related to this kind of learning, studies indicate that they are grouped under the following headings [8–11]:

(a) *IT issues*

Instructors and students can encounter technical difficulties during the implementation of online learning. These can include internet access, internet speed, downloading material, and the instructors' inexperience with IT applications.

(b) *Student-instructor interaction*

Online teaching can hamper the educator/learner interaction. The discussions that take place during face-to-face teaching and the human touch that is noted between the providers and receivers of knowledge is missing in this mode of teaching. Research conducted on this issue reveals that the lack of interaction has led to the psychological ill-being of both instructors and students.

(c) *Staff inexperience with IT applications*

The sudden shift to online teaching reveals that not all staff members are fully acquainted with the effective use of IT applications. Students' responses to surveys and questionnaires have shown that some staff members are incapable of effectively presenting course content using the IT facilities available to them; hence, the need to develop their IT skills and capabilities.

It is interesting to note that the aforementioned advantages and disadvantages associated with the transition to online learning seem to constitute global trends across higher education institutions all over the world. This is a clear indication that once the shortcomings of emergency remote teaching are overcome, with the help of more planned organizational strategies, the implementation of online teaching might prove a more successful endeavor.

3 Impact of Online Teaching: Literature Review

The sudden shift from the traditional face-to-face teaching to online teaching and learning during the COVID-19 pandemic "has shaken the landscape of higher education worldwide" [11]. According to Hodges et al. [7], although the procedures taken by the higher education institutions to overcome the consequences of the pandemic varied, three procedures were generally adopted to secure the continuity of education: (1) maintaining in-class teaching with social distancing; (2) creating hybrid models (blended learning, limitation of students on campus); or (3) moving to online. However, the staggering increase in the number of COVID-19 cases, dictated the total transition to, and the reliance on, online teaching making it the prevalent global teaching/learning approach.

In spite of the fact that this teaching/learning methodology was implemented by some institutions of higher education in developed countries prior to the pandemic, it was not common practice in many universities worldwide. Consequently, many studies were conducted to investigate the impact of this instructional method on all the parties involved in the educational process, namely the instructors, learners, and staff.

Although research that tackles issues related to e-learning started before the breakout of the pandemic, and focused on the challenges, advantages, instructor and learner feedback as well as course content [7, 12–16], the studies conducted during the pandemic discussed topics associated with the challenges of emergency remote e-learning, the instructors' and students' perceptions towards the implementation of online learning, and future strategies to keep up with the latest developments in e-learning teaching methodology [8, 9, 17, 18]. Research indicates that one of the most prominent challenges encountered during emergency remote e-learning, especially in developing countries, is the accessibility and affordability of digital devices and internet connection [4, 17, 18]. According to Pokhrel and Chhetri [18], many countries have major issues with providing a reliable internet connection and access to digital devices. Students who come from remote and economically disadvantaged areas cannot afford necessary devices; this has negative academic repercussions on such students whose motivation and performance are impacted by the unavailability of resources needed for e-learning.

Other challenges that received due attention by researchers include assessment methods and online course design. Since instructors were not prepared for online learning, they had to devise new techniques to assess students especially that the available plagiarism and cheating measures were insufficient [18]. Preparing online exams required expertise and IT skills in order to produce an output that is compatible with the material taught and the students' learning abilities [8]. Also, instructors had difficulties developing course content that meets the requirements of online learning since the pre-planned curricula used prior to the COVID-19 pandemic proved ineffective, and less interactive, and student-centered activities had to be incorporated in the course syllabi to secure the successful transfer of information. In fact, Means et al. [19] focus on the importance of introducing adequate course content because they are of the viewpoint that a successful online teaching/learning experience depends on the preparation of a course content that is tailored for such a milieu.

To assess their experience with online teaching, the educators' and the learners' perceptions were investigated. The studies reveal that the educators' feedback varied depending on their expertise with this mode of teaching, their institutions' preparedness for e-learning, as well as their knowledge of IT. Many faculty members affiliated to different institutions of higher education expressed dissatisfaction with the experience because of the lack of teacher-student communication and interaction [20], decline in students' engagement and performance [21], academic dishonesty, and difficulty to manage technology [22].

The students' feedback indicates that online teaching/learning has its positives and negatives. A study gathering the experiences of students at British universities stated that "The most significant positives are the "flexible assessments" and "digital content," whereas one of the most important drawbacks is the lack of interactions" [23]. The problem with interaction seems to be a global problem experienced by both students and instructors alike [4, 8]. Students at British universities also expressed dissatisfaction with the lack of support from the university and members of staff during the pandemic. In Canada, students also seemed to have concerns about the quality of online teaching they received; they were concerned about grades, the

ability to complete their courses, or that "their credential would not be equivalent to those not affected by the COVID-19 pandemic" [24]. In Jordan, research shows that students believe that the instructional and assessment quality during online teaching "improved their attitudes towards online learning" [25]. Students also pointed out that some disciplines are more suited to online learning; students specializing in medicine and other science courses, for example, believe that online learning is not suited for practical courses and can be applied more effectively to courses of a theoretical nature [25]. In fact, 75% of the students in the medical field enrolled at Jordanian universities stated that they were not satisfied with their online experience [26]. The challenges related to the effective applicability of online learning within specific disciplines seems to be noted on a global level, which entails that policymakers and stakeholders at institutions of higher education have to take this aspect into consideration when formulating recommendations on online teaching and learning in the future.

Researchers have also considered the future of higher education post the COVID-19 pandemic, and studies indicate that blended learning should be "the new frontier in higher education" [27]. In addition, researchers have suggested that institutions of higher education have to invest in information and communication technologies (ICT) infrastructure, online pedagogy and the formulation of an e-learning quality assurance framework if the desired learning outcomes are to be achieved [27].

Studies conducted on the impact of online teaching/learning reveal that efforts to overcome the challenges encountered during the implementation of this instructional mode are a necessity to ensure the continuity of education. Also, future plans have to take into consideration quality assurance in relation to e-learning if this mode of instruction is to predominate.

4 The Experience of the University of Petra with Online Teaching

The University of Petra (UOP) is a private university that was established in 1991 and which currently hosts around 7000 students. It offers 30 Bachelor of Arts degrees and 5 Master of Arts degrees in a wide spectrum of specializations and aims "to establish adequate resources and infrastructure for teaching and learning to create and disseminate knowledge and technology" to its student body [28]. UOP's experience with online learning can be divided into three phases: online teaching prior to COVID-19; online teaching during COVID-19; and online teaching post COVID-19.

4.1 Online Teaching Prior to COVID-19

Since its establishment, the predominant teaching mode adopted at the University of Petra was the traditional face-to face approach; hence, teaching was teacher-centered and instructors were responsible for passing on information to their students via planned curricula, and evaluation criteria and exams that fit this instructional method.

By 2003, some faculties started using e-learning systems to support their face-to-face course content and to administer exams; however, these attempts were sporadic and members of staff chose the e-learning forms they preferred without relying on specific e-learning references and standards. Before long, the university administration realized the growing importance of e-learning and the need to incorporate technology in the curricula to increase the effectiveness of the learning process [28]. To this effect, the e-Learning Centre, which is an independent unit, was established in 2012 to fulfil the following objectives: (1) enhance the capabilities and expertise of the academic and administrative staff as well as the students in using modern technology and e-learning to acquire knowledge; (2) provide a modern electronic environment and its applications to support the teaching and learning process; (3) create a digital database that includes the courses offered at the university; (4) contribute to improving the quality of learning and teaching through the application of integrated systems for students' evaluation and follow-up; and (5) provide technical and administrative consultations in the field of e-learning [29].

Two Learning Management Systems (LMS), namely Blackboard and Moodle, were made available to staff members, and regular training sessions and courses were conducted by the Academic Development Center in collaboration with the e-Learning Center to enable faculty members to utilize these systems effectively. The training consisted of basic functions in LMS, managing e-exams on LMS, and use of tools under Microsoft 365 accounts and Camtasia. In fact, in some faculties, especially the ones that offer science majors, the use of the LMS amounted to 95% and involved activities such as uploading course content and the evaluation of students' academic achievements by assigning homework and projects, and administering exams. These activities, however, were limited in scope and did not include online teaching practices; consequently, one can say that proper online teaching and learning was not the norm at UOP until the outbreak of the COVID-19 pandemic.

4.2 Online Teaching During COVID-19

UOP, like its counterparts worldwide, experienced a sudden emergency shift to online teaching on 18 March 2020, when the accelerating spread of the COVID-19 pandemic worldwide prompted the Jordanian government to implement a total lockdown in the country. This, in turn, led the Ministry of Higher Education and Scientific Research to suspend face-to-face teaching on university campuses and the transition to distance learning through the use of online learning platforms. The sudden shift to emergency

remote online teaching meant that the UOP administration had to take immediate action to secure providing its student body with an effective teaching and learning environment.

However, as soon as this new instructional methodology was adopted, a number of challenges started to surface that needed to be addressed urgently. The most prominent challenges included: (1) the majority of staff members had no pedagogical experience or knowledge in designing effective courses online; (2) it was difficult to train students to use LMS; (3) some practical courses required special gadgets (e.g. drawing tablets, light boards) to teach the material effectively and efficiently (e.g. explaining equations, or charting, or designs); and (4) staff members lacked the expertise needed to design online assessment methods; all of which were challenges encountered by other local, regional and international institutions of higher education that were forced to adopt emergency remote online teaching due to the COVID-19 pandemic [4, 7–9]. The aforementioned challenges had to be addressed and necessitated careful preparation on a number of administrative and academic levels: governance, infrastructure and IT systems, and training and support.

On the governance level, three new committees were formed to handle the emerging situation, namely the Crisis Committee, the Safety Committee, and the E-learning Emergency Committee, with different responsibilities attributed to each. The Crisis Committee was responsible for the implementation and follow-up of the regulations and decisions introduced by the Ministry of Higher Education and Scientific Research, while the Safety Committee was entrusted with the review and the implementation of the safety procedures. The most pressing responsibilities and duties were performed by the E-learning Emergency Committee, which was entrusted with pursuing all issues related to upgrading the university's infrastructure and securing the necessary training and technical support needed by the staff members. Two teams were formed to secure the fulfillment of these responsibilities: the first team consisted of staff from the E-Learning Center, whereas the second team comprised staff members affiliated to the Faculty of Information Technology.

Since the local servers and LMS available at the time of the lockdown were insufficient to cater for the needs of 280 staff members trying to deliver courses for 7000 remote students, swift decisions had to be undertaken to improve the infrastructure. To overcome problems associated with the internet capacity, cloud computing was used; the Moodle LMS was moved to a cloud server outside Jordan in Europe and the latest version of the system was installed to provide support for more faculty members. At the start of the lockdown, the available LMS did not support synchronous teaching, and for a short period of time, instructors were allowed to use any tool or social media to communicate with their students. In no time, licenses for synchronous e-learning platforms were purchased. Initially, Zoom was used then Microsoft Teams was made available for staff members.

Once the shift to online learning was implemented, training and technical support for the synchronous e-learning platforms was immediately provided online to staff members. This training had to cater for the needs of the new "era," and hence included the following workshops: basic functions in LMS; managing e-exams on LMS; the use of tools under Microsoft 365 accounts; managing grade books in LMS; importing

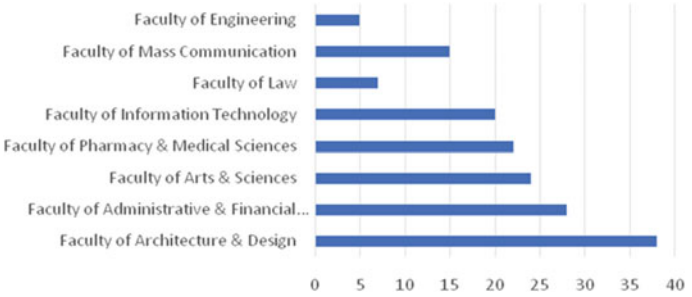

Fig. 1 Number of staff participating in the evolution in each faculty

and exporting questions on LMS; Excel for grade managing; calculating course outcomes from e-exams; e-learning methodologies; establishing YouTube Channels; recording videos using PowerPoint and movie editing. Also, training videos and manuals were developed and made available on the university website and social media. To solve unexpected technical problems faced by instructors and students, technical and functional support was provided 24/7 via hotlines, email, and ticketing systems.

A year and a half after the transition to synchronous teaching, the experience had to be assessed. Therefore, two questionnaires, one provided to staff members and another to students, were conducted online and posted on the university LMS between 24 August and 4 September 2021. The questionnaires aimed at identifying the strengths and weaknesses related to the transition to online teaching and learning, as perceived by the instructors and students. The responses were used to introduce measures that can enhance the strengths and overcome the weaknesses of this teaching mode.

The members of staff that answered the questionnaire amounted to 174, affiliated to the Faculties of Engineering, Mass Communication, Law, Information Technology, Pharmacy and Medical Sciences, Administrative and Financial Sciences, and Architecture and Design (Fig. 1). They had to answer questions that cover the following aspects pertaining to online teaching during COVID-19: (1) the university infrastructure and technical support; (2) the training provided by the university; (3) the assessment methods implemented; (4) the teaching methodologies adopted; (5) knowledge of the rules and regulations of e-learning; (6) quality assurance and e-learning; and (7) the adoption of e-learning and its impact on academic programs and study plans.

813 students affiliated to the Faculties of Engineering, Mass Communication, Law, Information Technology, Pharmacy and Medical Sciences, Administrative and Financial Sciences, and Architecture and Design answered a questionnaire that focused on their experience with online teaching/learning (Fig. 2). The questions addressed to the students investigated the following aspects: (1) technological accessibility

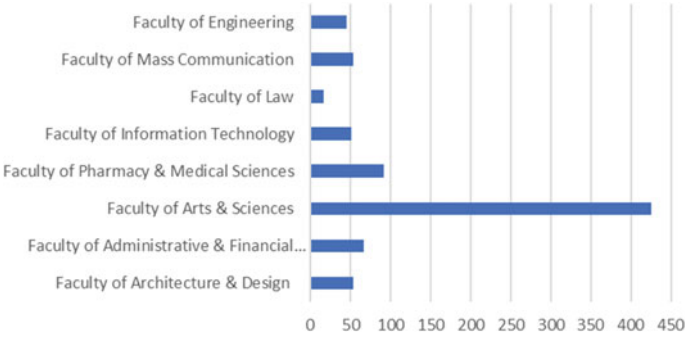

Fig. 2 Number of participating students

(internet, computers, mobiles etc…); (2) the appropriateness of the university infrastructure and support systems; (3) students' knowledge of the use of technology; (4) the teaching methodologies implemented; and (5) the assessment strategies adopted.

Research conducted on e-learning reveals that one of the challenges that all the parties involved in the online teaching/learning mode encounter is the availability of the appropriate infrastructure. This challenge, coupled with the lack of technical support, can disrupt the e-learning teaching/learning process, and can negatively impact the utilization of the e-learning system [4]. Consequently, instructors and students had to answer questions that address these issues. It is interesting to note that both the instructors and students expressed satisfaction with the university infrastructure, the e-learning tools available, and the technical support provided. While 83% of the instructors expressed content with the university infrastructure, 90% stated that the university has provided an effective synchronous learning system (Figs. 3, 4, and 5).

Students, like their mentors, commended the aforementioned facilities, for 80% were satisfied with the infrastructure and 72% stated that the university has provided an effective LMS for teaching and exams (Fig. 6). These services facilitated the

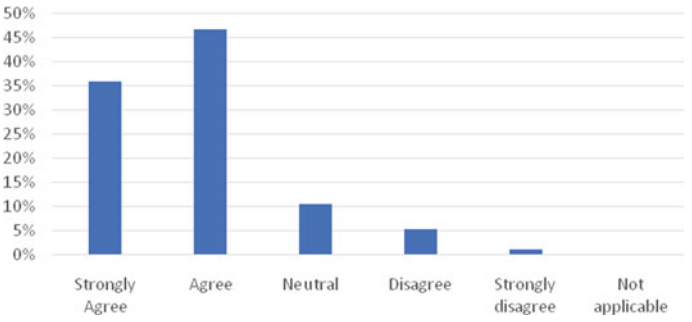

Fig. 3 I feel satisfied with the infrastructure and technical support available

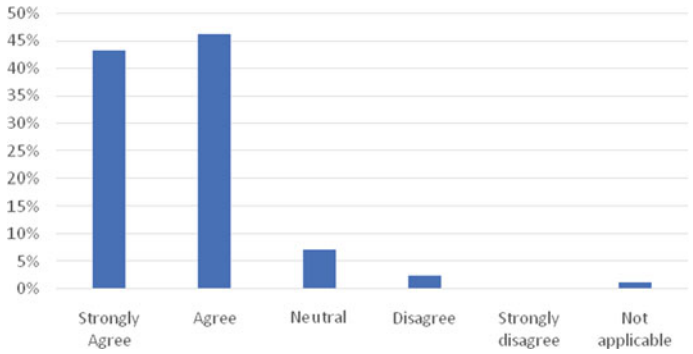

Fig. 4 There is an effective LMS

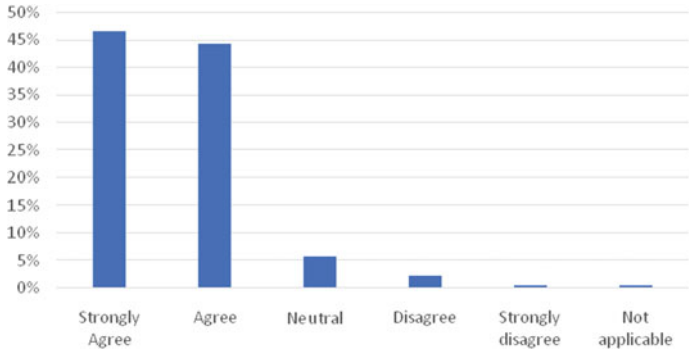

Fig. 5 There is an effective synchronous learning system

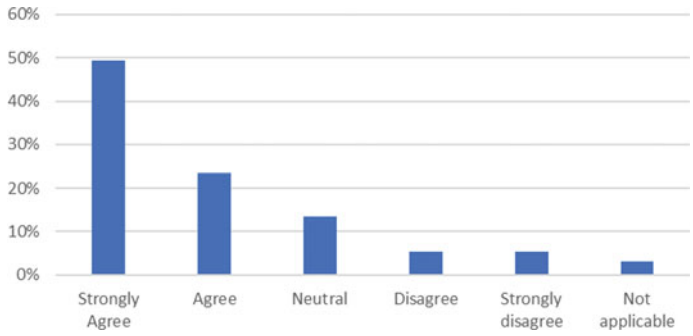

Fig. 6 There is an effective LMS for exams and teaching

sudden shift to online teaching and gave instructors and students more confidence concerning the implementation of this kind of teaching.

With regards to technical support, the instructors and students were satisfied with the technical support team for the help they provided. While 90% of the instructors were of the viewpoint that the support team responded to their queries and provided them with the necessary help when needed, 70% of the students were satisfied with the support team since they provided them with help by answering their questions (Figs. 7 and 8, respectively). The technical facilities and support provided might explain why 65% of the students stated that they are generally satisfied with the online teaching/learning experience.

The students' positive attitude towards online teaching and learning might also be attributed to the availability of the necessary technological facilities. Research carried out on this teaching methodology reveals that one of the challenges that face students is technological accessibility and issues of internet connectivity [8]. Students at UOP did not encounter this challenge, which was experienced by students enrolled at public universities who come from remote and disadvantaged areas in the country [4].

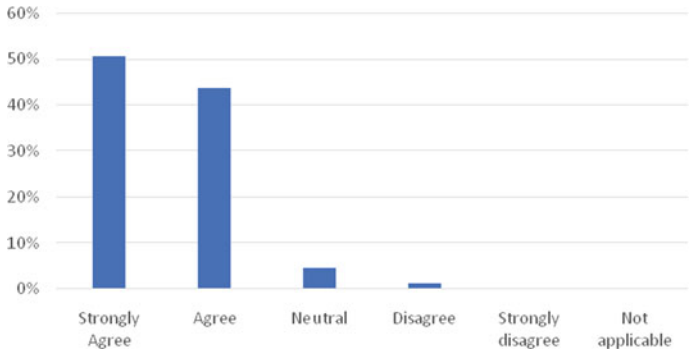

Fig. 7 I am satisfied with the support team offering help

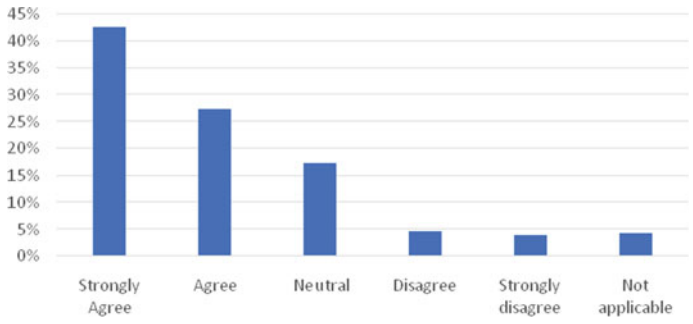

Fig. 8 I am satisfied with the support team answering questions and providing help

The sudden shift to online learning revealed that instructors and students alike were unprepared for this instructional method. Research carried out on the preparedness of the providers and receivers of knowledge via online teaching/learning show that these two parties needed training on a number of levels: the use of IT technology; the preparation of adequate course content; and devising appropriate assessment methods [7].

The analysis of the responses related to training revealed that 90% of the instructors stated that they are familiar with the terminology associated with online learning, and 95% were of the view point that they have the basic skills needed to use synchronous and asynchronous platforms (Figs. 9 and 10). However, 70% indicated that they needed additional training in the following areas: (1) video recording; (2) management of e-learning content; and (3) modern online teaching strategies and methodologies (Figs. 11, 12, 13). These answers show that the preliminary training provided succeeded in acquainting the instructors with the basics of e-learning and that more specialized training was needed to enable instructors to conduct classes effectively and efficiently.

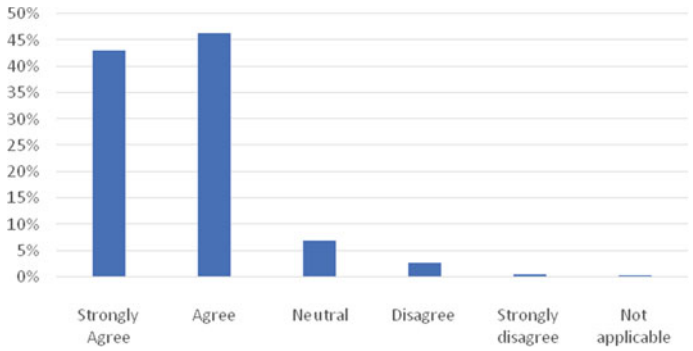

Fig. 9 I am aware of definitions related to synchronous and asynchronous learning

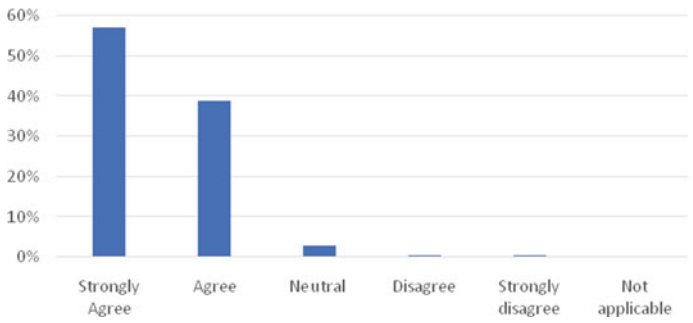

Fig. 10 I have basic skills in using synchronous and asynchronous platforms

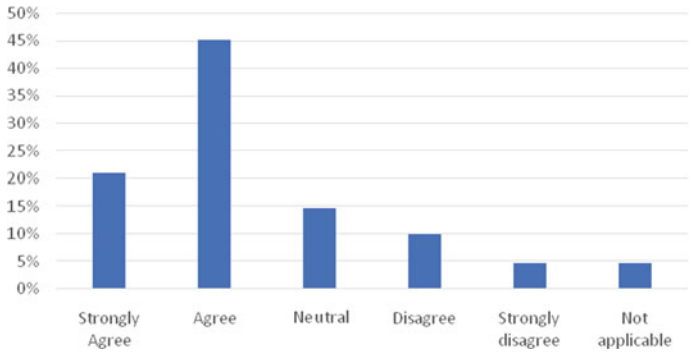

Fig. 11 I need training about recording e-learning videos

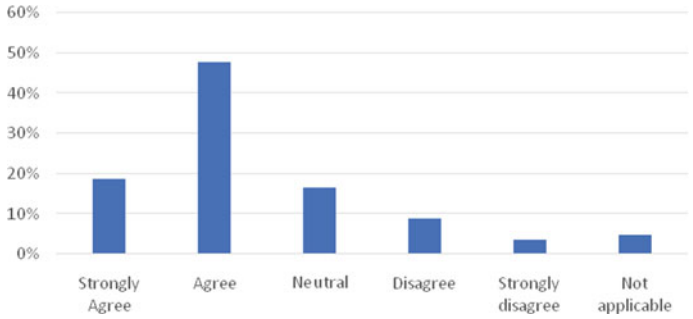

Fig. 12 I need training about development and management of e-content

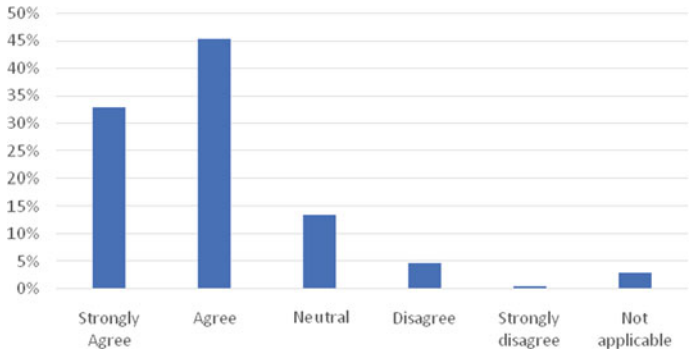

Fig. 13 I need training about modern teaching strategies

The feedback received from the members of staff regarding their training needs dictated the implementation of more advanced and diversified training sessions. These sessions covered the following topics: pedagogical design of e-courses; e-learning methodologies; interactive e-content (H5P); interaction tools in LMS (Discussion Forum & Choice); video recording using PowerPoint; and calculating course outcomes from e-exams. Teaching methodologies and course design were given due attention because research shows that these two components can play a significant role in the success or failure of online courses [19].

One of the challenges encountered when emergency online learning was implemented was training students to use the LMS. The students' answers regarding training showed that the technical support team succeeded in equipping them with the skills needed during online learning. 87% of the students chose "Strongly Agree" and "Agree" regarding their ability to use synchronous and asynchronous LMS platforms, and 91% commented that they knew how to use e-exam platforms. Also, 87% stated that they were cognizant of means used in submitting assignments as well as the discussion forms available on LMS (Figs. 14, 15). These responses indicate

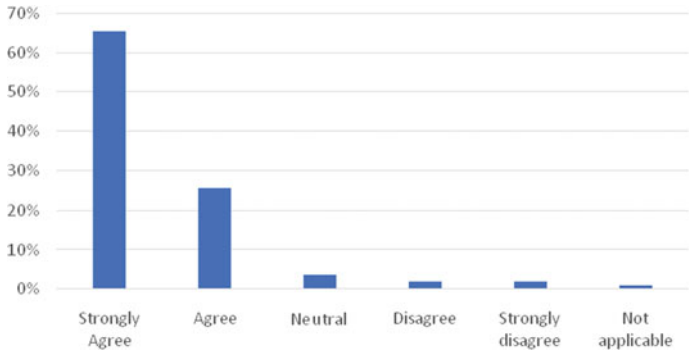

Fig. 14 I have knowledge about using e-exam platforms

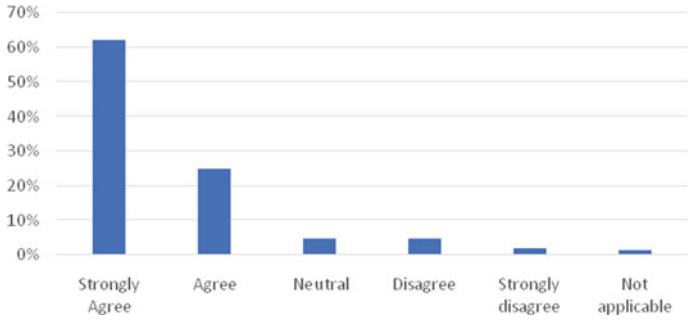

Fig. 15 I know how to submit assignments and use disscussion forms on LMS

that the training provided by the support team has fulfilled its objectives, and hence justify why the students commended the team.

Another challenge that research on online teaching and learning investigates is instructor-student interaction. Some researchers believe that the "human touch" noted in traditional face-to-face teaching is missing during virtual classes. This lack of interaction can create a barrier between the two parties involved in the teaching/learning process and can hamper the assimilation of information. As far as the instructors at UOP are concerned, some are of the viewpoint that students interact during virtual classes (40%), while others disagree (39%) (Fig. 16). Although students' interaction was a challenge during synchronous classes, it is believed that the training provided to the members of staff during the online teaching/learning experience introduced them to the e-tools that can help increase student interaction.

The students' feedback regarding interaction during virtual classes is slightly different in comparison with that provided by the members of staff. In fact, 75% of the students think that they interacted during virtual classes, whereas only 8% think otherwise. These responses may be attributed to the fact that students are unaware of what effective interaction entails (Fig. 17).

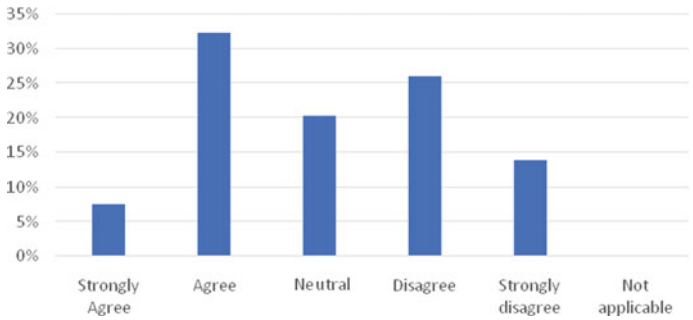

Fig. 16 Students interacted with teaching methods used during e-learning

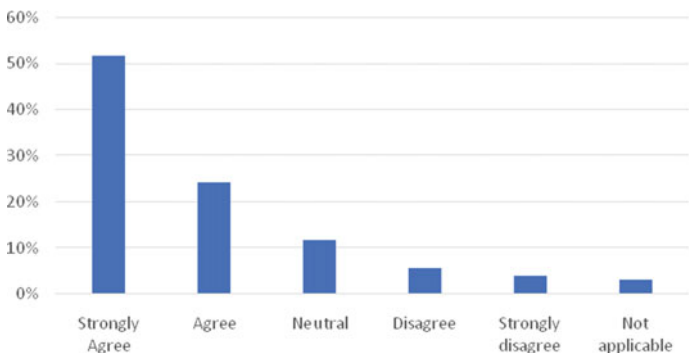

Fig. 17 I interact during the virtual lectures

The questionnaires also investigated the instructors' and students' perceptions regarding the assessment methods employed during the online teaching experience. The analysis of the instructors' responses indicates that the members of staff were not satisfied with the assessment strategies adopted during online teaching, as 40% of the instructors stated that they "Strongly Disagree" and "Disagree" with the proposition: "The assessment methods reflect the students' performance". Instructors also indicated that the assessment methods used lack integrity and credibility, for 55% chose "Strongly Agree" and "Agree" as a response to the statement: "The used assessment methods suffer from lack of integrity" (Figs. 18 and 19). These responses are in agreement with the studies that examine the methods of assessment adopted during the emergency online experience, which revealed that many staff members shifted to online teaching "without any competencies and experience in conducting online assessments" [27].

When discussing exams as an assessment method, only 59% of the staff members were of the viewpoint that it is important to reduce the percentage of marks on exams in e-learning in order to use a diversity of assessment tools. This is a relatively low percentage and indicates that the culture of adopting traditional exams in student assessment is still dominant which, in turn, entails that staff members have

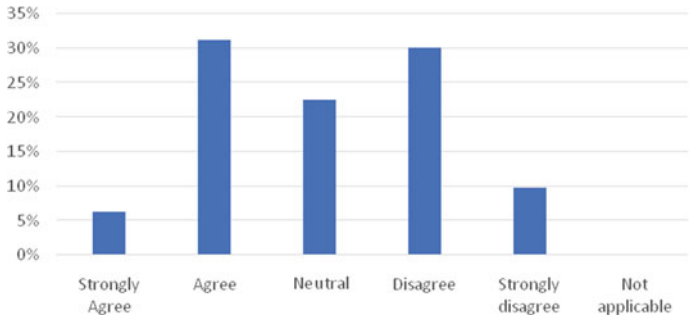

Fig. 18 I think the assesment methds used reflect students' performance

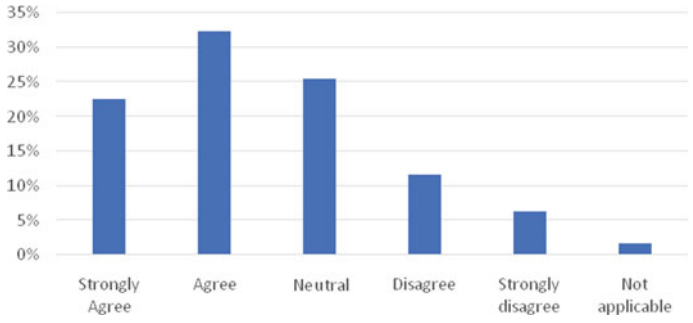

Fig. 19 The used assessment methods suffer from lack of integrity

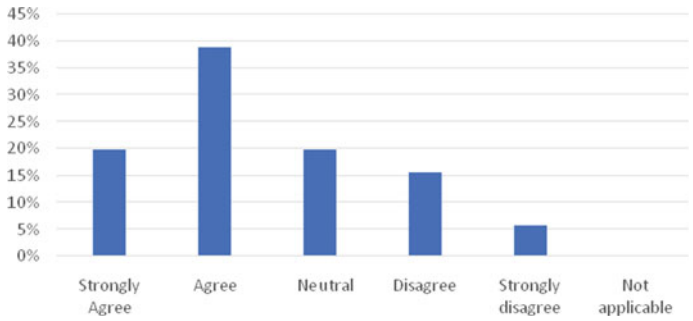

Fig. 20 I agree that it is important to reduce the percentage of marks on exams in e-learning

to be acquainted with modern assessment methodologies that are more effective in assessing and evaluating students' progress and performance in online teaching (Fig. 20).

The students' perceptions with regards to the assessment methods utilized by the members of staff to assess their performance varied. While 59% of the students expressed their satisfaction with the assessment methodologies adopted, and said that they reflected the students' performance, 46% chose "Strongly Agree" and "Agree" to the statement: "The assessment methods used lack integrity" (Figs. 21 and 22, respectively). This viewpoint is in line with the instructors' feedback, which is clear indication that the assessment methods used during online teaching need to be reconsidered and given due attention to secure credibility and integrity. Lack of previous experience in improvising assessment methods to suit e-learning environments can explain the dissatisfaction on the instructors' and students' part in this regard.

The instructors' questionnaire also investigated the instructors' knowledge of the rules and regulations pertaining to online learning. The responses showed that not all of the instructors are cognizant of the regulations administered. For example, only 44% of the instructors chose "Strongly Agree" and "Agree" for the statement: "There are regulations that govern cheating on online learning" (Fig. 23). This is a

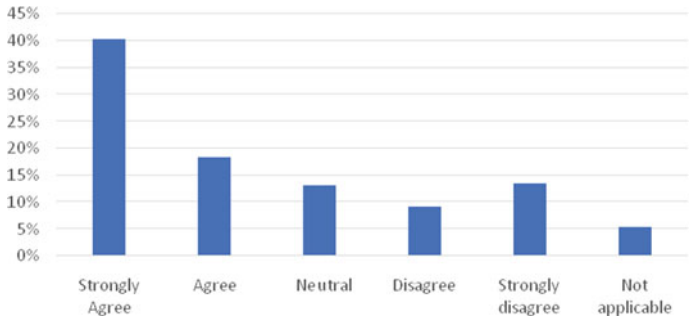

Fig. 21 The assessment methods used reflected the students' performance

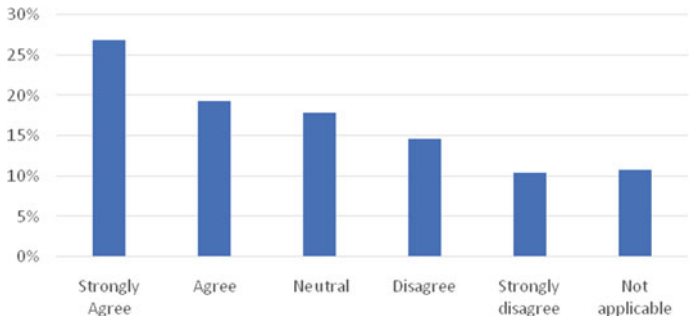

Fig. 22 The used assessment methods suffer from lack of integrity

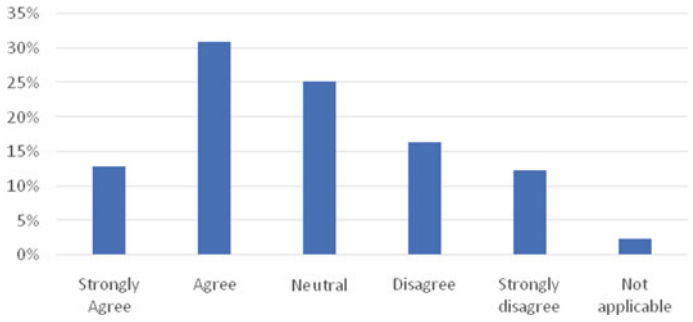

Fig. 23 There are regulations governing cheating in e-learning

low percentage, which indicates that more attention should be given by the university administration to the dissimenation of these rules. In fact, based on this feedback, training workshops that orient the instructors with the rules, regulations, and procedures of e-learning were administered post the COVID-19 pandemic period.

As for rules and regulations pertaining to the use of cameras during online learning, 65% staff members believe that the Ministry of Higher Education and Scientific Research should enforce the opening of cameras during teaching and exams to secure student attendance and interaction, as well as online exam integrity. There was agreement among staff members (81%) that the Pass/Fail option given to students should become null and void so that students take education more seriously (Figs. 24 and 25).

When asked about the future plans with regards to online learning, 74% staff members expressed that they are aware of the new teaching approaches that are to be implemented as a result of the online experience as well as their role in this transformation. Also, 90% expressed their readiness to modify the study plans to accommodate for blended learning. These responses consolidate those provided by staff members regarding their satisfaction with the online teaching experience, as 57% chose "Strongly Agree" and "Agree" for the statement: "I feel satisfied in general with the e-learning experience." (Figs. 26, 27 and 28, respectively).

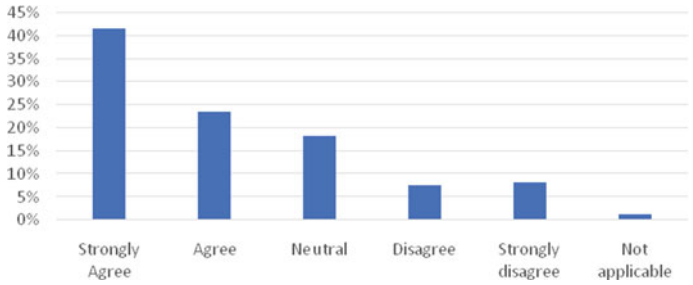

Fig. 24 MOHE should enforce opening cameras during lectures and exams in order to make students more responsible

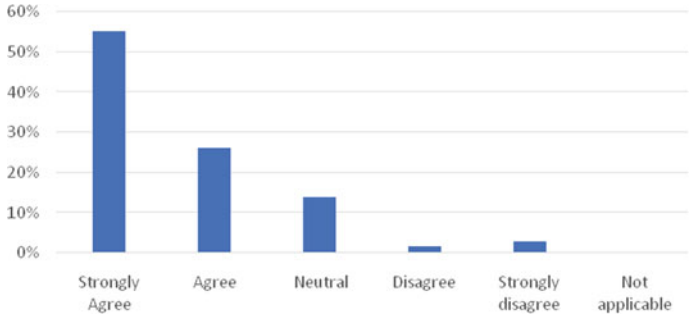

Fig. 25 The regulation of changing grades into P/F should be removed

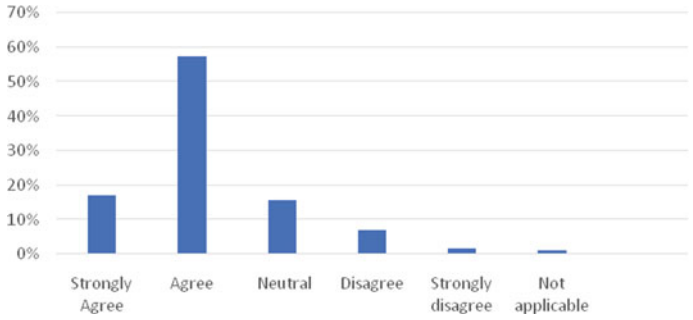

Fig. 26 I am aware of the new procedures and forms for e-learning

The feedback received from the two parties directly involved in the e-learning teaching and learning process indicate that their e-learning experience was a satisfactory one, which shows that the measures adopted by UOP during the COVID-19 pandemic have borne fruit. The instructors' and students' perceptions have been used to help in the planning for the post COVID-19 period to enhance the strengths and overcome the weaknesses related to the implementation of e-learning.

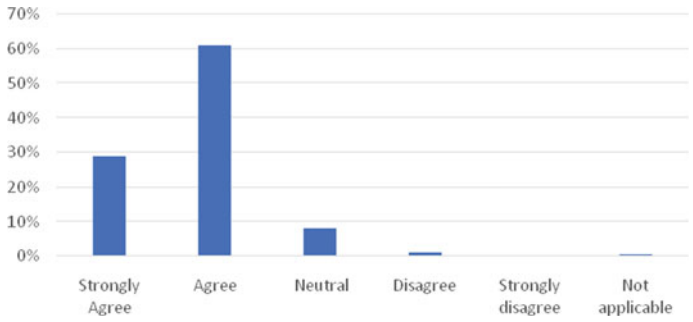

Fig. 27 I am prepared to work on implementing the blende courses

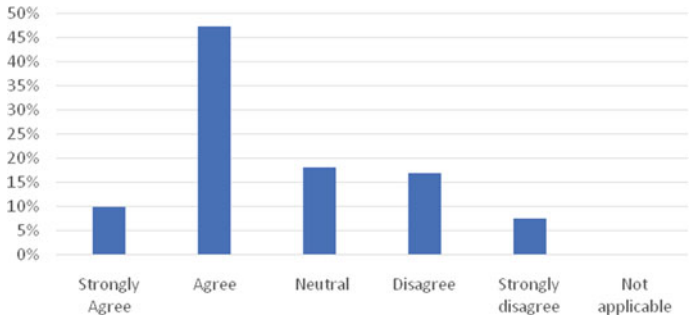

Fig. 28 I feel satisfied in general with the e-learning experience

4.3 The Post COVID-19 Period

The educational scene witnessed drastic changes after adopting e-learning at institutions of higher education in Jordan. As of the academic year 2021/2022, the lockdown imposed by the government was lifted, and students were allowed to resume classes on campus. However, the instructional methods adopted prior to the COVID-19 pandemic had to be revised, and the traditional face-to-face approach was no longer the sole teaching method adopted at the University of Petra; rather, a combination of teaching modes is currently used, and students affiliated to different specializations attend face-to-face classes as well as classes conducted using online and blended learning. As can be noted in Table 1, e-learning courses now occupy between 7 and 17% of the total number of courses offered by the different specializations, whereas blended learning covers between 27 and 53% of the courses taught. Therefore, an equilibrium has been created between the in-person on-campus classes and virtual learning. This shift is clear indication that blended learning is becoming "the new frontier in higher education" which would not have been possible without the e-learning experience imposed by the lockdown during the COVID-19 pandemic.

Table 1 Number of e-learning and blended courses post COVID-19

Program name	E-learning courses (%)	Blended learning courses (%)
Software Engineering	10	38
Computer Science	12	36
Data Science and AI	10	43
Information Security	12	38
Architecture	13	36
Interior Design	10	29
Graphic Design	11	45
Animation & Multimedia	10	27
Accounting	11	45.5
Business administration	11	43
E-Business	7	43
Finance	11	41
Marketing	11	45.5
Management Information Systems	11	32
Arabic Language & Literature	13	40
Educational Sciences	7	35.5
Chemistry	11	49
English Language & Literature	11	42
English Translation	9	42
Mathematics	11	26.5
Modern Languages	9	38
Nutrition	11	30
Pharmacy	11	35
Civil Engineering	13	23
Radio & Television	17	53
Journalism and Digital Media	24	51
Law	8	45

Such a development in the teaching methods introduced meant that members of staff had to be given more training workshops to secure the successful delivery of information and knowledge to the students in a teaching environment that has become more student-centered. Training workshops post the COVID-19 period are currently tailored based on two criteria: (1) the instructors' feedback on the questionnaire; and (2) the needs of the new "era". These workshops are provided in collaboration between the Faculty of Information Technology, the E-Language Center and the Academic Development Center. The training completed so far has covered the following aspects: pedagogical design of e-courses; e-learning methodologies; designing interaction e-content; handling e-forms and surveys; interaction tools in

LMS; calculating course outcomes from e-exams; orientation of new e-learning rules and procedures; and establishing YouTube channels. It is clear that pedagogical issues as well as course content design have been given due attention because these e-learning components can play a pivotal role in the successful implementation of e-learning. More training workshops that meet the ever-changing developments associated with online learning are being considered to improve the instructors' online teaching skills.

To cater for the delivery of information needed by the different disciplines, UOP is currently considering means of overcoming the limitations of online learning, especially with courses that are of a practical nature. Special gadgets, such as drawing tablets and light boards have been provided. In addition, the Department of Chemistry, for instance, has recorded the laboratory experiments conducted in the department and has made these recordings public to the students so that they can refer to the experiments when the need arises.

The university is constantly working on upgrading its infrastructure to meet the demand on the e-learning platforms and e-tools, and is considering the formulation of quality assurance measures that have to be implemented to ensure the university's academic integrity.

5 Conclusion

The COVID-19 pandemic and the lockdown imposed on institutions of higher education in Jordan has, once and for all, changed the education scene in the country. Although the sudden shift to the e-learning teaching and learning mode meant that challenges had to be overcome to secure the continuity of education, UOP managed to effectively address this unprecedented educational experience by providing its staff members and students with the necessary infrastructure, technical support, and training. Indeed, these measures have played an instrumental role in facilitating the smooth transition from the traditional face-to-face teaching to the online teaching methodology.

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Effective Partnerships with Multinational Organizations—A Case Study from Sohar University

Hamdan Al Fazari

Abstract No one company has everything it takes to run a business successfully. It is always beneficial for companies to have effective partnerships and collaborations with multinational companies, if only to bring together the multiple skills and resources required to improve their business outcomes. Partnerships are important and, accordingly, Sohar University (SU) has realized that working in alliance, or in partnership, is the only way to build stronger and more equitable communities working for a common purpose. This was reflected in the SU Strategic Plan 2018/2023, as it includes a standalone strategic goal entitled "Connect and Collaborate". This is designed to build strategic alliances with national, regional, and international communities to support innovation in educational, social, cultural, and economic development. However, there is no doubt that the COVID-19 pandemic has considerably disturbed or, at the very least, slowed down most economic activities all over the world and that it has impacted every aspect of everyday life. It has also affected partnerships activities that higher education institutions are usually engaged in. A study conducted by the National Centre for Universities and Business (NCUB) has found that business-university collaboration has decreased by one third between 2018/19 and 2019/20, as the impact of COVID-19 started to be felt in university and business collaborations fell by a third in early days of the pandemic, 2021, [1]). Also, in the same year 2021, the same study showed that there was a decline in the number of interactions with small and medium enterprise (SME) and large businesses by 39% and 2%, respectively in university and business collaborations as well [1]). On the other hand, the COVID-19 pandemic has opened new areas of collaboration in the fields related to the development and production of vaccines, drugs, clinical testing kits, medication techniques and equipment, and other related areas of medical research and technology. Hence, COVID-19 has triggered some novel collaboration in research. Hundreds of SMEs and academic start-up companies have been established worldwide and have succeeded in delivering many innovative products to help cope with the health emergency resulting from the pandemic (Naujokaitytė in ScienceǀBusiness, 2021, [2]).

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Keywords Effective partnerships · Multinational companies · Alliance · COVID-19 · Business growth · Strategic challenges · Innovation in education

1 Introduction

The pandemic has affected Sohar University (SU) partnerships, especially international ones, and it has slowed down interactions with business in general. This has led SU to modify its approach to partnerships and most meetings have been done online instead of in-person. This, however, has had the unexpected benefit of reducing travel expenses. At the same time, having effective partnerships has allowed us to share good practices for online teaching and academic materials, and to increase the use of information technology.

There is no hard data on this point, but it must be obvious that many higher education institutions all over the world must have benefited advantageously from similar opportunities to strengthen their partnership links with industry, business, and their wider communities. For instance, the COVID-19 pandemic has brought to light the crucial importance of supply chains, as severe shortages of supplies were experienced in many areas during the early days of the pandemic. This has led to instances such as Universities like as Cranfield University, which has been engaged via research partnerships in developing solutions based on Unmanned Aerial Vehicles (UAVs) for the delivery of medical supplies [3]. The outcome from such projects could help to ensure better supply chains in the future [4]. The Science, Technology and Innovation 2021 report of the Organization for Economic Co-operation and Development (OECD) [5] has highlighted that:

- The effects of the pandemic reminded the world that there is an urgent need to make maximum movements towards sustainability;
- Such pandemics require addressing very complicated problems in the shortest possible time and the need to conduct transdisciplinary research. This in turn requires wide international multi-disciplinary collaboration. This has been well demonstrated during the research response to COVID-19;
- Successful collaboration activities among higher education institutions, industry, and the health sector accompanied with huge emergency funding allocated for COVID-19 research and development (R&D) were the key factors in reducing the risk the pandemic;
- Certain industrial sectors, such as the digital and pharmaceutical sectors, increased R&D investments. By contrast, other sectors such as aerospace, defense, and the automotive industry reduced their R&D spending due to reduced sales;
- More than 20,000 scientific papers on COVID-19 were published as a result of collaborations between researchers from different countries.

2 Determining Potential Strategic Partners

The basis of determining potential strategic partnerships both pre and post COVID-19 depends on:

- The nature of the business of the proposed partner(s) and its alignment with institution's mission, vision, and strategic goals;
- The specific purpose for both institutions and advantages of the partnership;
- Creating a win–win situation for both parties;
- Having no conflict of interest between the partners.

The reasons for entering into partnerships for higher education institutions, both pre and post COVID-19 could be as follows:

- Joint business (on determined activities)
- Academic and research activities
- Consultancy and training
- Knowledge transfer, innovation and in-country-value (ICV) projects
- Industrial collaboration.

3 The Approach to Effective Partnerships in Response to COVID-19

Despite the challenges imposed by the COVID-19 pandemic, the international community has made significant efforts to mobilize partnerships in order to accelerate the global response, through providing urgent health and socio-economic responses and supporting communities, as well as working towards a post pandemic recovery and ensuring we "build back better" as described in the World Social Report 2021, a flagship publication of the United Nations Department of Economic and Social Affairs (UN DESA) [6]. This study established that:

- A wide range of partnerships have been formed during the pandemic, most focusing on the immediate response to COVID-19.
- Partnerships have provided financial support and technical assistance; supported project implementation and delivery; facilitated research, data collection and analytics; and coordinated various response actions.
- The United Nations, civil society, and the private sector have played a key role in initiating partnerships.
- A shared sense of urgency, pre-existing networks, partnership experience, flexibility, and the use of digital technologies are key factors that have contributed to the speedy formation of partnerships.

It was noticed that while some partnerships have been discontinued due to the pandemic, new ones have been speedily established. A number of factors have contributed to the rapid formation of the new partnerships: (1) the emergency nature

of the crisis, (2) the use of technologies to overcome barriers imposed by the crisis, (3) the adoption of innovative practices in the partnerships, (4) building partnerships based on trust and existing networks, (5) the flexibility of partners in facing the uncertainties of the crisis [6].

4 The Impact of COVID-19 on Higher Education Around the World

According to the International Association of Universities Global Survey Report, on 1 April 2020, schools and higher education institutions were closed in 185 countries, affecting 1,542,412,000 learners, which constitute 89.4% of total enrolled learners [7]. SU, for example, suspended teaching in March 2019 and did not start again until September 2021. During the suspension period, teaching was carried out online. As far as partnerships were concerned, 64% of higher education institutions reported that COVID-19 had a variety of effects [7]. Half of them reported that COVID-19 weakened the partnerships, while only 18% reported that it strengthened them. However, for 31% of respondents, the COVID-19 pandemic created new opportunities with partner institutions. In addition, the survey reported that for almost all higher education institution, COVID-19 affected teaching and learning, with two-thirds of them reporting that classroom teaching was replaced by distance teaching and learning. The shift from face-to-face to distance teaching did not come without challenges, the main ones being access to technical infrastructure, the competences and pedagogies for distance learning, and the requirements of specific fields of study. The survey also stated that at the same time, the forced move to distance teaching and learning offered important opportunities for more flexible learning possibilities, for exploring blended or hybrid learning, and mixing synchronous with asynchronous learning.

5 Impact of COVID-19 on Teaching and Learning at Sohar University

SU has maintained the delivery of taught provision since the cessation of on-campus classes in March 2020. Directed remote learning allowed the university to the second semester the academic year 2019–2020, with 6255 students completing their courses. The university has built upon this experience to develop an approach to blended learning for the academic year 2020–2021, which met the needs of students and fulfilled the quality indicators as per the Omani Qualification Framework (OQF) for higher education. These indicators are set by the Ministry of Higher Education, Research and Innovation in terms of the number of delivered taught hours. A total of 6478 students had registered for the academic year, comprising 1336 new students and 5142 continuing students.

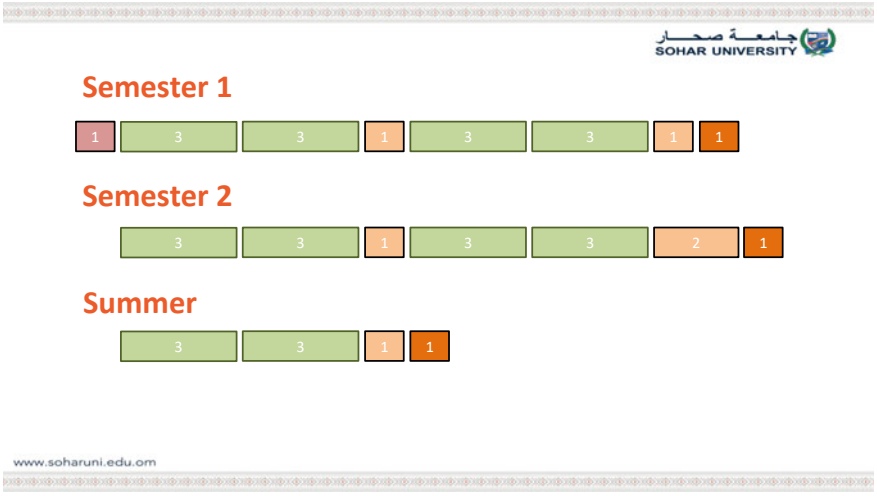

Fig. 1 Sohar University Academic Module Delivery Plan during COVID-19

The academic module delivery had to be adapted to a new mode during the COVID-19 and therefore, the university planned the academic year across three semesters, which are organized around the modular delivery of each course. Courses were broken down into four modules, each consisting of three weeks of study as indicated in Fig. 1, Students were provided with a course description, outlining the course objectives and learning outcomes. And at the beginning of each module, students were provided with a description outlining the materials to study and the schedule of all live sessions on the Microsoft Teams platform. The description also identifies the type of assessment to be conducted during or at the end of the module.

Each course is broken down into four modules, with each module consisting of three weeks of study.

All the resources students need were provided on the university Moodle-driven virtual learning environment (SULMS). Templates have been set up in folders for each module (1–4) to ensure a consistent format for courses and allow easy navigation for students. This has helped staff organize learning materials in an appropriate and consistent way. Students could navigate the resources needed to understand the module and carry out assessments, and on top of the two normal planned semesters, the university added a summer period of study to allow time for students to catch up and gain on-campus experience.

6 The Impact of COVID-19 on Sohar University Partnerships

There is no doubt that the COVID-19 pandemic inevitably affected SU partnerships and collaborations nationally, regionally, and internationally. It has to an extent disturbed or slowed down activities, and this effect has made all higher education institutions, including Omani ones, and SU in particular, adopt new ways and approaches for partnerships. Table 1 shows SU's partnerships and their status both before and after the pandemic.

Prior to COVID-19, the university was in discussion with many organizations for making effective partnerships, including the National Petroleum Investment Company of Oman, the Sohar Aluminum Company, the Petroleum Development Oman Company, public sector entities, and other industrial companies in both the Sultanate and abroad for implementing proposals on establishing a Technology Innovation Centre, a Plastic Technology Centre, an Enterprise Centre, and a Cultural and Heritage Research Unit. However, the pandemic has slowed down the discussions on these partnerships. Post-COVID there has been a certain amount of progress on some of these partnership projects and an incubation agreement for entrepreneurs has been signed with the Public Authority for Small and Medium Enterprise Development. Work has already started on this project. In addition, the Plastic Technology partnership with the industry is in its final stage of discussion and should commence soon. In summary, although COVID-19 slowed down some partnerships, the university has been able to recover lost ground post COVID-19.

7 Post COVID-19 Plans for Partnerships with Multinational Organizations

Based on the Oman 2040 Vision, national priorities have been identified in the knowledge-based industries, human capital development, private-sector-driven initiatives, socio-economic advancement, healthcare, direct foreign investment, youth employment, e-commerce and services, and streamlined bureaucracy.

Therefore, Oman identified some promising sectors for achieving economic diversification and SU has entered, or will enter, into partnerships in some of these sectors. Since the early years of its establishment, SU realized that the development of research with impact was one of the priorities for any higher education institution that wishes to develop its global brand and benefit the national economy. While the university focused on the development of quality undergraduate programs during its first 10 years, since 2009 the university's focus has widened to include research and knowledge transfer. The establishment of the Research and Industrial Collaboration Department at the University in 2009 has enabled the SU to attract international research funding linked with partnerships, and the first international research grant was received from the Qatar National Research Fund. In 2010, the

Table 1 The status of SU partnerships pre and post COVID-19

Partnership	During-COVID	Post-COVID
MoHERI-SU: Student scholarship • This partnership aims to prepare Omani students for the labor market • It aims to reach 800–1200 students a year • The funding is provided by the government	• The pandemic did not affect this partnership, as the MoHERI continued to sponsor students and the university was able to deliver the programs online	• This partnership will continue for the benefit of both parties
MoCIIP-SU: Advanced Manufacturing Research Center • SU has been working with the MoCIIP and AMRC at the University of Shefield in the UK to develop Intaj Suhar, which focuses on two main development areas, namely advanced manufacturing and manufacturing tools • This partnership is aimed at establishing state of the art facilities for advanced manufacturing research. These facilities will adopt and transfer innovative ideas into tangible prototypes and assess their performance • The facilities also will serve to provide the needed infrastructure to: – Develop the provision of technological skills and capability in advanced manufacturing – Build infrastructure capacity in product design and prototyping – Support the Omani private sector in diversifying business • The manufacturing sector was selected for the following reasons: – Globally, manufacturing is a principal contributor to the global GDP – The Availability of upstream industries in Oman such as steel making, smelting, and plastic production present valuable raw material resources for use in aluminum, and in downstream manufacturing industries. Most of the raw materials produced are being exported. So if the downstream manufacturing industry in Oman is developed further it will enable: (a) the production of higher value products to help in diversifying the economy, (b) the reduction in the dependence on intensive unskilled foreign labor, and (c) the creation of more suitable jobs for Omanis **Partnership with the University of Sheffield** • This partnership is in the academic area that includes training and the joint delivery of consultancy projects for industry • It consists of a food growing plant to localize advanced food technologies to support food security in Oman, funded by the British government as part one of the UK-GCC research grants	• COVID-19 slowed the progress of the two MoCIIP projects aligned with this partnership because: – The delivery of machines from international companies was affected due to lockdown and travel restrictions – There were delays in the arrival of staff from outside Oman due to visa restrictions and travel postponement – The interaction between SU and the University of Sheffield has almost ceased	• Excellent progress is being achieved • All machines and the specialist to carry out the commissioning of the machines have arrived • The project is fully operational • There are plans to revisit this partnership in order to strengthen it and cover more areas of specialization, not only advance manufacturing and food technology

(continued)

Table 1 (continued)

Partnership	During-COVID	Post-COVID
Grace-SU: Materials Characterization and Evaluation Labs • WR Grace is one of the main suppliers of oil refinery catalysts to Oman, the GCC, and MENA petrochemical industries • This partnership aims to: – Provide access to WR Grace's state of the art testing equipment to students at SU in order to gain advanced industrial knowledge and practice – Create jobs for Omanis and enhance their skills – This partnership is part of a National In-Country value program and represents a Foreign Direct Investment (FDI)	• As this is an international company, site visits were frozen and therefore business was done mainly online • Researchers and students work in the lab was suspended • The local staff were able to keep the lab running to a certain extent, but it was not fully operational • There was a reduction in the number of orders received in the lab and therefore, a reduction in the revenue	• Site visits by international company staff and experts to the lab were resumed • Researchers and students re-commenced work in the lab • The number of orders received in the lab increased and therefore has led to an increase in the income
CIE-SU: Students Scholarship and Training • This partnership is aimed at teaching Arabic to Chinese students and to follow English programs at Sohar University	• Students were not allowed to travel from China and therefore, no students arrived in Oman	• It is planned to have Chinese students starting September 2022 • It is also planned that the partnership will include the establishment of a Confucius Centre

Sohar University (SU); Ministry of Higher Education, Research, and Innovation (MoHERI); Ministry of Commerce, Industry and Investment Promotion (MoCIIP); Advanced Manufacturing Research Centre (AMRC); Chinese Institute for Education (CIE).

Research Council of Oman established the first research funding scheme for Omani higher education institutions, and SU won five research grants from the first cycle. These grants paved the way for the development of the SU research infrastructure. Over the years the university succeeded in winning more than USD 19 million in "Research and Knowledge Transfer" grants.

The SU approach to developing its research and knowledge transfer profile and enhancing its brand globally requires a sound system that is based on effective partnerships and on four pillars. These pillars are [8]:

- Academia: SU staff and infrastructure are the heart of the concept.
- Private sector (industry): The private sector is a main player in developing research with impact and in benefitting from its output.
- Government: Government authorities have a major role in driving the direction of research and knowledge transfer towards national priorities.
- International institutions: Collaboration with international higher education institutions, knowledge transfer centers, and global industries will definitely enhance the research and knowledge transfer output.

To align SU's research and knowledge transfer direction with the national priorities in Oman, the university has to focus on obtaining effective partnerships that can be concentrated on four carefully selected research themes (Fig. 2):

Fig. 2 Sohar University research themes mapped onto national research priorities

- Emerging and advanced technologies
- Enterprise and industry
- Environment
- Connecting communities.

It is worth noting that SU partnerships are based on the following:

- The SU strategic plan
- The Oman 2040 vision and national priorities
- The strategic plan of the Ministry of Higher Education, Research, and Innovation
- The location of SU
- International collaboration

The SU research and knowledge transfer approach has attracted partnerships as well as both domestic and direct foreign investment to support its research infrastructure and its global presence. This attraction of partnerships was due to SU's strategic location and the Sultanate of Oman's secure and peaceful profile. The partnerships are aligned with the University's imperative strategic plan and the Sultanate's national priorities.

8 Conclusion

Despite the challenges imposed by the COVID-19 pandemic, the international community has made significant efforts to mobilize partnerships to accelerate the global response—by providing urgent health and socio-economic responses and supporting communities to live with the pandemic, as well as working towards a post pandemic recovery and ensuring that we "build back better". In addition, there is no doubt that the COVID-19 pandemic has, to an extent, affected higher education institutions in general, and SU in particular, especially with regard to its partnerships and alliances in Oman and abroad. Activities in many aspects have slowed down, and in some cases ineffective institutions have been unable to do business. The post COVID-19 scenario has led institutions, including SU, to adopt new approaches for effective partnerships. On the other hand, it has been noticed that in some cases, partnerships have shared data during the pandemic and they have been able to do business effectively based on utilizing the strength available with each other.

In addition, the effective partnerships have had a noticeable impact, with the results demonstrating the validity of a partnership approach that is focused on strategically important challenges. Effective partnerships have enhanced the stature, the academic profile, and the image and reputation of both parties. During the pandemic, some partnerships have also supported the intuitions in their academic delivery and in obtaining professional recognition and accreditation from accredited professional organizations. Effective partnerships either pre or post COVID-19 have contributed

to business growth and they have demonstrated the importance of working in partnership across sectors. In addition, these partnerships have increased the local value-added, and they have attracted local and foreign investment, supported innovation and creativity, created jobs for the higher education institutions and Omanis in particular, and enhanced teaching and R&D capabilities.

As part of its strategic direction post-COVID-19, SU is planning to enter into a number of potential partnerships in teaching, R&D, knowledge transfer, training and consultancy, and in its endeavor to build a knowledge nation and a global presence.

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Higher Education in Syria Post-war and Pandemic: Challenges and Opportunities

Wael Mualla and Karim Jamil Mualla

Abstract The ten-year-old war in Syria has had a profound impact on all national sectors, including higher education. The damages inflicted on the sector were huge and enormous, ranging from losses of higher education infrastructure to higher education expertise; drop in teaching quality and disruption of the academic year; in addition to limited higher education funding, as funds were diverted to support other urgent priorities. In early 2020, as the Syrian higher education system was slowly recovering from the war, it was confronted with another major challenge, namely the COVID-19 Pandemic. The COVID-19 pandemic has caused the largest disruption of education in history worldwide, impacting learning and teaching in institutions, ranging from primary to secondary schools, technical and vocational training institutes, and universities. In March 2020, to prevent the spread of the pandemic, the Higher Education Council (HEC) in Syria ordered a lockdown of all higher education institutions for a period that lasted more than two months. This caused a major disruption to the academic year and to the teaching and learning process across the board. HEC also encouraged higher education institutions to continue with online teaching during the lockdown to maintain students' engagement. Many higher education institutions in Syria, especially large public universities, were unprepared to implement the HEC decree regarding online education. Many teaching staff did not have the proper training in these new methods of education delivery. Furthermore, from the students' perspective, the absence of necessary equipment, limited internet access, and the lack of support for students to follow online programs have all proved to be a formidable and unsurmountable obstacle. This eventually led the Ministry of Higher Education, to abandon its decree and ask all higher education institutions to go back to face-to-face teaching and compensate for the lost courses once the lockdown was lifted. In this chapter, the status of the Syrian higher education system prior to the COVID-19 pandemic is highlighted, including the enormous challenges it was facing in the post-war era. The additional challenges caused by COVID-19 pandemic are

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also described as well as the measures taken by the Syrian Higher Education Council to mitigate and overcome these challenges. Case studies on how higher education institutions in Syria tried to cope with the pandemic are presented as well as a case study from a prominent UK university. A new vision and options on how to prepare the higher education system in Syria in the future to address such challenges is also presented and discussed.

Keywords Syria · War · COVID-19 · Higher education · Recovery

1 Introduction

Syria has been experiencing a severe war since 2011, which has affected all economic and social sectors in the country, including the higher education sector. The damages inflicted on the sector were huge and enormous, ranging from losses of higher education infrastructure to higher education expertise; drop in teaching quality, disruption of the academic year; and limited higher education funding, as funds were diverted to support other urgent priorities.

In early 2020, as the Syrian higher education system was slowly recovering from the war, it was confronted with another major challenge that needed to be coped with, namely the COVID-19 pandemic. The pandemic has caused the largest disruption of education in history worldwide, impacting learning and teaching in institutions ranging from primary to secondary schools, technical and vocational training institutes, and universities.

To prevent the spread of the pandemic, the Higher Education Council (HEC) in Syria, which is the highest policy-making body in the country, ordered a lockdown of all higher education institutions for a period that lasted over two months. The decision to temporarily close higher education institutions was taken because it was considered that large gatherings of students constituted a serious risk to public health during the pandemic. HEC also encouraged higher education institutions to continue with online teaching during the lockdown to maintain students' engagement.

The response of Syrian higher education institutions to the HEC decree regarding online education varied considerably according to the size of the institution and its E-readiness. Public universities with huge number of students (such as Damascus University) had considerable difficulties in implementing this decree, whereas higher institutes and private universities that had relatively small number of students (few thousands) managed to implement some online courses.

In this chapter, the status of the Syrian higher education system prior to the COVID-19 pandemic is highlighted including the enormous challenges it was facing in the post-war era. The additional challenges caused by the COVID-19 pandemic are also described as well as the measures taken by the Syrian Higher Education Council to mitigate these challenges. A new vision that includes options for preparing the higher education system in Syria to address such challenges in the future is also presented and discussed.

Table 1 Public universities in Syria

No.	University	Governorate	Date of establishment	No. of students in 2020
1.	Damascus University	Damascus	1923	172,698
2.	University of Aleppo	Aleppo	1958	77,234
3.	Tishreen University	Latakia	1971	72,836
4.	Al-Baath University	Homs	1979	84,959
5.	Al-Furat University	Deir Al-Zour	2006	35,552
6.	University of Hama	Hama	2014	17,063
7.	Tartous University	Tartous	2015	19,276
8.	Syrian Virtual University	Damascus	2002	31,781

Source Ministry of Higher Education, Syria

2 The Higher Education Sector in Syria Pre-pandemic

The higher education sector in Syria consists of public universities, public higher institutes, private universities, and technical and vocational training institutes.

2.1 Public Universities

Eight public universities exist in Syria (Table 1). They are all regulated by the University Regulation Law and its executive text, except the Syrian Virtual University (SVU) [1, 2]. The SVU was established in 2002 by special law and offers distance learning courses [3]. It provides two-year and four-year undergraduate programs as well as a number of postgraduate programs. All other public universities offer undergraduate and postgraduate programs [2, 3].

2.2 Higher Institutes

Several types of higher institutes exist in the Syrian higher education sector (Table 2). There are higher institutes that belong to the Ministry of Higher Education [4], such as the Higher Institute of Business Administration (HIBA), and higher institutes

Table 2 Public higher education institutes in Syria

No.	Higher education institute	Ministry	Date established	No. of students in 2020
1.	Higher Institute of Business Administration	Ministry of Higher Education	2001	1800
2.	National Institute of Administration	Ministry of Higher Education	2002	254
3.	Higher Institute for Applied Sciences and Technology	Syrian National Centre for Scientific Research	1983	329
4.	Higher Institute for Population Studies and Research	Ministry of Higher Education	2003	680
5.	Higher Institute for Water Resources Management	Ministry of Higher Education	2007	–
6.	Higher Institute of Drama	Ministry of Culture	1977	237
7.	Higher Institute of Music (Conservatoire)	Ministry of Culture	1990	149

Source Ministry of Higher Education and Ministry of Culture, Syria

that belong to other ministries, such as the Higher Institute of Music (Conservatoire) which is associated with the Ministry of Culture. These institutes have their own special laws and are not regulated by the University Regulation Law. A third type of higher institutes exists and include institutes that are established within public universities, and which are regulated by the University Regulation Law. These institutes have the same status as colleges; however, they offer programs only on the postgraduate level. Examples of some of the institutes that belong to Damascus University are the Higher Institute of Earthquake Studies and Research, the Higher Institute for Laser Research and its Applications, the Higher Institute for Administrative Development, the Higher Institute of Translation and Instant Interpretation, the Higher Institute of Languages, and the Higher Institute of Regional Planning [5].

2.3 Private Universities

In 2001, Legislative Decree No.36 was issued which allowed for the licensing of private higher education providers for the first time in Syrian history [1, 2]. The first private university to be established was the University of Kalamoon in 2003. The number of private universities then increased gradually until it reached 22 in 2021 [4] (Table 3). These private higher education providers are only permitted to offer bachelor's degrees and cannot offer postgraduate programs of any type [2].

Table 3 Private universities in Syria

No.	University	Governorate	Date of opening	No. of students in 2020
1.	University of Kalamoon	Damascus Countryside	2003	3763
2.	University of Cordoba	Aleppo and Hassakeh	2003	2217
3.	Ittihad Private University	Raqqa (temporarily in Allepo)	2003	1761
4.	Arab University for Science and Technology	Darra	2005	5867
5.	International University for Science and Technology	Daraa	2005	4306
6.	Syrian Private University	Damascus Countryside	2005	4420
7.	Wadi International University	Tartous	2005	2461
8.	Al-Andalus University	Tartous	2007	3444
9.	Al-Jazeera Private University	Deir Al-Zour (temporarily in Daraa)	2008	1347
10.	Al-Hawash Private University	Homs	2008	4614
11.	Ebla Private University	Idleb (temporarily in Allepo)	2009	1070
12.	Al-Shahbaa University	Aleppo	2009	967
13.	Yarmouk Private University	Daraa	2009	1578
14.	Arab University for Science and Technology	Hama	2008	1824
15.	Al-Wataniya Private University	Hama	2010	2629
16.	Bilad Al-Sham University for Sharia Sciences	Damascus	2011	1221
17.	Al-Rasheed Private University for Science and Technology	Daraa	2012	2705
18.	Qasyoun Private University	Daraa	2012	1766
19.	Al-Sham Private University	Damascus Countryside	2013	4940

(continued)

Table 3 (continued)

No.	University	Governorate	Date of opening	No. of students in 2020
20.	Al-Manara University	Latakia	2016	1169
21.	Antioch Syrian Private University	Damascus Countryside	2018	421
22.	College of Theology	Damascus	2021	

Source Ministry of Higher Education, Syria

Two additional higher education institutions exist in the higher education sector in Syria, namely the Arab Academy for Science, Technology and Maritime Transport [6] and the Arab Academy for E-Business [7]. Both institutions were established by special laws and are affiliated with the Arab League.

2.4 Technical and Vocational Training Institutes

Two types of technical and vocational training institutes exist: technical institutes that belong to the Ministry of Higher Education (57 institutes) and technical institutes that belong to other ministries (141 institutes) [4]. They are regulated by the Supreme Council for Technical Education and offer vocational training degrees in applied and vocational subjects, and aim to prepare students for the labor market.

3 The Higher Education Council

The Higher Education Council (HEC) is the highest policy-making body for higher education in Syria. It is headed by the minister of higher education and includes representatives from public universities (presidents and vice-presidents), private universities, student unions, the instructors syndicate, the Center for Scientific Studies and Research, the Atomic Energy Commission, the General Authority for Remote Sensing, the General Commission for Scientific Agricultural Research, the General Authority for Biotechnology, the National Center for Energy Research, representatives from the State Planning Commission, and two vice-ministers nominated by the Prime Minister.

4 Major Reform Efforts in Higher Education Post 2000

To have a better understanding of the impact of the war on the higher education sector in Syria, it is essential to review and understand the status of this sector in the pre-crisis era (i.e., in the period post 2000 and before 2011). The higher education sector in Syria has been subjected to major reforms in the post 2000 era. In 2001, Legislative Decree No.36 was issued which allowed for the licensing of private higher education providers for the first time in Syrian history [1, 2].

In 2005, the four public universities that existed in Syria at that time (namely Damascus University, Aleppo University, Tishreen University, and Al-Baath University) were asked to expand horizontally by opening branch campuses in other governorates. Some of these branch campuses have become at a later stage independent universities: for instance, the Deir Al-Zoor branch campus of Aleppo university became the Euphrates University; the Tartous branch campus of Tishreen University (Latakia) became Tartous University; and the Hama branch campus of Al-Baath University became Hama University [1].

In 2006, a new University Regulation Law enhanced university autonomy, increased decentralization, and financial reforms [1]. And in 2009, Legislative Decree No 1, which regulates joint programs with foreign higher education institutions paved the way for public universities to establish joint programs at the postgraduate level with prestigious foreign higher education institutions in areas that are in line with labor-market needs and national development plans [1].

5 Reform Impact

The reforms have resulted in many positive outcomes [1], such as:

- Successful partnerships with many foreign higher education institutions which led to the establishment of numerous joint programs with foreign partners in areas that have vital relevance to the labor market and the national development plans, the establishment of university centers for quality assurance and the implementation of quality-assurance programs, the establishment of university career centers to support student transition into the labor market, very active student-exchange programs as hundreds of foreign students were hosted to study customized courses in Arabic language and culture at Damascus University.
- Capacity building of numerous teaching staff from Syrian universities at European universities, which was facilitated through agreements signed with European partners.
- A huge expansion in infrastructure in main campuses and the opening of new branch campuses in other governorates. As mentioned earlier, some of these branch campuses became independent universities at a later stage, such as Euphrates University, Hama University, and Tartous University.

- The introduction of new modes of study and admission at public universities, such as the Open Education System, which consists of distant-education programs, and the Parallel Admission Process. Through this process 25% of students are offered "Parallel" educational opportunities in public universities on fee paying basis.
- Financial reforms: Public universities, for the first time, had their own internal financial resources collected from fees in the Open Education Programs and the Parallel Admission Process. Internal resources have been used to enhance salaries of academic staff; to improve research facilities; to encourage staff to engage in research through incentive schemes; to support the teaching and learning process in the newly established branch campuses by encouraging academic staff to teach in these institutions through incentive.

6 Impact of the War on the Higher Education Sector

The ten-year old war in Syria has had a profound impact on all national sectors, including the higher education sector [1, 8]. Although there is no official assessment to date on the material and non-material damages inflicted on the sector, it is worth mentioning here a project conducted recently by UK NARIC and the UNESCO Beirut Office, which describes the impact of the war on Syrian higher education provision and the key challenges the country needs to address on the road to recovery [2]. The damages can be described as huge and mainly infrastructure in many regions of the country; loss of intellectual capital; drop in teaching quality caused by the loss of experienced qualified staff; limited higher education funding, as funds were diverted to support other urgent priorities; disruption of the academic year caused by low attendance of both staff and students [1, 8].

Moreover, one of the most noticeable impacts of the war on public universities, particularly Damascus University, was the stoppage of almost all international collaboration projects and activities including joint academic programs as a result of imposed sanctions and travel bans.

Although the Syrian higher education system has been severely affected by the protracted war, it has proved to be more resilient than many have expected. Numerous articles were written expecting the collapse of the system [9–11]; however, the system continued functioning in some parts of the country albeit at a reduced capacity [12, 13]. The fact that the higher education system is mainly a centralized system turned to its advantage as many important top-down decisions were taken at the central level by the HEC and implemented by universities, which proved to be effective in mitigating the impact of the crisis and maintaining the functionality of the system in major cities [1].

7 Impact of the Pandemic on the Higher Education System

The COVID-19 pandemic has caused the largest disruption of education in history worldwide, impacting higher education institutions, whether in terms of teaching and learning, access and student recruitment, student mobility, and impacting academic and non-academic staff, and university operations. The Syrian higher education system was not an exception. In fact, the impact of the pandemic was more severe in the Syrian case as the country was slowly emerging from a prolonged war.

7.1 Teaching and Learning

From a student perspective, the most immediate impact has been the temporary cessation of face-to-face teaching. In an attempt to prevent the spread of the disease, the HEC in Syria ordered a lockdown of all higher education institutions for a period that lasted more than two months [4]. This has caused a major disruption to the academic year and to the teaching and learning process. The HEC also encouraged higher education institutions to continue with internet-based teaching during the lockdown to maintain students' engagement [4].

The response of Syrian higher education institutions to the HEC decree regarding online education varied considerably, according to the size of the institution and its e-readiness (examples are given later). Public universities with diversified programs and a huge number of students (such as Damascus University) had considerable difficulties in implementing this decree, whereas some higher institutes and private universities, that had relatively a small number of students managed to successfully implement some e-learning courses on their platforms.

However, low connectivity and poor infrastructure in many parts of the country as a result of the prolonged crisis, and the difficult access to internet and digital devices by many students, especially in rural areas, have proved to be a major obstacle to implementing viable distant e-learning programs by many higher education institutions. Many students from rural areas who have returned to their homes found themselves with worse connectivity conditions than they had in their urban residence near the higher education institutions where they study. This has led to pressures from students and from the Student Union to prevent the transition to online education, arguing that it does not have the same quality and that it did not assure equity.

Faced with these formidable challenges, the HEC eventually retracted its earlier decree, ordering all higher education institutions (public and private) to reintroduce all missing courses face-to-face once the lockdown is lifted even if they had already been delivered online [4].

7.2 Access and Student Recruitment

In public universities in Syria where fees are almost non-existent or can be described as very affordable, there was no impact (as expected) on students' recruitment in the academic year following the pandemic, nor on dropout rates in the year of the pandemic. The student admission process to public universities is carried out centrally by the Ministry of Higher Education and is based, almost entirely, on the students' scores in the national examination of the General Secondary Certificate (Baccalaureate). It usually results in large number of students being admitted to public universities [2].

By contrast, each private university runs its own admission process based on the guidelines set by the HEC. The process usually results in smaller number of students being admitted to each university in comparison to public universities. The maximum allowed number to be admitted to each program is determined depending on many factors, including student/staff ratio. As in the case of public universities, there was no significant impact on student recruitments in the academic year following the pandemic, nor on dropout rates in the year of the pandemic. However, during the lockdown and the attempt to move to online education, some students in private universities demanded that a large portion of their tuition fees be reimbursed. They considered that the disruption of the academic year and the interruption of the teaching and learning process made the cost of the regular annual fees not worth it. However, these demands faded following the withdrawal of the decree regarding online education.

7.3 Student Mobility

The spread of COVID-19 has affected the global travel of thousands of students. Travel restrictions to various locations have impeded the flow of international students, faculty, and university staff around the world [13]. This resulted in considerable revenue losses for many countries that depend on international students as an important source of income such as Australia [14]. However, in Syria, where the reception of international students has been very low since the start of the war in 2011, the economic losses from the global travel restrictions was marginal, by comparison. Nevertheless, some private universities reported a drop in the recruitment of Syrian students whose families are living and working in the Gulf region.

7.4 Academic Staff

Although the focus is always placed on the impacts on students, academic staff in Syrian higher education institutions also suffered significant impact. The most

evident impact on teaching staff was the expectation that they continue to teach using virtual modalities [14]. In Syrian higher education institutions, many staff members did not possess the ability or the experience to do so. Furthermore, the teaching of subjects which require the development of professional competences through practice (clinics, design, engineering, and all subjects that are heavily dependent on practical workshops or laboratory work) proved to be a source of greater uncertainty, as universities were not sure how to deal with the online delivery of these subjects.

In terms of job security, as the government is the employer in Syrian public universities, there was no impact on academic staff in terms of job losses or redundancies. Even private universities which depend largely on contracts by faculty working in public universities (whether faculty contracted part-time or seconded faculty) have not reported any drop in the number of contracts as student recruitments have not been affected by the pandemic and given the universities are obliged to maintain a certain student/staff ratio specified by the HEC to meet the accreditation requirements.

7.5 Non-teaching Staff

In Syrian public universities, as the employer is the government, the situation of non-teaching staff working in administration and services was not affected by the pandemic. However, in private universities the situation of non-teaching staff was considered risky, particularly for those whose main tasks were not considered critical to the continuity of teaching. For instance, personnel working in technical and computer support were considered critical to the institution, whereas personnel working in canteens, dining rooms or cleaning services were deemed non-critical and their numbers were reduced in some universities as a result of the closure.

8 Coping with the Pandemic

In the following paragraphs, some case studies of how Syrian higher education institutions (public and private) dealt with the COVID-19 pandemic and its repercussions on the higher education system. A case study of how a UK university (University of Leicester) dealt with the pandemic is also presented for comparison.

8.1 Public Universities

Public universities in Syria such as Damascus University, Aleppo University, and Tishreen University (Table 1), are huge multi-disciplinary universities that contain numerous colleges including Medical, Engineering, Basic and Social Sciences. They

are generally characterized by a large number of students and over-crowded classrooms, especially in the humanities. All public universities have their own platforms; however, they do not deliver any online programs.

As stated earlier, during the lockdown, and in response to the HEC decree, public universities encouraged academic staff to upload their courses on the university' platform and deliver them online. However, many teaching staff did not have the proper training in these new methods of education delivery. On the students' side, the absence of necessary equipment, internet access, and the support that would allow students to follow online programs have hindered many students from getting online. Some academic staff used generic applications, in the absence of a virtual campus, such as email, video calls and WhatsApp to communicate with students through their mobile phones and keep them engaged. However, these were isolated attempts and did not make significant impact.

8.2 Private Universities

Unlike public universities, private universities in Syria, such as the Arab University for Science and Technology (AUST), the International University for Science and Technology (IUST), the Syrian Private University (SPU), etc., Table 3, are relatively small universities that contain limited number of colleges and programs, mainly in Medical Sciences, Engineering Sciences and Business Administration. Programs in Basic Sciences, Social Sciences and Literature are uncommon because of low demand by students. Private universities are generally characterized by small classrooms with a small number of students (not exceeding 50 students per class). Most private universities have their own platforms and have installed a learning management system, however, they are not licensed to deliver any regular online programs.

During the lockdown, private universities were different in their response to the crisis imposed by the pandemic and the cessation of face-to-face teaching. The difference was mainly due to each university' E-readiness, its ability to provide continuous technical support for both staff and students, and academic staff competencies on the use of technology. For example, the SPU has prepared a special program for the synchronous or asynchronous implementation of remote lectures in order to compensate for educational losses during the suspension of face-to-face teaching [15]. Lectures were uploaded on the university's platform (Moodle-SPU) in multiple electronic formats, including text, audio, video, etc. The SPU benefitted from the support extended by the Syrian Virtual University on the transition to online education. The IUST followed the same course of action as the SPU by asking staff during the lockdown to upload their lectures (in PowerPoint format plus audio) on the university's platform. As in public universities, some academic staff used generic applications, such as email, video calls and WhatsApp to communicate with students through their mobile phones during the lockdown and keep them engaged. However, despite all these efforts, many students (especially in rural areas) during the lockdown have complained about not having access to digital equipment, and not being

able to have internet access in their homes. Moreover, the frequent blackouts and prolonged power outages due to the protracted crisis, made following lectures online a daunting, if not impossible task. All these challenges led the HEC to abandon its decree regarding the transition to remote teaching.

It is worth mentioning here that following the decision of the HEC to back down on its online teaching decree, higher education institutions had to go back to face-to-face teaching and compensate for the lost courses once the lockdown was lifted, even if they were already delivered remotely, the momentum gathered by some higher education institutions to move to online delivery was lost.

8.3 Higher Institute for Applied Sciences and Technology (HIAST)

The Higher Institute for Applied Sciences and Technology (HIAST) accommodates about 350 students. The very strict admission requirements imposed by the institute result in that only high achieving students in the Syrian secondary education certificate are admitted to the institute [16].

E-learning was established in HIAST in 2003, long before the spread of COVID-19. An E-learning platform, called '*e-class*', had been created on the institute's network and servers. It was based on the open-source software *Moodle*. Distance learning was not offered at the time at HIAST, but the platform was used to explore the possibilities of blended learning and to conduct training courses for workers in remote areas [16].

HIAST obtained many benefits from the platform, as it effectively contributed to the electronic documentation of educational content, allowed the presentation and management of educational activities electronically, and facilitated the exchange of documents between students and instructors. With the passage of time and the increased experience in the capabilities of the platform, it became a means of communication between the administration of HIAST and Student Affairs on the one hand, and between instructors and students on the other [16].

With the emergence of the COVID-19 pandemic and the start of the implementation of "social distancing" measures, HIAST found in the '*e-class*'*s* platform a suitable and familiar alternative to ensure the continuity of the teaching and learning process. Therefore, a decision was taken by the Institute's Council to switch to e-learning and to prepare the necessary software and manuals to facilitate the transition process. Furthermore, instructors were asked to record their lectures using special tools, with the aim of supporting the content they provide in text files or presentations with audio explanations.

Given that the '*e-class*' platform proved to be an effective means of communication between all those concerned with the educational process in HIAST, the administration of the institute was able to assure minimum disruption to the academic year (the semester was only delayed by eight days from the previously announced

schedule). A technical support service was also placed at the disposal of everyone (students and professors), to help solving any technical problem, whether at the institute or from a distance. Furthermore, to facilitate the work of instructors and students, a special course was established on the platform that included all the requirements for distance learning, including software, technical guides, academic guides, and guidelines for planning and organizing the teaching process, so that the instructors can provide content, communicate with students, and help them manage their time.

However HIAST lacked a platform for synchronous communication, in which the instructor can communicate with his students at the same time to answer their inquiries, especially those related to practical lessons and solutions to exercises. Although some of the tools available on the platform (such as forums and chat tool) could make up for this deficiency, some staff and students still preferred synchronous communication. Recently, a video conferencing service has been successfully installed on the servers of HIAST, and will be integrated with '*e-class*' to facilitate the synchronous delivery of educational courses [16].

With the easing of social distancing measures in the country and allowing students to return to their educational institutions, the administration of HIAST decided to continue teaching the theoretical content of their courses online, while allowing students to attend only practical sessions that require the use of laboratories on campus. And final exams were conducted on campus following the lift of the lockdown [16].

The most important factors that contributed to HIAST's success in switching to online education are [17]:

- The familiarity with the e-learning platform that was installed more than 15 years before the pandemic
- The small number of students in the institute
- The high quality of the students and student's excellence in technology-related subjects
- The provision of continuous technical support for both staff and students

And the most notable challenges that the institute had to face were [17]:

- Students' accessibility to digital equipment. As students left their accommodation during the quarantine period and went back home, access to the distance learning platform of the institute became at their own expense and, of course, requires a computer or a smart mobile phone. As some students didn't have these facilities, especially first-year students, the HIAST administration tried to secure special SIM cards for those students to help them access the education platform from their mobile phones, and tried to deliver the SIM cards to their locations; however, this process was not entirely successful due to many technical obstacles
- Students' access to internet as some students didn't have access to the internet in their homes
- Power failures and electricity cuts, as many students, especially in the countryside, faced long period of electricity cuts caused by the prolonged crisis, and were unable to find alternative solutions

- The need for real time interaction between students and instructors, as the available platform did not, initially, include the possibility of synchronous communication. This problem was solved later by adding a new platform (BigBlueButton which is an open-source software), although it was not widely used by instructors

It is worth mentioning here that HIAST was not obliged to follow the HEC decree to re-deliver all courses face-to-face once the lockdown was lifted because the institute was established by special law and is not regulated by the Council of Higher Education.

8.4 The Syrian Virtual University

As stated earlier, the SVU was established in 2002 and offers distance learning courses entirely delivered online [3]. It initially provided two-year and four-year undergraduate programs. Currently, SVU additionally offers a number of postgraduate programs too. The university consists of three faculties: the Faculty of Information Technology and Communications, the Faculty of Management Sciences, and the Faculty of Humanities. Each faculty offers a number of bachelor's and master's programs [3]. The university has also eight independent academic programs and five training courses outside the framework of the faculties [2, 3]. It is worth mentioning here that the Syrian Virtual University is the only Syrian public university that included in its establishment law the post of "Vice President for Lifelong Learning", and has established in 2017 a Centre for Lifelong Learning. The center seeks to occupy an advanced position in the field of e-learning and training at the national and regional levels [18].

The SVU uses its own University Information System (SVUIS), which has been built and developed internally [19]. This system is the backbone of the university's information systems, where the main components of the virtual learning process are managed such as: students' admission and registration; students' enrolment; e-payments, etc.

The e-learning platform of the SVU is based on the learning management system *Moodle*, which is an open-source software and was adapted to SVU's needs. This system manages the learning process through: ensuring communication between students, teachers and university staff through a web interface or by using an email client software; automatically creating courses and enrolling users; supporting the use of various types of e-content (such as text, audio, video, SCORM packages); providing a wide range of tools and components to organize courses and tracking educational activities such as assignments, quizzes, forums, etc. [18, 19].

Distance teaching and learning is provided in a number of ways, including synchronous lectures, recorded lectures, videos, etc. Final exams are not carried out online at SVU but rather in certified national and international telecentres [20]. National centers are spread throughout Syria and international centers are based in certain locations in the Arab region and Europe (Table 4) [3].

Table 4 National and international telecenters of the SVU in 2021

No.	National telecentres	International telecentres
1.	Faculty of Information Technology (Damascus City)	Jeddeh (Saudi Arabia)
2.	Mezzeh (Damascus City)	Riadh (Saudi Arabia)
3.	Information Technology (Damascus City)	Kempten (Germany)
4.	Al-Rawda (Damascus City)	Maskat (Oman)
5.	Al-Tal (Damascus Country side)	Erbil (Iraq)
6.	Sednaya (Damascus Country side)	Al-Manama (Bahrain)
7.	Homs	Istanbul (Turkey)
8.	Hama	Kuwait
9.	Tartous	Beirut (Lebanon)
10.	Latakia	Cairo (Egypt)
11.	Aleppo	Amman (Jordan)
12.	Sweida	Dubai (UAE)
13.	Daraa	Khartoum (Sudan)
14.	Idleb (currently closed)	Vienna (Austria)
15.	Deir Al-Zour (currently closed)	Moscow (Russia)
16.	Al-Raqqa (currently closed)	
17.	Hasakeh	
18.	Qamishly	

Source The Syrian Virtual University

As one would expect, the impact of both the war and the pandemic on the SVU is different in comparison to other Syrian universities. The war which began in 2011 had a huge impact on traditional higher education institutions in general. As stated earlier, the damages inflicted on the institutions were huge including losses of infrastructure, disruption of the academic year, and limited higher education funding. Furthermore, attrition rates have increased in traditional higher education institutions due to internal displacement [1]. In the case of the SVU, as all its courses are delivered remotely, the impact of the war was significantly less compared to other universities (public or private). In fact, in the early years of the war (2011–2014), many students considered studying at the SVU as a safe mode of higher education study, which has resulted in a significant rise in the total number of enrolled students (Fig. 1) [21].

As expected, the pandemic has not affected the teaching and learning processes at the SVU. Lectures in all programs continued in a normal way. Only final exams (which are usually carried out in certified telecentres) were postponed for a period of two months in spring 2020 [14]. Regarding admissions and student recruitment, a steep rise in the number of enrolled students at the SVU was observed in the academic years 2019–2020 and 2020–2021 (Fig. 1) [21]. This significant increase was an expected impact of the pandemic as many students considered studying at the SVU as a safe mode of study during the pandemic as well.

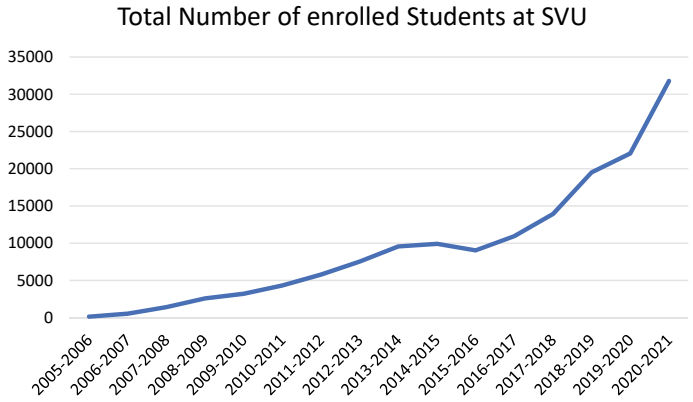

Fig. 1 Total number of enrolled students at SVU. *Source* The Syrian Virtual University

It is obvious that the most important success factor of the SVU during the pandemic was its extensive experience in remote teaching, with instructors having the necessary qualifications and degrees specifically designed to be taught online.

It is worth mentioning here that the SVU has made its virtual educational tools available to other universities and has provided help in recording lectures and installing them on their servers. Moreover, a number of private universities have consequently installed the Learning Management System (*Moodle*) on their servers and put their scientific content on it [19].

8.5 The University of Leicester, UK

This section reviews the hybrid and blended-learning practices that were adopted during the COVID-19 pandemic by the University of Leicester in the UK. In 2021, the University of Leicester was ranked 27th in the UK and 185th in the world by Times Higher Education [22], and has received positive feedback and recognition from students and other similar-sized institutions as a result of the way dual-delivery and hybrid-learning was managed [23]. This section covers a high-level description of six pedagogical areas of focus that were deemed critical to ensure a successful implementation of a hybrid and a remote process for teaching and learning.

8.5.1 Strategies for Designing and Delivering Formative and Summative Assessment

Universities were forced to adjust the way formative and summative coursework was carried out. In essence, measuring student and staff workload in relation to each subject's intended learning outcomes, had to be revised and altered according to the

hybrid and online mode of study. Accordingly, innovative methods for formative assessment came to light, and replaced key summative coursework elements. For example, one of these approaches was *The Checkpoint Qualification System* [24]. This approach was designed for science-based programs, where dissimilar types of labs and practical sessions were required. The method was adopted and tested by several computer science modules at the College of Science and Engineering at the University of Leicester. The system operates by monitoring student engagement in a practical session via simple 'checks', instead of awarding summative marks that count towards the final module credits and weighting. The approach offers an adaptive worksheet with smaller-sized problem statements that are associated with different difficulty and skill levels. Furthermore, when a student reaches a certain percentage of 'checks', they would qualify to the final summative coursework, which will in turn weigh more and have a significant impact on the knowledge gained and module progression. This exercise allows students to control the pace of learning at a more personalized level, especially when accessing and engaging with resources remotely. Students are also able to navigate more freely between smaller-sized questions, with different skill levels and topics, without having to dwell about summative marks and progression.

It was observed that these types of formative assessments can provide quicker feedback to a larger number of students, which to some extent, can be provided in real-time compared to traditional approaches, which require internal and external moderation. During COVID-19, it was essential to optimize staff and student workload when it came to designing and delivering examinations. On this note, conventional types of fixed-time and staff-invigilated exams became unfeasible. As a result, a full remote examination style was adopted. This was carried out by changing the exam style to an open-book problem-solving one with a 24-h window for students to submit their answers. For this to succeed, it required the implementation of comprehensive plagiarism detection tools, as will be addressed in Sect. 8.5.6.

8.5.2 Encouraging Student Engagement and Monitoring of Virtual Attendance

Traditional methods for monitoring attendance were not applicable during the COVID-19 pandemic. While most teaching and learning activities took place remotely via online platforms, it was essential for higher education institutions to find an alternative approach to record virtual attendance, especially for international students with regulatory visa requirements. Several research-intensive universities, such as the University of Leicester, adopted a student-engagement monitoring approach as a replacement for the traditional attendance recording method [25]. This was designed on a program level, and in accordance with each modules' intended learning outcomes (ILOs). The aim was to increase the frequency of formative assessments during the entire academic year in order to eventually improve the level of engagement and students' appetite to learn in a challenging and remote environment.

Examples of the innovative tools and platforms that were utilized to accommodate this are addressed in the blended-learning technologies section below.

8.5.3 Providing Pastoral Student Support and Academic Tutoring in an Inclusive, Supportive, and Accessible Environment

Providing academic and pastoral support to students was essential during the COVID-19 pandemic. While students were not able to physically knock-on doors and seek help in-person, online platforms such as Microsoft Teams, Blackboard Collaborate, and others were utilized to their full potential in order to bring the virtual campus feeling to life, and support students using different innovative approaches. In principle, personal tutors provided a reliable, personal link with their university, and a tutor was made available for tutees to discuss issues and proactively respond to concerns or disclosures. Personal tutoring became part of a wider student support network. While a university tutor is not responsible for answering all questions or resolving complex issues, a comprehensive support process was put forth by numerous UK Universities, which included various administrative and academic roles and services. For example, the University of Leicester personal tutoring strategy divided the types of support provided into the following domains [26]:

- Guidance on mitigating circumstances procedures
- Guidance on regulations and administrative processes
- Queries for staff and students on programs, module choices, and academic schedules
- Guidance on supporting tutees with disabilities and specific learning difficulties
- Guidance and questions on how to gain a better understanding of different social, ethnic, demographic, and personal characteristics

One approach, which became popular amongst students, was the virtual door-knock option. This was designed by the School of Computing and Mathematical Sciences at the University of Leicester. It works by creating a schedule where different members of academic staff are made available through virtual office-hours online. Accordingly, there was no need for students to book an appointment during these virtual office hours, and students could directly call the relevant member of staff through MS Teams, similarly to knocking on their office door in a pre-pandemic era.

8.5.4 Managing Student and Staff Workload with Online Teaching and Remote Assessment

Designing teaching materials for an online mode of delivery had notably shifted the way workload was calculated for both students and teachers. The learning outcomes, which were set via class-based and on-campus process, had a drastic impact on student workload when a fully remote approach became mandatory. In essence, almost all types of assessments were turned into an open-book and problem-solving

style with unlimited hand-in attempts, and a 24-h window, rather than the conventional fixed-time script approach (e.g. theory exams with invigilators, in-class tests, assignments with fixed date/deadlines, and other forms of on-campus examination). This new form of assessment increased the time required for both students to complete their tests, and for academic staff to mark and provide timely feedback. The following list illustrates a few of the key actions initiated by the School of Computing and Mathematical Sciences at the University of Leicester to address these concerns:

- Revisiting the modules' aims and intended learning outcomes per assessment element
- Adopting a temporary change across all curriculums, by switching modules with a final theory exam to 100% coursework ones
- Reducing the number of summative coursework and replacing core assessment elements with formative evaluations, while making sure these still covered the same ILOs and timely feedback was provided to students
- Increasing the number of teaching assistants per module to support different types of questions during a longer 24-h submission window for both exams and courseworks.
- Introducing module-level synchronous and asynchronous Q&A sessions throughout the semester
- Utilizing user-friendly online learning technologies for hand-ins, Q&As, plagiarism reporting, feedback, and live updates

8.5.5 Selecting, Implementing, and Adapting to Appropriate Blended-Learning Technologies for Teaching and Supervision Activities

Various virtual learning environments (VLEs) have become widely available by major software companies across the world. As a world-leading university, it was essential for the University of Leicester to determine, evaluate and choose the most appropriate integrated learning system that meets the needs of any higher education institution. For this, a major investigatory initiative took place at an early stage of the pandemic to select suitable learning platforms to guarantee [27]:

- The user-friendliness and compatibility with the university's taught and research programs
- Suitability and service compliance with students' demographics and historical data on end-user behavior
- Robust accessibility services and live text-caption compliance for both synchronous and asynchronous sessions
- Flexible and adaptable assessment features for design, release, marking, and submission
- Reliability with online conferencing for large numbers of students (e.g., Breakout rooms, in-call 1-2-1 feedback, and virtual whiteboards)

- Swift provisioning and handling of technical issues and queries (e.g., bandwidth, speed, access control, bottlenecks, and other scalability options)
- Accessibility compliance for students with disabilities and/or other difficulties (e.g., live captions, zoom-in features, dyslexia friendly style guide)

As a result, Microsoft Teams, Panopto, and Blackboard Collaborate were selected by the University of Leicester as the key learning platforms. Accordingly, there was a strict requirement across 25 departments to only employ these systems, and nothing else, given the above requirements.

8.5.6 Developing Effective Strategies for Detecting and Preventing Plagiarism Following the Utilization of Open-Book and Remote Assessments

One of the unforeseen challenges faced by most leading universities around the world when switching to online assessment, was the student plagiarism factor [28]. This came to light and increased significantly when the open-book assessment approach became more dominant. This phenomenon escalated to a notable extent when coursework deadlines were offered on a 24 and 48-h basis. Without a doubt, plagiarism has been a major concern, even in the pre-pandemic era, and especially with the worldwide reliance on VLEs as the primary teaching and learning method for higher education institutions.

In the attempt to overcome and mitigate these challenges, the following describes some of the key actions taken by the School of Computing and Mathematical Sciences at the University of Leicester:

- To introduce video assignments with instant rubric-based feedback
- To increase the number of formative assessments to replace key summative coursework elements, which have the potential to generate more plagiarism cases
- To invest additional staff time to redesign open-book style summative coursework with the aim to minimize the potential for plagiarism. This was carried out by reviewing and investigating existing internal and internet-based resources on a module-level
- To utilize industry-standard tools such as TurnItIn as a mandatory form of text-based submission to report and monitor plagiarism
- To allow students to view individual similarity reports and re-submit assessments accordingly within the allowed assessment timeframe
- To offer comprehensive guidance on how to avoid plagiarism on a module-level and for each summative coursework element
- To dedicate special synchronous and asynchronous Q&A sessions about plagiarism. In particular, these sessions were designed and conducted on a module-basis to answer any student queries about plagiarism detection in general, and similarity reports that are generated after each coursework submission. These automated reports explain the plagiarism percentage, links to the referenced online materials, and the degree of similarity.

- To employ a plagiarism officer as academic member of staff.

The previous six areas of discussion, which included numerous strategies and methods, have without a doubt generated other challenges and concerns from different viewpoints and domains. Leading universities have realized that their overall objective throughout the pandemic was to turn these challenges into opportunities in real time, and learn for the future in the event similar and unpredictable events takes place. These universities across the world are now more equipped and ready to handle similar situations on a more confident and positive level. Consequently, universities in Syria and other parts of the world (especially in third-world countries), with infrastructure and resource limitations, have an opportunity to study and learn from the experiences of such higher-education institutions, and eventually, design unique strategies that fit with their internal core competencies, technical capabilities, and available academic and professional resources.

9 Preparing for the Future

All countries and universities should use these challenging times to reshape higher education for the better. Mechanisms should be put in place to strengthen the resilience of higher education institutions in the face of future crises. Higher education institutions should pay special attention to developing their technical, technological, and pedagogical capacities to appropriately use non-face-to-face methodologies, as well as their abilities to monitor students, especially the most vulnerable [14].

9.1 Teaching and Learning

In times of emergency, such as the COVID-19 crisis, the guiding principle of the policies of higher education authorities should be to do everything possible to ensure the continuity of educational activity [14]. This means that higher education institutions must be well prepared to deal with any crisis that may cause the cessation of traditional face-to-face teaching. It is clear from the aforementioned case studies that higher education institutions that did not offer any online programs and did not have any prior distance education experience, were unable to do anything viable to ensure continuity of teaching during the lockdown period. Whereas, institutions with established e-learning platforms, previous online teaching experience, and qualified technical staff, had been able to mitigate the impact of the pandemic and offer distance learning courses either in synchronous or asynchronous forms. This necessitates that higher education institutions work on three different fronts:

- Platforms
- Teacher training
- Digital content

The most important element to guarantee the continuity of the teaching activity is the learning platform. All higher education institutions should have their own virtual educational platforms, i.e. the technological mechanisms and resources for teaching courses remotely. The learning platform should be designed with the learner's experience in mind, i.e., the learners should be able to log on quickly, easily navigate themselves around the site, find relevant learning resources within just a few clicks, and be engaged throughout the process [29]. It should also have a responsive design that enables learners to log on at any time, from any device. Furthermore, the learning platform should be compatible with SCORM (which is the industry technical standards for online learning content) to ensure that the learner can access a wide variety of learning material both now and in the future. It is also important to make sure that the platform can be scaled up in terms of number of users and functionality [29].

The second crucial element to guarantee the continuity of the teaching activity is the teachers' own competences to operate in virtual environments of high technological complexity, for which they are not necessarily prepared [14]. The Ministry of Higher Education should prepare precise guidelines for action for public and private universities to start developing their institutional capacity in virtual education. Universities should be encouraged to set up training programs, which aim at developing staff teaching capacities in virtual education. Moreover, universities should also be encouraged to disseminate good practices and offer support in teacher training to the other universities through a device managed by the Ministry of Higher Education (similar to the support extended by the SVU to other universities).

The third element is the digital content. Well-designed content must be able to fill in for the teacher by tapping the curiosity of the learners, encouraging them to explore lessons or concepts further, allowing them to test their understanding, enabling them to compare notes and share learning with other course participants, in addition to facilitating participation and involvement [30]. As discussed earlier, higher education institutions start from very different situations in terms of content. Institutions that have their own platforms have the advantage of having an important collection of digital teaching resources whose availability and quality can be critical. Other institutions that did not have any e-learning platform or digital teaching resources, had the choice of either developing their own courses, or adopting courses developed by other institutions. It is logical that higher education institutions share resources with other institutions in a crisis situation. The Ministry of Higher Education should facilitate this process and generate incentives for higher education institutions to do so.

9.2 Bridging the Digital Divide

Higher education institutions should always bear in mind that the transition to virtual mode is often accompanied with very high risks of widening the effects of the digital divide by leaving unattended those with no access to quality equipment, bibliographic resources, or connectivity necessary to take advantage of the distance education offer

backed by high technological components [14]. Taking into account the huge digital divide does not mean rejecting virtualization, but rather designing strategies and support mechanisms that help combat it intensively. For example, higher education institutions should take advantage of the availability of mobile lines in areas where the rates of mobile lines are high and should focus their efforts on technological solutions and content based on the use of mobile phones [14]. A good example on such support mechanisms is given by HIAST for students who did not have access to the internet and digital equipment in their homes during the lockdown. HIAST tried to secure special SIM cards to help them access the education platform by delivering the SIM cards to their locations.

9.3 Governance

The pandemic has forced higher education institutions to experiment with new forms of communication and governance. Thanks to technology, non-face-to-face governance mechanisms can have great potential to become permanent forms of governance that are more flexible and efficient. Moreover, it has been shown that the number of physical meetings can be drastically reduced without affecting the quality of decisions or being able to reach consensus among the different actors [14]. Also, it was clear that the circulation of documents can be perfectly limited to digital circuits, which would drastically reduce the need for printing. It is evident that the direct economic savings, in terms of the reduction in the number of trips and environmental impact, are very significant [14].

10 Conclusion

The pandemic has dramatically shifted higher education systems to a virtual mode, often underlining the need for better infrastructure and easier access to internet and digital devices [31]. The crisis imposed by the pandemic must be considered as an opportunity to transform higher education institutions in terms of quality and equality.

It is evident that higher education institutions in Syria and throughout the world, that had bespoke platforms and digital teaching resources, were successful in shifting to online delivery and assuring teaching continuity during the pandemic. Therefore, all Syrian as well as Arab higher education institutions should be prepared to shift to remote learning should the necessity arise, with all that this entails in terms of technology and skills for digital teaching and learning. This involves preparing both teachers and students for this transition in a timely and non-labor-intensive manner. The shift to remote learning is not considered a viable replacement for the campus experience that so many students aspire to, yet it is important in emergencies to assure teaching continuity without compromising the quality of learning.

Many of the technologies that helped some higher education institutions to survive and sustain teaching continuity during the pandemic should become permanently embedded in our educational methods [32]. Higher education institutions in Syria as well as in the Arab region should incorporate the blended learning model in the majority of their courses by following the footsteps of various other universities around the world. As discussed in the previous case studies, blended learning refers to a mix of different educational approaches that facilitate learning both inside and outside the classroom [33]. This learning model strives to deliver the best of virtual and traditional learning experience by leveraging the benefits of technology while still retaining instructor-led-training. Online learning is an integral part of the blended learning models although the time spent online tends to vary depending on the adopted learning model.

Courses should also include the option for students to join some classes remotely or watch it later and contribute their thoughts to an asynchronous conversation. Flexibility positively impacts the student experience, and capabilities that make the traditional classroom more engaging, more accessible, and more inclusive are accretive to the learning process [29].

More efforts should be invested in those technologies and teaching resources that are within the reach of all, to improve the quality of face-to-face teaching and promote hybrid methods; in other words, to combine the best of face-to-face with the potential of technology to support pedagogical renewal and improvement [14].

Higher education institutions in Syria should prepare themselves to conduct students' assessment online, benefitting from the experience of other world leading institutions in this regard, such as the University of Leicester.

The pandemic has forced higher education institutions to experiment with new forms of communication and governance. Non-face-to-face governance mechanisms should be employed by higher education institutions as much as possible and physical meetings should be drastically reduced. Circulation of documents should be limited to digital circuits as much as possible.

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Through a Glass Darkly: Oral Histories of Teaching During the Pandemic

Colin Smith

For now we see through a glass, darkly; but then face to face: now I know in part; but then shall I know even as also I am known. First Corinthians 13:12, King James Version

Abstract Professors in the Faculty of Arts and Sciences, American University of Beirut, a US accredited, English-language University in Lebanon, were interviewed about their online teaching experiences during the COVID-19 pandemic and 2020–2021 lockdown. Faculty were approached non-systematically and interviewed anonymously in a semi-structured format in person and in writing. Thirteen interviews are included in the chapter. The interviews are briefly analyzed for coalescent and divergent experiences and for insights as to the potential future of higher education.

Keywords Online teaching · Pandemic · Oral history · Lebanese financial crisis · Thawra

1 Introduction

The American University of Beirut is an English language university based on the American system of higher education. It was founded in 1866 and has about 9500 students, of which about 8000 are undergraduate students. It includes schools of arts and sciences, agriculture and food science, business, engineering and architecture, health sciences, nursing, and medicine with an attached medical center. The Faculty of Arts and Sciences has about 150 professors in residence.

In 2019, the Lebanese financial system collapsed when the central bank was no longer able to maintain the exchange rate with the US dollar. Relevant here is that in addition to the disruption of the financial collapse, there were sustained protests beginning 17 October 2019 (the Thawra, "*revolution*") that also prevented students, faculty, and staff from reaching campus. Beginning 18 October 2019, the university was sporadically closed. Faculty were encouraged to accommodate students unable to

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attend classes as best as possible, and some adopted remote online and asynchronous teaching.

The value of the local currency plummeted more than ten-fold over the next two years, banks limited withdrawals and wire transfers abroad, and there was massive inflation of prices in local currency. Complex ramifications resulted, including episodes of fuel shortages, frequent and long-duration interruptions to electricity via the national power grid and private suppliers, and poor internet connectivity. Some imported goods (cameras and headsets) disappeared from the market.

Beginning 2 March 2020, the COVID-19 pandemic affected higher education by country-wide lockdowns, university-imposed restrictions of faculty and students entering campus, and a forced transition to remote education. The crises have been multifaceted and have affected higher education in complex ways. Teaching fully in-person resumed at the beginning of October 2021, with some exceptions for some freshman and students unable to return to Lebanon.

For many years, there had been a promotion of online teaching, primarily by the encouragement, even celebration, of "hybrid" courses, yet most professors remained hesitant. When the COVID-19 lockdown imposed remote teaching, few faculty had experience with online modalities. During this period, I heard many anecdotes from colleagues about unusual teaching situations. Some older colleagues had been university students or taught during the Lebanese Civil War and had insightful comparisons. At one point, a colleague and I discovered that the profusion of recent unexpected, even surreal, events had resulted in our inability to recall them without struggle. Thus, I saw an opportunity to collect stories from faculty, with the hope that these oral histories and reflections could provide insights on how higher education may weather the future.

2 Approach

Thirteen faculty were interviewed in a semi-structured format using questions conceived in this project. The faculty were not approached in any systematic form: they were selected from those in the Faculty of Arts and Sciences with whom I had had previous reflective conversations about higher education, and to represent some diversity of discipline and educational background. The interviewees represent diverse disciplines (five natural sciences, three humanities, three social sciences, and two quantitative thought) and systems of pre-graduate education (several US, several Lebanon, several continental Europe, one UK, one Australia, one South Asia, and one post-Soviet Union). Interviews with most faculty occurred initially live, and the transcript revised as texts to best reflect their responses. Several interviews were conducted as written responses without a live session. All faculty had taught at least eight years at the university, and the interviews took place between the second half of the fall semester of 2021, when in-person teaching resumed, and the beginning of the spring semester of 2022. The interviews are appended below the conclusion and are presented arbitrarily in their reverse chronological order.

3 Analysis

Various dimensions emerge when considering the set of interviews. Discipline and educational background did not present as obvious influences in attitudes, though they may affect the emphases and terminology of faculty. Unexpectedly, the degree of faculty experience with online education, their access to (or commonly, lack of) equipment and training, did not present as relevant: "*I do the same thing online; it is just technology;*"[I] "*I trained myself, and my kids helped;*"[M] "*The training offered was the blind leading the blind;*"[I] "*I was given no extra equipment, not even a headset. I had no training*;"[J] "*I cannot think of an occasion when I sought help;*"[A] "*In the beginning, I hated it: it was tiring. By the end, it was easy, but I cannot say that I like it*."[L].

The strongest commonality was unsurprisingly in how the online modality affected dimensions of communication: "*So many cues that underpin a healthy conversational dynamic get lost even when cameras are working;*"[A] "*How do you call them to the blackboard?*"[E] More subtle consequences of online education included alterations to pedagogy, especially the inexorable reduction of discussion in favor of lecturing, "*That I had to talk all the time,*"[C] interfered with the formation of community, "*If you remove the human element, you dehumanize them, and we have to resist it,*"[D] and even helped prevent assumptions that occur in person, "*Students and I did not assume we shared a culture with the people in the screen.*"[E].

What was improved? Most frequently, faculty perceived learning was not improved online, yet live chat and time management were employed widely. Live chat was appreciated for several aspects: it provided equity to all students, including the shy and those with impediments "*I can see everyone's private answers instead of a few vocal*;"[K] "*I had a student who stuttered: for them, the chat feature was much better.*"[C] The diversity of student responses was far clearer than in person: "*I could see the variety of questions and see how they clustered: I could see better what lacks of understanding needed to be addressed*,"[K] and the chat, being text, could easily be recorded. A couple of faculty expressed interest in incorporating live chatting during in-person teaching: "*It worked so well that I want to adopt it in face-to-face teaching with smart phones.*"[K] Several appreciated having their teaching recorded: "*Lectures could be structured and presented knowing that students could rewatch the recording.*"[B] Sometimes, being online spurred creative approaches that might not have been tried otherwise: "*Home demonstrations were very successful. The value was in having them explain them to their families;*"[G] "*I was teaching neo-Kantian aesthetics from the hallway of my apartment under gunfire and RPGs. This seemed untimely, and we changed the conversation to discuss the contemporary political and social life in Lebanon and the way it affected the students. It was useful to be able to switch the students to addressing the conditions in their own historical moment.*"[F].

What was lacking? The inability to see students was an almost universally recognized impediment while online: "*Not having immediate feedback through seeing the students faces looking bored, confused, or angry…it was flying blind*;"[K] "*I cannot see if they understood or not*;"[I] "*I used to watch students; online I was blind.*"[M]. Several

identified the importance of the performative dimension to teaching: "*Teaching is performative, dynamic, and responsive*."[E] The depth and timeliness lost online were recognized as essential to effective learning: "*What we lecture is not the main part; it is the interaction*;"[C] "*Students need to see how I think, and I need to see how they think.*"[L]. Interestingly, one instructor whose students did use their cameras noticed how the mind fills the gaps and projects: "*I realize how much I had become unused to all the information conveyed by in-person: one's physical mannerisms, one's bodily style. I must have been projecting much on students when I could only see faces and hear warped, echoey voices.*"[E] That resonated with my own personal experience of failing to recognize my regular convenience store clerk when he did not wear his mask, and makes one wonder how much we might be assuming about others normally in person.

Very common, though often not emphasized, were difficulties with assessing students, even in disciplines that did not rely on exams: "*A major disaster was students cheating during online exams in any way they could*;"[J] "*I had never seen so many plagiarized papers.*"[F] Faculty responded with diverse attempts to adjust: "*I gave easier homework and exams than usual because the students would not be able to handle the usual level*;"[M] "*I also tried 24 to 36-h take-home exams allowing all resources other than live people*;"[K] "*I introduced a mode of assessment from the post-Soviet system: oral exam interviews*;"[F] and worried as to whether students learned: "*I would worry they may have muddled through because it was easier to cheat.*"[K].

Although faculty did not voice many concerns with their own access to equipment, software, and training, they did voice concerns with the students' access, especially their internet connections "*The students access because of power outages and poor internet was very bad,*"[J] and insightfully, the absence of a defined teaching venue, because online learning occurs where everything else does: through a glass. For many faculty, their introduction to computers and the internet were for research, but for today's youth, computers and the internet are about social media, entertainment, and everything else in their lives: "*There is a specific economy of attention brought about by the fact that the online course is just another thing on the screen. Students did not have the physical transition to campus environment, neither did they have a separation between private and public lives*;"[F] "*the family home can contradict learning.*"[D].

Throughout the interviews, the faculty concern for their students' well being, their sense of professional responsibility, and even personal warmth is apparent: "*I also learned that I am a teacher and not an undertaker, and I will not act as an undertaker*;"[D] "*I had to purchase more equipment and had to use 3G on my phone*;"[C] "*Sometimes the students arranged to all turn on their cameras together. It was emotional.*"[H].

Concordant with the local political scene, university leadership appeared, at best, irrelevant. Scathing criticism emerges on a few specific matters: "*Not allowing us on campus was the most ridiculous decision*;"[G] "*They would not give us a Zoom license*;"[D] "*No one ever asked how the university could support our teaching or research*;"[B] "*The administration totally failed by not addressing that students might*

not have internet and electricity, and they do not have home offices."[E] Tellingly, few seemed to have asked or expected support: "*We did it on our own.*"[C] Some of the criticism concerns the absence of discussion about the failure of online education: "*The lack of discussion about the failure of online education is alarming*;"[B] "*It is a shame to see the university jumping to promote online teaching and online degree programs.*"[H].

Of course, during this period, student and faculty research activities were also affected for reasons substantial and psychological: "*My graduate students could not come*;"[J] "*I could do very little to no research*;"[G] "*It was very difficult, constant improvisation with the changing circumstances, and the planned collaboration with colleagues in other disciplines was impossible to implement. The research grant we had lost 80% of its value with the collapse of the currency and banking sector, making it very difficult to get even simple equipment or to hire the research team we counted on*;"[H] "*During the pandemic lockdown I was not productive; I felt my intelligence had diminished.*"[M].

The most disturbing idea to emerge is that the online period had long-term, negative consequences. Most interviewees worry that students did not learn, they expressed reluctance to hire the product of online education, and some even worry of permanent damage, as if their education was a train that derailed: "*They seemed confused and unaware of what is a reasonable effort to ask of them as university students*;"[H] "*All students were displeased, all were dissatisfied. They claimed they had to spend more time and could not focus*;"[F] "*Now that we have returned to in-person teaching, we see that students did not learn what they needed in the prerequisite courses*;"[J] "*I would be mainly concerned that students did not learn what they need for graduate school or professional careers*;"[M] "*It looks like online caused them permanent damage.*"[B] One might worry about the parallels to long COVID, in which we do not realize the long-term consequences until much later.

4 Conclusion

Now in the post-online period, faculty welcomed the return to in-person teaching, sometimes cogently: "*I cannot remember well; it is fading like a nightmare.*"[I].

The set of interviews reveals a convergence of faculty across disciplines and educational background, that education is a participatory interaction, a conversation, a joint exploration, a forging of a community. Faculty responses are in striking contrast to the language of proponents of online education, who describe online as efficient and scalable. Indeed, the monologue of university administration has changed from pre-pandemic encouragement of "active learning" and "flipped classrooms" to a pandemic-period language referring to teaching as "delivery" of "content" and "materials." Cynically, one might expect universities will follow the practice of hospitals in responding to the terrible, and everyone should expect a new "Center of Excellence for Online Education." [1] What is needed are critical analyses of how online teaching failed in order to understand in which specific circumstances it might

have value. We do not need yet another disaster to exploit for publicity, cronyism, and budget redirection.

Historical modes of distance learning, textbooks, education television, and correspondence courses suggest that although they may be excellent resources for motivated students, for professional development, for non-degree programs, and for hobbyists, they are a poor substitute for a classroom focused on intellectual development. There are those who apply the strawman fallacy and describe "traditional teaching" as if the instructor lectures (in the sense of reading a prepared text at the lectern without reciprocal communication) to large audiences with little interaction, and in which student learning is assessed with multiple-choice exams or writing graded by graduate students. This is a fallacy: if that is all that is happening in the classroom, something is too wrong to fix without personnel replacement.

What futures do universities envision? If it is not recognized by all stakeholders that education is a highly developed craft practiced by experts in person, the expertise of universities may reduce universities to being assessment centers, diploma mills, events venues, and bureaucracies. Many have already advanced in those reprehensible dimensions. How will universities compete with publishers, who already have vertically integrated platforms with fully developed content, presentations, virtual laboratory activities, and assessments? All publishers lack is the accreditation to award degrees.

Typically, technology does not change what is done, rather it shifts menial, repetitive, and strenuous work from humans to machines, typically creating gains in metrics of efficiency and uniformity with losses of quality and personalization. Parallel to consumer goods, higher education ranges from cheap mass-market versions to luxury, handcrafted brands with coveted name recognition. The challenge is whether effective online learning is possible and how to best balance what is gained and what is lost when we see through a glass. Surely, the first steps are to recognize that there are many aspects to learning, and it is no simple matter to replace classrooms, laboratories, and studios with screens. Let us hope that after the obvious failures of online education, we consider applying technology where it improves learning rather than chasing the next, new shiny thing.

Appendix: Interviews

A

Had you any relevant experience with online teaching?

The pandemic was my first experience with online teaching.

What prior experience, of any sort, as a student or instructor had prepared you best for online teaching?

Not so much prior educational or professional experience as experience watching online streaming platforms that integrate some form of live chat.

What was the most remarkable teaching experience you had online?

The most remarkable thing was receiving two final assignments in the form of videos—not a medium I had ever considered countenancing (nor had a student ever proposed submitting) previously, but I was blown away by both of these: one was a single-person dramatization of an excerpt from Shakespeare, the other a whole-family dramatization (with animated sections and considerable additional production) of an original condensation of *Paradise Lost*. A theatrical performance option exists in the Shakespeare class; the first of these videos really reproduced the spirit and work ethic of what I thought could not possibly be duplicated under lockdown.

What was improved? What was your best online teaching experience?

Forum responses proved to be a good impetus to a kind of informal but reflective writing (perhaps of the kind encouraged by this questionnaire!) that homework assignments for in-class submission sometimes failed to elicit. (What they generally elicit instead is anxiety about being "academic" enough and insistence on rubrics etc.; the confidence to write casually is not widespread on campus.)

What was lacking? What was your worst online teaching experience?

My classes are seminars, generally about 10 MA students or 25 undergraduates. What I am always aiming for is a sense that a real community of inquiry is coming together—even if only for one term—in which everyone is an equal member although we will express ourselves differently and at different frequencies. This was hard to replicate online. So many cues that underpin a healthy conversational dynamic get lost even when cameras are working. Without them (as was the norm over this period, at least in my classes, where infrastructure precluded streaming video and I felt uncomfortable insisting on the use of an invasive technology), there are practically none. So, my sense at the end of each semester was that while some or many students felt connected, others did not. Perhaps they consciously decided to "coast" without any easy way to help them decide differently; perhaps they had too many other troubles to manage. Either way, I feel bad for being unable to do more to reach them.

What was your overall experience in terms of effort and success?

I have mixed feelings. The experience exceeded my expectations in many respects, in that I felt that the classes did draw out a great deal of student effort and helped students produce work of an expected standard (and in many cases imaginative new kinds of work). I found these semesters very physically taxing: teaching and conducting all the follow-up meetings and writing associated with the course from a desk chair became a health issue. And I also was conscious that, while good and average students were generally enjoying the same kinds of value from the course, those who were

on the margins of participation, motivation, or concentration were much harder to reach than under regular teaching conditions. Subtle methods to check or re-activate attention that are available in a classroom and on a campus are not on Zoom, and I think the semester marked, in some cases, a regression towards forms of plagiarism that I had learned to circumvent as a face-to-face teacher.

What new approaches did you try, and how did they work, and which might you use or adapt in the future, online or in-person?

I became a much more active overseer of the Learning Management Software (Moodle). I tried to use it both as a generative site—especially by posing fresh questions for fora, where students with difficulties connecting to Zoom sessions could feel more active—and as a space of review, where I would post notes or reflections after sessions. I have kept both techniques on return to face-to-face teaching, although devoting somewhat less time and space to both.

Did you already have the equipment and training necessary for teaching? How was your access to hardware, software, and training for teaching?

I had what I needed in my office and at home, although in both locations the internet was periodically unstable to the point where streaming video had to be interrupted.

Did you find online interfaces compatible with your teaching approach?

Generally yes, but I could feel the "pull" of the medium from time to time. When (largely for connectivity reasons) most or all students have webcams off, I think being the only animated figure on screen induced more periods of lecturing than I let myself get away with in a seminar room. I also felt that I became quite adept at following two "channels" of student discourse: speakers and chatters. I would often call out a connection or challenge, or put a quip or reminder into chat while a student was speaking or finishing speaking—that is a real difference from my classroom practice, where I am modeling attention to one thing and generally seek to maintain a single thread of discourse. On the other hand, I can also see it as an adaptation to a new medium of a higher principle to register every voice and keep the discussion active.

Did you require assistance, and if so, how did you receive help?

I cannot think of an occasion when I sought help—a flaw of temperament may be involved here, but I cannot recall any major hurdle except the sheer mental strain of engaging a vulnerable group of learners under so many constraints and pressures, which was at least partly relieved by occasionally chatting with colleagues at my own or other institutions.

How did your institution support your online teaching?

There was a lot of communication that helped set expectations and publicize resources; at a technical level these were not impressive, but support from IT personnel and key administrators was full of good will. More important than this, though, was a general devolution of responsibility to departments and individuals;

there was no imposition of a uniform style or arbitrary benchmark, but a general sense of trust that teachers would do their best.

Did you get any feedback from students?

I received quite a lot of feedback both during and after the semester. Most of it was positive praise for projecting enthusiasm and providing understanding, of which they felt sorely short. One feature, that some students wanted and would have felt was an improvement but that I did not provide, was access to recordings. This was partly to protect my own sense of privacy (and maybe proprietorship), but primarily so as not to suppress, deform, or otherwise change the sense that we were pursuing spontaneous seminar inquiries whose essence lay in the duration of participation.

How did the lockdown affect other aspects of your professional life, especially research and service?

Research went into deep-freeze. Time preparing and following through on teaching took up a lot more time and mental energy, while the peace of mind that is normally a prerequisite for analytic writing was entirely fractured. The lockdown/pandemic was, of course, just one context in Lebanon, where social protest, an economic catastrophe, and the explosion of the port of Beirut massively disrupted most aspects of individual and collective wellbeing. With that said, university service sometimes felt like something that was achievable (sometimes barely) and useful (sometimes barely). University systems required continuous ad hoc adjustment in the face of events and a lot of people needed a lot of personal support. It felt worthwhile to try to affect practices and decision-making during this period.

What would be your concerns when hiring someone whose education was mostly or entirely online? Would you recruit someone to your graduate program whose entire undergraduate education was online?

I would have some concerns or reservations about attainment and capacity to absorb critique or challenge. I think universities, programs, and instructors have to feel less secure about the level of educational attainment that has been possible across this period, and as I intimated above, I think student accountability may have lapsed and plagiarism risen as an almost inevitable consequence of the "system shock." Thinking more widely than the pandemic-induced and -enforced remote learning, the experience left me questioning whether the quality of self-directedness that helps create success in online learning might nevertheless leave out (or even accentuate) the experience of negotiating direct challenge to principles or arguments that face-to-face seminars can constructively foster. That said, I am in a writing discipline, and if a student can present a credible account of online studies that produced high quality samples of academic work, I would vote them into our graduate program alongside their conventionally educated peers.

Are there experiences related to this subject that you would like to recount?

No answer recorded.

B

Had you any relevant experience with online teaching?

I had been making videos for some years.

What prior experience, of any sort, as a student or instructor had prepared you best for online teaching?

Probably presenting professionally and teaching large lecture courses where immediate interaction is somewhat limited: they tend to be more one-way with few opportunities for back-and-forth or side-tracked discussion. Perhaps watching "how-to" videos, but those are limited to learning specific skills and not so much for learning how to think.

What was the most remarkable teaching experience you had online?

I taught online from a different time zone for a few weeks where I was staying at an acquaintance's and trying to volunteer in a research group. I had to teach at midnight and at 5 am. That was difficult. I would go to bed, wake up for the midnight class with confusion, blurry vision, and a rough voice. Worse and completely unexpected was that I could not fall back asleep until a couple of hours after class ended. It was very difficult trying to live normally during the day while teaching at night. And yes, I taught in my pajamas.

What was improved? What was your best online teaching experience?

It is hard to say anything was really improved. Online, students did not distract me by being on their devices etc., did not interrupt, and did not ask me to repeat. I could sit, speak, and use a pen comfortably. I could focus on the imaginary ideal student who had properly prepared and understood everything. I could finish what I intended. I could digress without seeing their eyes glaze over. I did not notice anyone falling asleep. Lectures could be structured and presented knowing that students could rewatch the recording. It is not fair to say those were improvements: they were natural developments of the medium. Now that we are back in person, one real improvement is that I have two semesters of recorded lectures to provide to students who miss class or find them useful as soporifics.

The best experience? When it was over, seeing how happy students were to come to class. The least bad experience was that in one course involving presentations, I had at two or more hours of one-on-one, online meetings with each student. I kept my camera on for students to see my facial expressions and have a live audience, but most students showed only their screens. It was far from ideal, but because they were one-on-one, those sessions approached the effectiveness of in-person meetings.

And of course, online department meetings: just keep the camera off and do something else, but keep an ear open in case of being asked a question.

What was lacking? What was your worst online teaching experience?

The typical struggle in science teaching is moving beyond "how does it work" and "what is the experimental evidence for our current understanding," to understanding which aspects are generalizable, and how it relates to current questions. Moving beyond requires discussion that did not happen.

In my graduate course, we normally do close readings guided by student questions. Online, the students did not engage: I had to do all the talking. Their learning is severely limited if all they do is listen to me. How can they ever learn to develop their own abilities if they do not practice?

My worst experiences were with assessment. Of my class in the first online semester final exam, on one essay question, two flagrantly plagiarized, and at least a third appeared to have cheated. Worse is now that we are back to in-person teaching, I see dramatically poorer exam performance compared to before the online era. It is as if they did not learn for the last two years.

We have sessions in which students go to the board. Online, it just did not function. Students not having home studios, having poor bandwidth, not wanting to be on camera. It was not worth the time, and I usually converted it to me doing problems they requested. If I asked students questions, I did not get replies. If I called on a specific student, they might take minutes to respond. I gave up.

The optional pass/fail system was imposed on us. The idea that we as instructors could not properly assess did not seem to be considered: it was about whether the student preferred a pass over a numerical or letter grade. We had students with 93/100 choosing "pass" to keep their GPA high in order to graduate with high distinction.

Overall, the worst online teaching experience has been that the students did not learn and apparently cannot learn what they would have in-person. It looks like online caused them permanent damage.

What was your overall experience in terms of effort and success?

Much more effort for much less success. We all flailed about, and despite trying our best, it is not clear whether students benefited much.

What new approaches did you try, and how did they work, and which might you use or adapt in the future, online or in-person?

The only really new approach I tried was during this in-person semester when I had students who had difficulty coming to campus. I brought my camera to the classroom, which has a large screen. I used a headset and camera so that the students in the room and online could both see and hear me. I would interact with the students in person normally and with some difficulty students online, and I would record the session via WebEx to be posted on the course Moodle site. It was not ideal because the in-person and online students could not hear or see each other, and interacting with the online students was more difficult, but it made the best of a difficult situation. I will consider doing this for students who cannot always attend and as a means to have recordings of the class available, but I would not want it to be a substitute for being there. I tried

the chat feature, but I could not monitor the chatting while talking and writing at the board.

Did you already have the equipment and training necessary for teaching? How was your access to hardware, software, and training for teaching?

Not really. I did not have a computer at home, and a hand-held device is not a substitute for a professional studio. The department gave me a webcam for my office. There were no cheap, wired headsets available on the market (probably because all the high schools had also gone online), so I had someone bring me one from abroad. My office computer is a hand-me-down because the budget is restricted. Software was normally WebEx or Zoom. Training? The internet, colleagues, and sometimes my students helped when I asked.

Did you find online interfaces compatible with your teaching approach?

Partially, but it is not about teaching, it is about whether the students learn, and the answer is clear: they did not learn to reason, to explore, or to synthesize well online. You ask the wrong question: the question should be whether there are effective ways for students to learn any subjects other than specific technical skills online.

Did you require assistance, and if so, how did you receive help?

A couple of times. Colleagues and students helped. Once, I had an odd technical problem. My WebEx recordings were poor resolution. I called someone who knew how to fix it.

How did your institution support your online teaching?

They failed in so many ways, let me mention just a few: by not allowing faculty to come to their offices, and by letting us rely on our smart phones, irregular electricity, and poor internet overwhelmed by our children's online school competing for bandwidth at home. Granted that it is probably the administration's dream, but banning faculty from campus it might interfere with the university's mission. Graduate students could not enter campus to do their laboratory research. I even had to intervene at the gate to let a doctoral student enter for her defense.

No one ever asked how the university could support our teaching or research. Instead of online laboratory demonstrations, we could have prepared take-away laboratory kits. Instead of encouraging voice-over PowerPoints, we could have had cameras in classrooms for live teaching, simultaneously broadcasting, and recording. They could have provided cameras and headsets for office teaching, or at least sourced models. It is clear that the administration does not care about teaching, learning, and research. They seem only to care about university rankings and other Ponzi schemes.

Did you get any feedback from students?

Yes. Now that we are back in person, I asked my undergraduate and graduates what they thought of online education. Almost universally, they expressed strongly negative opinions about online. One timidly stated that not having to come to campus was convenient.

How did the lockdown affect other aspects of your professional life, especially research and service?

My research has hit a brick wall. Though that is primarily due to the financial crisis, not allowing researchers to come to campus was like several gratuitous blows to the head.

What would be your concerns when hiring someone whose education was mostly or entirely online? Would you recruit someone to your graduate program whose entire undergraduate education was online?

As a scientist, have they had formative laboratory and field experience? As a researcher, have they ever identified questions, chosen methods, and presented to rigorous review? As an academic, are they able to converse intelligently when confronted with new ideas? As a supervisor, can they work with others? No. I would rather wait for the next cohort.

Are there experiences related to this subject that you would like to recount?

Yes. The lack of discussion about the failure of online education is alarming. To have voice-over PowerPoints paraded as success stories is demoralizing. If our university teaching is competing with voice-overs, someone needs to raise their sights.

C

Had you any relevant experience with online teaching?

Absolutely none. I am technophobic.

What prior experience, of any sort, as a student or instructor had prepared you best for online teaching?

I am a member of a large common research group run abroad with 25 researchers working together. We are transnational and used Zoom pre-COVID. I also learned in this group how to bring people together who were not physically in the same place. When the Thawra and COVID came, I was on leave, so I did not have that sudden abrupt transition: I had some warning from my colleagues.

What was the most remarkable teaching experience you had online?

That I had to talk all the time. Normally, it would have been mostly discussion: I would be speaking 20 of 75 min, and the students would be speaking the remaining time.

What was improved? What was your best online teaching experience?

Not much. A few things were interesting. The chat feature on Zoom and WebEx was useful. Students sending notes without interrupting. Student participation was improved, but it meant I had to multitask. In my first course after a few weeks, a

colleague suggested that I split the class into two halves and spend one day a week on each. I shifted to this and found we could have more conversation. I was reluctant and worried about contact hours, but it seems we could do more. It took more effort.

The best experience was when we switched to smaller groups, from about 25 to two groups of 13. I discovered we could have a discussion, and that was exciting, but the excitement faded, and we got tired.

What was lacking? What was your worst online teaching experience?

Human contact was lacking. The technology was lacking: students kept their cameras off, they had connection problems, students were reluctant. Once toward the end of the semester, I went to a demonstration and a person approached me and said they were my student. I did not know what they looked like.

What was your overall experience in terms of effort and success?

It took quite a bit of effort. I am used to having a set of questions to discuss rather than a prepared lecture: I had to prepare enough for me to be speaking the whole time because there was not a discussion among students and the students needed me to ask questions and guide them. It went from me speaking 20 of 75 min to 60 of 75 min, and it was structured about me speaking rather than a discussion.

What new approaches did you try, and how did they work, and which might you use or adapt in the future, online or in-person?

The chat feature and dividing the class into two groups. Dividing worked, but I would not do that in person. Online chat during in-person teaching would be interesting. Especially as I had a student who stuttered: for them, the chat feature was much better.

Did you already have the equipment and training necessary for teaching? How was your access to hardware, software, and training for teaching?

I had a camera and headset already for calls. When we could not come to our offices, I had to purchase more equipment and had to use 3G on my phone.

I had no training. I had one WebEx training session at the university, but I learned by myself with students and my kids' help. I learned in the classroom.

Did you find online interfaces compatible with your teaching approach?

No, not compatible. I want students to participate. Teaching students to write takes much interaction.

Did you require assistance, and if so, how did you receive help?

IT was helpful. They were always available. My kids knew how to do things.

How did your institution support your online teaching?

It did a really poor job. I had no access to my office. Information was limited. We did it on our own.

Did you get any feedback from students?

Not really, little. I usually have good contact with students, and this remained the case. I write recommendations for them. Students were very happy to return to in-person classes.

How did the lockdown affect other aspects of your professional life, especially research and service?

I was on leave and supposed to write my book. Year 2019 was very distracting. I had to work very hard, and my kids were at home, so I would wake up at 5 am to write. It was finished, but it was very tough, and I had to push myself very hard. I have not been able to do anything since.

My service had lessened and is still diminished. Everyday worries and everything.

What would be your concerns when hiring someone whose education was mostly or entirely online? Would you recruit someone to your graduate program whose entire undergraduate education was online?

I would be concerned. We have a small program, and the cohort is a close-knit community. I feel they each reinvent themselves: that transformation cannot happen online. The student experience is lacking. The transformation that happens to undergraduates in college is about, indeed requires, being in a community of learning, and that learning journey is about discussing with other students. What we lecture is not the main part; it is the interaction, the relationship.

Are there experiences related to this subject that you would like to recount?

No answer recorded.

D

Had you any relevant experience with online teaching?

No.

What prior experience, of any sort, as a student or instructor had prepared you best for online teaching?

Best was having been an organizer because teaching is example of organizing. Making documentaries and writing fiction are relevant. Any new medium, no matter how dark, is a means to communicate. Using a new method and being critical of it is not new experience, rather both a Godsend and shackles.

What was the most remarkable teaching experience you had online?

The fact that it does not work. It may work if someone has bandwidth. I am now very sensitized to the phrase, "Can you hear me?" It is like nails on the blackboard. Internet providers do not know what they are doing, and it does not work. There

is any number of things that can go wrong. The Lebanese experience is not online teaching, it is online reaching.

What was improved? What was your best online teaching experience?

Something is better than nothing. We are humans, and it was a means to tell stories, but we are not two-dimensional screens, and that missing component is very important. I do not know if I am talking to people: it is not possible to know how to conduct a workshop. Breakout rooms are not a solution for many aspects, such as spontaneity. Normally, I would see and raise an eyebrow: I cannot see that online. The students might not have electricity. But it is better than nothing: we learn in real time. In my teaching, we used a different system, Discord, not WebEx or Zoom to have better bandwidth.

Best experience? The best of bad was that at least we could continue the process of teaching even if we do not know how to do it. Students were there: Avatars were sometimes rude, and how to have a real conversation with a strange avatar? Best is that it happened because the alternative was being nothing, especially with the COVID context. We will never get rid of online. Do not fight it: we need to use it to our advantage. I am not a Luddite: technology does not replace humans.

What was lacking? What was your worst online teaching experience?

Humanities are about human emotions. How do I find this, how do I extract this from an avatar of a duck? Even if there is power and bandwidth, there is a lack of humanity. The classroom should be a place of drama.

There were lots of worst experiences. I did not who was there. They may or may not be there. How do we discuss anything, if when I call on someone and it takes three minutes: there could be a valid reason. They are not in the classroom: they are not there. Where are they? Not in the place of learning: they are struggling with living, and the family home can contradict learning.

What was your overall experience in terms of effort and success?

We got through, so it was a fantastic success by a very broad sweep of measurement. It is remarkable even if students accomplished half what can be expected in a semester with no bandwidth.

What new approaches did you try, and how did they work, and which might you use or adapt in the future, online or in-person?

I used to do make-up classes if I traveled. This time, I would give advance classes before travel and use the students' choice of software, Discord, that is excellent and worked much better, and they chose it. I was so worried about physical security in Lebanon, I was planning to meet students off campus where it was an easier and safer place for students to reach. And I had them use a pen. I will always offer off-campus options, and will anticipate crises, and give sessions in advance.

I also learned that I am a teacher and not an undertaker, and I will not act as an undertaker. The only thing I have for students is time, so I had a Write-a-thon on a Saturday. This was new, and it worked so well that I will do it again early in the

semester. In response to the Lebanese crisis, I gave them my time and did not worry about the minimum number of sessions.

Did you already have the equipment and training necessary for teaching? How was your access to hardware, software, and training for teaching?

I already had my own equipment. They would not give us a Zoom license. I had no training and would not have had. I learned on the job and put faith in the students to teach me.

Did you find online interfaces compatible with your teaching approach?

I adapted with ups and downs. I do not use a manual for creative writing, so I only give feedback and got the students to give feedback to each other. Sometimes we could meet, but sometimes we could not. I set my office hours as standard, and made myself available to students based on their schedules.

Did you require assistance, and if so, how did you receive help?

Yes, I required assistance and got help from students for technical issues in class.

How did your institution support your online teaching?

I do not think they did. The department helped me with some things on campus, and also IT did when asked.

Did you get any feedback from students?

I asked students what I did wrong. This time students considered that we could not do some media demonstrations because of bandwidth. I felt bad about this, but nothing could be done.

How did the lockdown affect other aspects of your professional life, especially research and service?

Negative impact. I was not able to meet colleagues and collaborators for discussion, but there were some advantages. I am used to organizing events and discussing when authorities monitor, and I learned to speak in code. I am so used to difficult situations when communicating and used to making do. I am not speaking to you, I am speaking to Big Brother, and while you can listen, technology is playing with us. So, we learn to speak in code.

What would be your concerns when hiring someone whose education was mostly or entirely online? Would you recruit someone to your graduate program whose entire undergraduate education was online?

I would have to meet them. I would be concerned that they would not know where the toilets are, where to get fed, that the cats are not wild, the basics of people, how to read faces. I would worry about getting them to be human. Nothing has changed from kindergarten. If you remove the human element, you dehumanize them, and we have to resist it.

Are there experiences related to this subject that you would like to recount?

No answer recorded.

E

Had you any relevant experience with online teaching?

I had used Zoom for fitness since the very beginning of the pandemic, and to attend talks, and had a collaborative in-person exhibit that went online. I am part of a collaborative interactive practice group with weekly meetings that went online.

What prior experience, of any sort, as a student or instructor had prepared you best for online teaching?

Being a parent, organizing birthday parties, the ability to read faces to manage interpersonal exchanges, negotiating with children. There was nothing digital, but knowing about Zoom and conference calls was helpful.

What was the most remarkable teaching experience you had online?

Teaching anthropology when I was no longer physically located in the same space as students opened up cultural questioning without a common ground and no "Lebanese hegemony": the "we" no longer existed, no longer would one assume Lebanon was the context, especially as now we have diverse students from outside Lebanon. Students and I did not assume we shared a culture with the people in the screen. That was an advantage because normally, it is a barrier in anthropology.

What was improved? What was your best online teaching experience?

Cultural anthropology in an introductory course was improved online by freeing us from the Lebanese hegemony. It was easier to connect concepts and theories with the urgency of reality, to accept that the world is going to hell. The apocalyptic discourse and world crisis helped them to be critical. "Why are you here, and what do you want from this course?" was no longer melodramatic.

The best was giving a writing workshop, three-hours weekly, to graduate students: we need to have graduate students writing, and me being abroad and in relative comfort, I was able to help students develop realistic expectations and help them form a community.

What was lacking? What was your worst online teaching experience?

The technical, especially for students. How do you call them to the blackboard? How do you make up for weak connections? Also, they needed help to negotiate boundaries to have time for class even while home. The administration totally failed by not addressing that students might not have internet and electricity, and they do not have home offices. I tried WebEx, and it was horrible. I bought Zoom personally and shared it with a colleague who could not afford it.

The worst experience was trying to look like an adult while staying at my parent's house when my father would intrude on camera. That lack of control over the professional space was frustrating, embarrassing, and distracting.

What was your overall experience in terms of effort and success?

It was exhausting to prepare and to be "on." To have eye contact on the screen was draining. It took more emotional labor. Success was less. I lowered expectations and spent more time thinking about how I was teaching, and the discussions were not as wide ranging. It was hard coming up with exercises that could give students a sense of anthropology as a living science conducted amongst people in their familiar spaces.

What new approaches did you try, and how did they work, and which might you use or adapt in the future, online or in-person?

I tried breakout rooms online. Usually in physical classrooms, I put students into small working groups, but the classroom acoustics interfere. Breakout rooms are isolated from the noise and distraction, so that was better. For a few collaborative exercises, my control over the timing and pairing for student encounters improved their grasp of concepts. I would like to try confronting the Lebanese hegemony in person. Also, I had close readings with undergraduates online, by sharing PDFs on my screen and reading and annotating word by word, and I am hoping to keep this.

Did you already have the equipment and training necessary for teaching? How was your access to hardware, software, and training for teaching?

A relative gave me an extra screen, I bought a camera, I had earphones, and bought a headset to avoid losing my voice. A relative who is a teacher helped with tips about additional software, but I did not have time to develop them in my teaching.

Did you find online interfaces compatible with your teaching approach?

No. I had to adapt. Teaching is performative, dynamic, and responsive. There was no board, no physical space, I overworked my voice. Facing blank squares sometimes with names like "iPhone," I tried to pick up on student cues by word choice, but that was very difficult and exhausting. The activities with the informal, weekly, (extracurricular) colleague group gave me the experience to engage the limitations more productively, but then, nothing was at stake in that extracurricular setting.

Did you require assistance, and if so, how did you receive help?

My family helped. For online exams, IT was essential to set them up and walked me through it (on WhatsApp). However, the grading component of the online exam was useless, since spelling mistakes and idioms prevented the computer from recognizing answers. I had to regrade everything.

How did your institution support your online teaching?

The institution did not support at all. I felt like it was on another planet. But the department did by advocating for a shared Zoom account, at least, and providing a site for commiseration and brainstorming.

Did you get any feedback from students?

I had structured requests and surveys asking what worked for them. These were helpful. The graduate students were good and gave feedback, but established interactions for feedback were fewer. I had high attendance in my undergraduate courses, which surprised me.

How did the lockdown affect other aspects of your professional life, especially research and service?

I cancelled research trips, cancelled interactions with colleagues. It was really hard to produce writing when it felt like the world was elsewhere (or just ending), but I got my book out. I was confined to the desk, so I could not conduct fieldwork. I had longed for extra time to focus on processing my findings and reading background literature, but I discovered that it was not to be without unstructured collegial interaction. You need input, feedback, daydreaming, and reassurance from colleagues who are not all watching their lives fall apart.

What would be your concerns when hiring someone whose education was mostly or entirely online? Would you recruit someone to your graduate program whose entire undergraduate education was online?

For hiring, I would be concerned by their ability to address and to be alert to everything that cannot be digitized. For recruitment, I would like to hear how they can read texts together. I fear having to judge.

Are there experiences related to this subject that you would like to recount?

The transition back was extremely jarring. It was unclear what expectations for participation and timely work could be, and I think that vagueness left everyone undermotivated. Also, I realize how much I had become unused to all the information conveyed by in-person: one's physical mannerisms, one's bodily style. I must have been projecting much on students when I could only see faces and hear warped, echoey voices. What physicality, locatedness, social belonging I was filling in: I had not realized until they came into the classroom with different bodies and beings that, already a month into classes, I had to reassess. Everyone went from having equal space (all had their cameras on) to half faces (covered by masks) and no convenient name tags. Usually, I have a survey about student backgrounds and interests whose answers I draw on throughout the semester to incorporate the students' fuller lives in the classroom. This time in-person, I could not assimilate it, and I feel much less that I know them, I feel less able to let them all be their different selves to produce together the specific cases and concepts in class. Usually, the class comes together, but this semester I did not feel it happened with my either of undergraduate section.

F

Had you any relevant experience with online teaching?

Only online professional talks and workshops, nothing systematic.

What prior experience, of any sort, as a student or instructor had prepared you best for online teaching?

I had pre-academic experience with media, TV, and I consider myself media literate, but nothing had prepared me to teach online.

What was the most remarkable teaching experience you had online?

The most remarkable online teaching experience was seeing the effort of students to overcome the alienation induced by technology, where communication takes place through a standard interface. In the second semester, it was rewarding seeing the natural collaboration efforts amongst students to overcome the limitations of online education.

What was improved? What was your best online teaching experience?

I managed to retailor my courses to be more accessible to undergraduate students and lowered my expectations about their ability to retain, especially non-majors. I normally assign several writing assignments through which students perform critical commentaries on assigned texts, as well as develop argumentation and synthesis. Normally, by the end of the semester, I notice improvement in their writing skills. However, this time I did not see that. So, in the second semester, I lowered the pace of the course, made sure to pause on various assignments and provide more comprehensive feedback before we would advance to another topic/assignment. Given the problematic nature of assessing presence and participation with so many issues with electricity and internet, I introduced a mode of assessment from the post-Soviet system: oral exam interviews.

What was lacking? What was your worst online teaching experience?

What was lacking was a phenomenological dimension of the teaching experience: to sense the classroom, from the students' mood to their preparation, their reaction to material, and whether lecture affected them. It was more difficult to overcome the gap between the communicated course material and the students' reception of it. With all the other crises in the country and globally, students' experiences are more fragmented. Learning in isolation was not conducive to communication. The worst was during the recent political unrest when students joined online from the classroom because I was unable to exit my neighborhood due to violence. I was teaching neo-Kantian aesthetics from the hallway of my apartment under gunfire and RPGs. This seemed untimely, and we changed the conversation to discuss the contemporary political and social life in Lebanon and the way it affected the students. It was useful to be able to switch the students to addressing the conditions in their own historical moment.

What was your overall experience in terms of effort and success?

A lot of effort is spent to deliver online, to create synergy and sense of community, to keep students' attention. It was difficult to retain during online courses given that students probably have several other screens and tabs opened—social media sites, news, and so on. There is a specific economy of attention brought about by the fact that the online course is just another thing on the screen. Students did not have the physical transition to campus environment, neither did they have a separation between private and public lives.

What new approaches did you try, and how did they work, and which might you use or adapt in the future, online or in-person?

I held oral exams and conducted exercises that promote collaboration during online learning. For instance, we collaboratively developed an online dictionary of key concepts that students were responsible for writing up. This is continuing. Another exercise that I am still using, was to have them take the "minutes" of the course: one student would take notes and share them with the class.

Did you already have the equipment and training necessary for teaching? How was your access to hardware, software, and training for teaching?

I had an old laptop that was insufficient, and the Faculty provided a better one. I had my own headset. I had no training but caught up quickly.

Did you find online interfaces compatible with your teaching approach?

Yes, sufficiently so. I could switch back and forth, though I would prefer that students turn on their cameras, and always had some with cameras on. Last spring, I had so many plagiarized papers, even by senior student who had high GPAs. They claimed to be overwhelmed, especially Architecture and Graphic Design students. I had never seen so many plagiarized papers.

Did you require assistance, and if so, how did you receive help?

No, and I did not approach anyone for assistance.

How did your institution support your online teaching?

They supplied the laptop, and on campus, there was guaranteed electricity and internet. IT gave support for the battery and equipment.

Did you get any feedback from students?

I held feedback sessions, as always, at the end of the semester. All students were displeased, all were dissatisfied. They claimed they had to spend more time and could not focus.

How did the lockdown affect other aspects of your professional life, especially research and service?

My research required psychological adjustments. My service was productive. Performing minor tasks was therapeutic. Because of the difficulty of paying attention to productive research, I spent time on minor service tasks. I took much time and effort to help adjunct faculty. We had a departmental forum for teaching online, and it was really excellent. We shared experiences and recommendations. That is not continuing: we are more fragmented because of Lebanon's situation and wanted to focus on graduate students making up for the lost time.

What would be your concerns when hiring someone whose education was mostly or entirely online? Would you recruit someone to your graduate program whose entire undergraduate education was online?

For hiring, if I had any concerns, it would be the ability to foster interpersonal relationships, especially with students and to have a participatory classroom. For recruitment, not really. Museum visits and practical activities were not available, but international museums launched online exhibitions.

Are there experiences related to this subject that you would like to recount?

Online experience made in-person teaching much more valuable. The students came with anticipation and appreciated courses. They did not take classes for granted. I found it much easier with students who already had experience with in-person learning in the university, especially graduate students.

I fear this forced experience will accelerate certain processes of delivering packaged content in higher education, creating technologically mediated teaching environments where the medium itself is more valorized than the content. Some of the demands—such as posting lectures online-further accelerates the commodification of higher education.

G

Had you any relevant experience with online teaching?

Not at all.

What prior experience, of any sort, as a student or instructor had prepared you best for online teaching?

I never taught online and never took an online course.

What was the most remarkable teaching experience you had online?

I was happy with the student interactions: attendance was better, and they were more interactive, especially on the chat feature. I left student microphones open for students to ask questions.

What was improved? What was your best online teaching experience?

Because they were at home and the lab courses were online only, I asked them in the lecture course to make use of household items to demonstrate concepts to self, parents, family, and friends, and send a video to me. It is difficult to do technical activities at home, but we managed to measure the speed of light with microwave ovens and convert their computers to oscilloscopes using a simple circuit, microphone input, and downloaded software. I would share the recordings with the class. I asked for 5 or 6 at-home experiments. It took creativity to have them do demonstrations at home with what was available. Beforehand, I used to do in-class demonstrations. So not to replace live demonstrations, but in addition to them, I did all the normal demonstrations live online and had them do extra demonstrations at home. The home demonstrations were very successful. The value was in having them explain them to their families. That was very useful. The students were very happy, and it was reflected in their course evaluations. The experience was good.

What was lacking? What was your worst online teaching experience?

Most difficult was how to fairly assess. Testing was difficult, and there was no good system of proctoring. The worst experience was a technical failure of the online lecture platform, and I needed better camera for demonstrations. I always had my camera open so that they could see me, but the students kept theirs off.

What was your overall experience in terms of effort and success?

We had plenty of time and so channeled it into teaching, and it was worth the effort.

What new approaches did you try, and how did they work, and which might you use or adapt in the future, online or in-person?

The at-home demonstrations. I encouraged them to do them this online semester without requiring them, because with in-person teaching, they were not worth the effort. I am considering using them in the future. Recording and sharing recordings was a new approach. I share old class recordings in addition to live.

Did you already have the equipment and training necessary for teaching? How was your access to hardware, software, and training for teaching?

The department brought me a camera, and I bought my own headset. I never had training. From the department, I had technical support for demonstrations, such as a camera stand, but not all departments would have such support.

Did you find online interfaces compatible with your teaching approach?

Yes, I managed well.

Did you require assistance, and if so, how did you receive help?

I did not ask for any assistance; I managed fine.

How did your institution support your online teaching?

WebEx.

Did you get any feedback from students?

I believe the feedback was positive. Several students appreciated how active I was.

How did the lockdown affect other aspects of your professional life, especially research and service?

Research has been very hard, I could do very little to no research. I had to ask permission to come to my office. It was the most ridiculous thing to have to ask permission to come to the office to teach considering the bad internet at home. Not allowing us on campus was the most ridiculous decision. They abused faculty by insisting that we enter only from Main or OSB Gates. I was refused at Sea Gate, and was told that none of my colleagues complained, but entered anyway.

What would be your concerns when hiring someone whose education was mostly or entirely online? Would you recruit someone to your graduate program whose entire undergraduate education was online?

For hiring: Do we have a choice? I would have concerns as to the training they had. For recruitment, it is hard to say now. I have the feeling from this in-person semester that students are more relaxed in a bad way, that their level is lower. It might have a component of other crises in a difficult combination.

Are there experiences related to this subject that you would like to recount?

Overall, it was not a bad thing. The experience was a new, strange experience. I never imagined it would go so far online. Overall, I think we managed pretty well.

H

Had you any relevant experience with online teaching?

No.

What prior experience, of any sort, as a student or instructor had prepared you best for online teaching?

As an undergraduate student, lecture-based courses were based on the professor just speaking in a very structured lecture. It does work, and I am familiar with it, even if students are not. Classes can be in a non-discussion format and function.

What was the most remarkable teaching experience you had online?

It was traumatic to teach without seeing faces: it was teaching to the void; there was no traction.

What was improved? What was your best online teaching experience?

Nothing. Sometimes the students arranged to all turn on their cameras together. It was emotional.

What was lacking? What was your worst online teaching experience?

I could not see them. From semiotic anthropology, we know that communication takes place at, and involves, several levels simultaneously. For example, the words one uses are constantly contextualized by the expression on one's or the addressee's face. Gestures, posture, eyes, faces, aspects of communication, which are typically below the threshold of consciousness but fundamental. Almost all of that was taken away and missing.

I have come to believe online teaching cannot work because teaching requires an element of live performance, theatre, if you will. Even the old-style, non-interactive lecture functions because it involves many levels of communication beyond the words. Take even a star researcher's lecture online, it simply does not have the same impact on your mind. Try it: it does not work; it is boring. We need the physical presence.

What was your overall experience in terms of effort and success?

It took more effort to achieve less.

What new approaches did you try, and how did they work, and which might you use or adapt in the future, online or in-person?

Not really. I tried discussion forums, but students did not use them, so I gave up. If I want to have it work, it will come at cost of great time and other learning. Assessments stayed the same, but assignments were shorter.

Did you already have the equipment and training necessary for teaching? How was your access to hardware, software, and training for teaching?

No, and I still do not: only a laptop and my field recorder rerouted as a microphone. No training.

Did you find online interfaces compatible with your teaching approach?

No.

Did you require assistance, and if so, how did you receive help?

I did not require much assistance, when needed I would turn to my colleagues for help.

How did your institution support your online teaching?

Very little. We had to share a Zoom account between ourselves, and it was a fight to get even that.

Did you get any feedback from students?

Yes, via official and personal means. Students really appreciated courses, even if they learned less. There was a mix of appreciating the efforts, enjoying the course, and learning. So, there was a discrepancy. It was not possible to learn the same, but it was not just theatre. I told them I understood the situation was terrible, how tragically unfair it was that their student years be taken away from them in this manner, and they appreciated that I did not pretend everything was good.

How did the lockdown affect other aspects of your professional life, especially research and service?

My discipline is fieldwork-based, so it was a disaster for my research and that of our graduate students. I had leave with pay to start a second project line. I did launch and conduct this project, but it was very difficult, constant improvisation with the changing circumstances, and the planned collaboration with colleagues in other disciplines was impossible to implement. The research grant we had lost 80% of its value with the collapse of the currency and banking sector, making it very difficult to get even simple equipment or to hire the research team we counted on. There was a psychological impact as well, namely, a chronic depression getting much more severe and no access to treatment. It was painful to get little recognition from our employer for our efforts in this period, a sense that they expected us to conduct business as usual, and I found myself withdrawing little by little from all service outside the department.

What would be your concerns when hiring someone whose education was mostly or entirely online? Would you recruit someone to your graduate program whose entire undergraduate education was online?

We see this year, two years into this crisis, how different, poorly prepared, the freshmen are. They have poorer skills and serious problems of attention and focus. I teach in a way that requires students to do a reading before every class session. Now they do not read. Many of them seemed not to have the capacity to spend an hour with a text, and, what is worse, they do not even seem to perceive or fully grasp that something is amiss if it is the case. I give five very simple, short quizzes over the course of the semester at the beginning of class, as a way to keep them on their toes in terms of doing the reading before class. They are supposed to be unannounced quizzes, but I quickly realized this year that I had to warn students by email to read the text before each quiz. For the first time ever, they wrote to me, as a class, to ask me to delay the quiz until after we had discussed the material in class, as if the whole point—having a quiz to help them find the motivation to read 20 pages from one week to the next—made no sense to them, or was unreasonable. They seemed confused and unaware of what is a reasonable effort to ask of them as university students. I do not blame them, not at all. Knowing what is a reasonable effort to ask of yourself is something that has to be learned, and they were deprived of an environment in which they could learn that, and we were deprived of an environment and means to adequately teach them that. They were robbed by circumstances of

a life environment conducive to developing important capacities. It is awkward to feel that university administrations minimize or ignore what a massive disruption it has been, the scars it will have left. As long as this disruption has not been properly acknowledged and reflected upon, as long as we have not taken the time to draw the lessons we can gather for it—and this needs time—it is a shame to see the university jumping to promote online teaching and online degree programs. We all, teachers and students, learned it does not work, or at least that online teaching is a degraded form of teaching, and a degraded form of learning. To pretend innocence and to describe it as positive that we learned these online skills is deeply cynical. Were we even asked for feedback about these techniques, as those actually doing the work of instruction? To not discuss, instead to promote, is contemptuous. Some very specialized programs could work, but not to acknowledge the problems and limitations? Teaching is not a form of content delivery, teaching is a rich and subtle form of social interaction. Online, the conditions only allow for content delivery.

Are there experiences related to this subject that you would like to recount?

No answer recorded.

I

Had you any relevant experience with online teaching?

No, yet the Thawra should have prepared me.

What prior experience, of any sort, as a student or instructor had prepared you best for online teaching?

I took an online course in coding about five years ago, but it did not prepare me for online teaching. I also took the two-week ASU course (Arizona State University Master Class for Teaching Online) that helped me keep students engaged. Because students kept their cameras off, I felt I was talking to myself, and the ASU course gave me ideas to use the chat feature, etc.

What was the most remarkable teaching experience you had online?

We had a big online exam with breakout rooms for proctors to watch students better. It was a disaster because one could not go back to the main room from the breakout to admit other instructors. Some rooms did not have proctors. All these settings and unexpected problems! Trying to be creative for an exam was not good, and even though we had run a pilot, we did not find that problem.

What was improved? What was your best online teaching experience?

Nothing was improved, though it was convenient to wake up and teach. There was no specific best experience, but it was easy, and time management at home was quick and easy especially when students became used to online and became engaged. The

most important improvement is that I became more comfortable managing the needed online platforms, which made the whole online experience much better and nicer for the students. The last online semester worked well: students asked questions et cetera, but still almost never showed their faces.

What was lacking? What was your worst online teaching experience?

At first, student engagement was lacking. There was no feedback, and I cannot see if they understood or not. Even at the end, there were many unresponsive students that I could not see, and I did not feel I really knew them. I am used to observing students to see if they understand.

The worst was assessment: cheating was terrible. After an exam, a student accidently told me that during the exam, the group chat had the wrong answer. Even those did badly as group. After that, we used Respondus and large question bank, and interviewed students suspected of cheating.

What was your overall experience in terms of effort and success?

Efforts were small in teaching and large in assessment. It was not so successful, but improved much over time.

What new approaches did you try, and how did they work, and which might you use or adapt in the future, online or in-person?

Not really, just the use of Zoom and Notability. I do the same thing online; it is just technology. It worked, but not as well, not as interactive. Motivated students managed fine, and the recording is useful, but other students did not manage well. In the future, I will use the question bank and the computer for half of in-person exams.

Did you already have the equipment and training necessary for teaching? How was your access to hardware, software, and training for teaching?

I had an iPad that I had been using to write in lecture halls that did not have a whiteboard.

Did you find online interfaces compatible with your teaching approach?

Yes, pretty much.

Did you require assistance, and if so, how did you receive help?

I figured out everything by myself with some help from my spouse. It would have been helpful to have had training (the training offered was the blind leading the blind).

How did your institution support your online teaching?

Not really. The WebEx platform was very bad, so I bought my own Zoom subscription.

Did you get any feedback from students?

The students did not like online education. They liked having the recording and the notes together with live teaching, which I did not have before.

How did the lockdown affect other aspects of your professional life, especially research and service?

Positively, as I was able to manage my time better. I published three papers during this time. Service was a problem, as IT is needed, and I had to hire my own people because the university IT was so busy.

What would be your concerns when hiring someone whose education was mostly or entirely online? Would you recruit someone to your graduate program whose entire undergraduate education was online?

For hiring, I would prefer not to, being worried that they did not learn much. For recruitment, I might consider.

Are there experiences related to this subject that you would like to recount?

I cannot remember well; it is fading like a nightmare.

J

Had you any relevant experience with online teaching?

No.

What prior experience, of any sort, as a student or instructor had prepared you best for online teaching?

I had used PowerPoint.

What was the most remarkable teaching experience you had online?

For the first time, I gave take-home exams of 24 to 48 h. This was the first time that students had enough time. It was different; it was good because it reduced cheating and was less stressful to monitor an online exam. Students also came with new ways of presenting their answers without copying each other as any similarities in answers reduced the evaluation.

What was improved? What was your best online teaching experience?

My own time management was improved: I was always on time. Teaching online was less stressful than in person because there were no interruptions. Students asked questions in the chat feature, which is less disruptive. Also, I did not have distractions from students talking in class. If the internet connection were good, it would be convenient to teach from home and never be late. Having my classes recorded was good too, as it worked as reference material for students and reduced the number of

students attending the office hours. When a couple of students missed a lecture due to other circumstances, they could also follow the material easily afterwards.

What was lacking? What was your worst online teaching experience?

The students access because of power outages and poor internet was very bad. At first, Zoom only allowed 40 min, WebEx was problematic, and sometimes it could not be used. Some bad students were not there or not paying attention: only the good students paid attention. Also, some faculty cheated by using recorded classes from previous semesters.

A major disaster was students cheating during online exams in any way they could. The more precautions we took, the more students found new ways to cheat, even using smart glasses. We had a mid-term exam with poor performance followed by a final exam with very high performance and many students alleging that cheating occurred, yet no conclusive evidence was available.

What was your overall experience in terms of effort and success?

About the same effort, though in large classes, many separate emails made more work than addressing a group during office hours. The good students learned, but not all students did. Now that we have returned to in-person teaching, we see that students did not learn what they needed in the prerequisite courses.

What new approaches did you try, and how did they work, and which might you use or adapt in the future, online or in-person?

I assigned take-home work and exams for undergraduate students. I asked graduate students to prepare their own questions and answers: they did it once for midterm exam but later complained to not have it in the final exam and in another course, as it needs lots of efforts from them. I will still use take-home exams for graduate students, but not for undergraduates, and maybe in senior electives because class size is smaller.

Did you already have the equipment and training necessary for teaching? How was your access to hardware, software, and training for teaching?

I used my laptop. I was given no extra equipment, not even a headset. I had no training.

Did you find online interfaces compatible with your teaching approach?

Yes, it was much the same online with PowerPoint as in-person.

Did you require assistance, and if so, how did you receive help?

I needed help with online exams via Moodle, and I got it, but I was limited when I was doing things from home because of the time required and connection.

How did your institution support your online teaching?

The Moodle team supported my exams, and we were provided WebEx (which I did not like) and a Zoom license for the department, though only one class can use it at a time.

Did you get any feedback from students?

I got mixed reactions: good students were happy, but many of them were concerned about grades rather than learning. If the grades were not good, they complained more, but that is all.

How did the lockdown affect other aspects of your professional life, especially research and service?

As an experimentalist, difficulties were in funding and purchasing imported goods. My graduate students could not come, but it was not as bad for me as for some others. My service was manageable.

What would be your concerns when hiring someone whose education was mostly or entirely online? Would you recruit someone to your graduate program whose entire undergraduate education was online?

For hiring, yes, we do not have a choice. For recruitment, if there were a choice, I would worry about the laboratory experience and validity of grades.

Are there experiences related to this subject that you would like to recount?

Online, I did not have contact with colleagues: that was a mix, some good, some bad. I learned how to work from home and realized that I do not have to come to office to get work done. I got used to communicating via WhatsApp with students in general and my graduate students. Some of these are indeed helping now: I am still communicating more online with my students, research assistant, colleagues, and service-related work using WhatsApp, email, zoom, etc., and sometimes I feel it is not necessary to visit the office unless it is needed, especially with the COVID situations not yet over completely.

K

Had you any relevant experience with online teaching?

Not really, other than during the Thawra.

What prior experience, of any sort, as a student or instructor had prepared you best for online teaching?

Nothing really.

What was the most remarkable teaching experience you had online?

I had 3-h lab activities live online, and I needed a restroom break. When I returned, I overheard students discussing the course, "I like it because we do not have to memorize much, and once I get it, it is straightforward." So, I made my presence known before any other students expressed their dissent.

What was improved? What was your best online teaching experience?

Lab activities were improved. My computer-based activities are better online: instead of walking around to each laptop, everyone could see and participate, if they chose; everyone learning from each other's problems. I did not have to repeat myself, instead, we had useful follow-up questions. Also, there is a recording that students might use, and the recordings could be used in the future as a resource.

Monitoring participation was easier in lecture because when I ask questions online with the chat feature, I can see everyone's private answers instead of a few vocal. Even the shy had to ask questions. Instead of students acting like lemmings, I could see the variety of questions and see how they clustered: I could see better what lacks of understanding needed to be addressed. I saved all the chat files for review for the next time.

What was lacking? What was your worst online teaching experience?

Not having immediate feedback through seeing the students faces looking bored, confused, or angry (it could be a positive not seeing students bored or apathetic). Having an audience is energizing: online it was flying blind.

The worst experience was not major event. I forgot to turn on my microphone, and students made fun of me on the chat, "LOL: is he talking?" after five minutes.

What was your overall experience in terms of effort and success?

About the same, I cannot say it was worse online. It was less lively and engaging, but I do not see a decrease in student learning. It could be that my courses are computer-based and adjust well.

What new approaches did you try, and how did they work, and which might you use or adapt in the future, online or in-person?

Using private answers with the chat feature, and I adjusted to ask different questions and gave more questions. It worked so well that I want to adopt it in face-to-face teaching with smart phones.

I also tried 24 to 36-h take-home exams allowing all resources other than live people. The exams were designed to take two to three hours, but they were not limited. It worked very well. I was worried students would collaborate, but only the bad collaborated with bad, so it was not a problem. The logistics of scheduling were easy, and no one complained they did not have enough time (The only time I saw some level of cheating was in a graduate course and complaints when the exam was too hard and took too much time). The take-home, long-duration format allowed me to ask better questions with higher-order thinking. Students were not limited

by access to background factual knowledge: they could look it up, and I could see more clearly what students learned. The biggest advantage was that students could see where their deficiencies were: after the exam, we reviewed the deficiencies in class and that was very valuable for students. I am using this now for in-person teaching. Also, I could ask the same questions in different form in the mid-term and final exams, and I can see that some have learned. It is easier to have more involved questions in a take-home format, and student do not have the stress of a proctored exam room.

I will also continue one-on-one meetings with students about their projects and record even though in person, so it will be available to other students as a resource, and they can see the diversity and learn from others' projects.

Did you already have the equipment and training necessary for teaching? How was your access to hardware, software, and training for teaching?

I had a little private corner that I could set up: it was far from ideal, but it sort of worked. I had no training.

Did you find online interfaces compatible with your teaching approach?

Yes, somewhat.

Did you require assistance, and if so, how did you receive help?

Not really.

How did your institution support your online teaching?

They provided WebEx and Moodle.

Did you get any feedback from students?

No.

How did the lockdown affect other aspects of your professional life, especially research and service?

My research was not affected since it relies on online data. Online committee and department meetings had the problem (and sometimes advantage) that meeting members can tune out. Interviewing student applicants online did not work well where we asked students to explain concepts on the whiteboard. However, even in normal times, international applicants were interviewed online, in that sense the pandemic erased the advantage of local applicants.

What would be your concerns when hiring someone whose education was mostly or entirely online? Would you recruit someone to your graduate program whose entire undergraduate education was online?

For hiring, I would worry they may have muddled through because it was easier to cheat. Opportunities to interact were probably limited. For our graduate program, I would consider, as some subjects are less worrisome.

Are there experiences related to this subject that you would like to recount?

In an online exam, I saw a code that had been copied. That was not so much a problem, but I then asked about the very specific, small steps that the student could not explain. Thus, if the student copied and cannot explain how it works, that is problematic.

L

Had you any relevant experience with online teaching?

No.

What prior experience, of any sort, as a student or instructor had prepared you best for online teaching?

None.

What was the most remarkable teaching experience you had online?

There was nothing remarkable.

What was improved? What was your best online teaching experience?

I found there were stages to online teaching: in the beginning, I hated it: it was tiring. By the end, it was easy, but I cannot say that I like it. At first, I based my classes on PowerPoint presentations that contain the material I want to go over. I used to show the presentation as a full screen and without my face. The students did not show their faces either: this it was strange. Then, I showed my face and felt human, but students still did not show theirs.

Another improvement was that I found my presentations do not have to be polished. In my in-person classes, I tend to use PowerPoint in lower-level courses, but I always use the board in senior courses, where ideas needed to be worked out. I did not have the patience to learn how I can do a similar thing online. I nonetheless started to use non-polished PowerPoint presentations, where I would start with a blank or minimal things on a screen and add to it words and figures one by one, so making it similar to what I would do in-person. That greatly helped.

What was lacking? What was your worst online teaching experience?

How I perceive teaching is that I need to have students work in class, in order to observe them and give them feedback during in-class activities. I tried to do this online, but it did not work. Students need to see how I think, and I need to see how they think.

I tried filming myself at the board, recorded it, and placed it online. I watched it and found it strange, not good, and did not use it.

What was your overall experience in terms of effort and success?

In the beginning, I put lot of effort in preparing for each class, only to get moderate success. This happened because I was trying in providing well-polished and informative PowerPoint presentations. Later I started to make my online class closer to in-face class in the sense that I introduce things on near blank slides. This still required effort, but the classes were more successful, at least from my perspective.

What new approaches did you try, and how did they work, and which might you use or adapt in the future, online or in-person?

I did not really try anything new, but it did evolve to where I added showing my face. Now that I am used to this way, I am unlikely to try more new approaches.

Did you already have the equipment and training necessary for teaching? How was your access to hardware, software, and training for teaching?

My only equipment was my laptop, which I already had. I had no training, so I figured it out myself, which is why I used Zoom.

Did you find online interfaces compatible with your teaching approach?

Online was compatible in part, and I adjusted my approach, but certain activities cannot be done online.

Did you require assistance, and if so, how did you receive help?

No assistance.

How did your institution support your online teaching?

No support.

Did you get any feedback from students?

Students complained about internet lagging. I do not know if students watched the recordings online.

How did the lockdown affect other aspects of your professional life, especially research and service?

It did not affect my research very much because I am not an experimentalist. I am not so involved in service in any case.

What would be your concerns when hiring someone whose education was mostly or entirely online? Would you recruit someone to your graduate program whose entire undergraduate education was online?

Very reluctant.

Are there experiences related to this subject that you would like to recount?

Earlier, I would have dreaded online teaching, but now I am used to it, and it is fine.

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Had you any relevant experience with online teaching?

No.

What prior experience, of any sort, as a student or instructor had prepared you best for online teaching?

None: I had not used even Skype.

What was the most remarkable teaching experience you had online?

The department provided a writing tablet, and at my desk, writing one place while looking at another, the screen, and not paying attention to how I was setting (being focused on explaining the material), damaged my back so that I could not walk properly for a couple of months.

What was improved? What was your best online teaching experience?

Nothing good except that students were not shy and asked many more questions than usual. I have an undergraduate course of about 100 students, and the pre-pandemic class asked far less questions than when the course was online.

What was lacking? What was your worst online teaching experience?

I could not see the faces of the students, and hence I could not tell if they were really getting the material.

What was your overall experience in terms of effort and success?

Big and little, respectively.

What new approaches did you try, and how did they work, and which might you use or adapt in the future, online or in-person?

In my graduate course, I gave easier homework and exams than usual because the students would not be able to handle the usual level.

In the undergraduate course, we redesigned our examinations against cheating. Students had two cameras each to see their desks, hands, and whole faces, and they were asked not to touch the keyboard during the exam. They wrote their exams on blank paper and scanned them with their student IDs at the end. We used many live online proctors, and no one could leave before they show on camera the same ID that they had scanned.

Did you already have the equipment and training necessary for teaching? How was your access to hardware, software, and training for teaching?

I had no training. The department gave me a web camera and the writing tablet.

Did you find online interfaces compatible with your teaching approach?

I used to watch students; online I was blind. No, it was no way to communicate, the showmanship was not possible, it was like stand-up comedy without an audience. So, not even close.

Did you require assistance, and if so, how did you receive help?

I trained myself, and my kids helped.

How did your institution support your online teaching?

I think the pandemic changed things too fast for institutions to adapt smoothly to the resulting constraints.

Did you get any feedback from students?

They were sympathetic, but they provided no substantial feedback.

How did the lockdown affect other aspects of your professional life, especially research and service?

In 2006 and 2008 (the July 2006 war and a period of civil strife in May 2008), I worked well, but during the pandemic lockdown I was not productive; I felt my intelligence had diminished.

What would be your concerns when hiring someone whose education was mostly or entirely online? Would you recruit someone to your graduate program whose entire undergraduate education was online?

I would be mainly concerned that students did not learn what they need for graduate school or professional careers. I would be very hesitant until they prove that they in fact attained the needed knowledge.

Are there experiences related to this subject that you would like to recount?

The case of British Airways Flight 38 in 2008 is relevant. Two years of investigation to discover that cold temperatures during the flight caused ice crystals to clog the tiny tubes of the fuel heat exchanger, and the engines could not provide sufficient thrust. This example is meant to illustrate that things evolve to reach a level of sophistication where even the tiny details matter in a big way. Established methods of teaching have evolved to such a level of sophistication, and hence many little things matter that changing them defies prediction.

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Flagship Projects for Accelerating R&D During the COVID-19 Period in Kuwait

Samira Omar Asem and Sabah AlMomin

Abstract Flagship Projects (FPs) are defined as multidisciplinary research partnerships, aimed at aligning capabilities to confront big transformative goals in major significant areas of research. Their large-scale, long-term, and clear focus on adaptation and adoption of research outputs and outcomes are designed to maximize delivery of positive impact on the national vision for development. Therefore, an FP serves to generate model solutions to important challenges faced by the society and the country, while generating awareness of the problem among the public leading to national or international visibility. Since the year 2020, COVID-19 pandemic has caused and still is inflicting severe impacts on health, economy, and the environment. Kuwait has acted promptly to limit its spread within its borders. Kuwait Institute for Scientific Research (KISR) forms a key role in the national innovation ecosystem. In addition to establishing policies, health and safety measures, and awareness campaign programs on the pandemic, KISR has established a Task Force in March 2020, to oversee its multidisciplinary FP, tackling the pandemic-related challenges to accelerate the preparation of research proposals in public health, economics, the environment, water security, food security, and other innovative pandemic-related issues in the fields of artificial intelligence (AI), Internet of Things (IoT) and information technology (IT). Funding sources for the FP were provided by Kuwait Foundation for the Advancement of Science (KFAS) and KISR. The outcomes of the FP provided solutions for sustainable recovery and overcoming challenges arising from infectious diseases in the country. It has also accelerated the preparation and execution of the research and development (R&D) projects related to the COVID-19 pandemic in addition to sharing results with local authorities for mitigation measures. Application of FPs at research institutions like KISR is necessary and highly recommended to direct the efficient and productive use of institutional resources in terms of workforce, facility, and finances.

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1 Introduction

When the novel coronavirus was reported as an unexpected unknown variant of the Coronaviridae family, it has become one of the biggest threats to public health, the global economy, financial markets, and industrial sectors. It has caused insurmountable losses to human lives, jobs, livelihood as well as disruptions in education and food security, and challenged an overburdened health system globally. As the virus spread rapidly around the world, it posed unprecedented challenges for policymakers, medical professionals, scientists. Governments, business leaders, and citizens, all were required to adapt to constantly evolving socio-economic conditions and respond to unforeseen challenges. As of 3 March 2022, the World Health Organization (WHO) reported 438,968,263 confirmed cases of COVID-19 worldwide, including 5,969,439 deaths [1]. In the Eastern Mediterranean, there were 21,239,692 confirmed cases and in Kuwait, 620,980 cases were reported with 2540 deaths (Fig. 1) [1]. Weekly confirmed cases per million people in Kuwait are shown in Fig. 2 [2]. These figures are updated daily by the WHO and Our World in Data [1, 2]

While no country could escape the negative effects of the COVID-19 pandemic, Kuwait's sound macroeconomic fundamentals allowed it to withstand some of the most severe challenges imposed by the crisis. The country entered the pandemic with the third highest GDP per capita in the Arab world, giving residents a cushion against some of the hardships to follow. The current account balance was strongly positive at the start of 2020, as Kuwait retained a high sovereign credit rating and one of the world's largest sovereign wealth funds. At the same time, solid consumption growth prior to the outbreak points to a diversifying and prosperous economy.

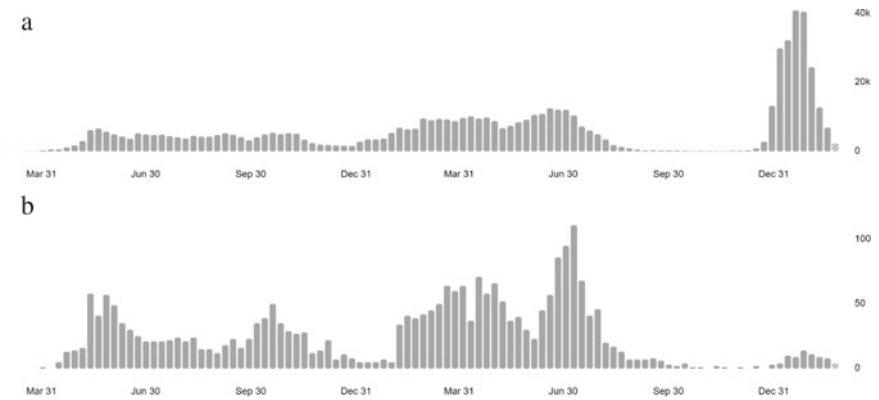

Fig. 1 The number of confirmed cases of COVID-19 (**a**) and deaths (**b**) in Kuwait until 3 March 2022 (WHO) [1]

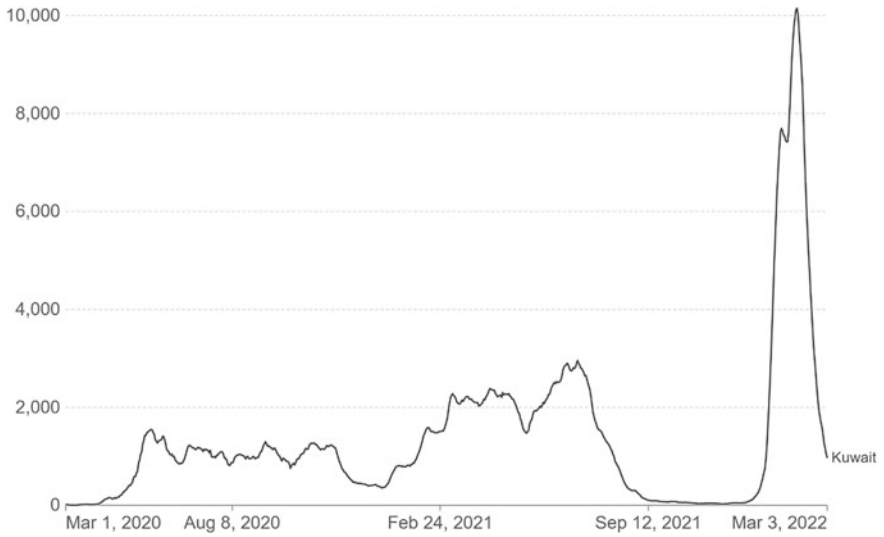

Fig. 2 Weekly confirmed COVID-19 cases per million people in Kuwait [2]

At the onset, Kuwait took actions to implement strict measures against the pandemic. The government initiated a call upon institutions to propose advanced ideas and programs relevant to their respective mandates. The Kuwait Institute for Scientific Research (KISR) responded to the government initiative by participating in public awareness programs and offering its technical knowhow and expertise in research and development (R&D). The institute also established collaborations with the Ministry of Health (MOH), Kuwait University, non-governmental organizations, and other public and private sectors. COVID-19 has adversely affected R&D and put a halt on the regular activities with less clarity and doubts on the abilities to cope with crises. Some research projects were delayed, priorities were refocused and stressed on more short-term duration plans while longer-term ones had their scope diverted towards research on sustainability. The situation and response of translational research was supported by Kuwait Foundation for the Advancement Sciences (KFAS) as funding body. The foundation has created a rapid response funding system and fast-tracked the processing of grant applications. While a typical grant application review takes several months, decisions for the rapid grants would take just a few weeks, allowing researchers to mobilize more quickly. This is exemplified in having the institute embark on a multidisciplinary Flagship Project (FP) tackling the many facets of the pandemics including economic, environmental, public health, energy, food and water security issues by employing advanced technologies, and innovations. KISR introduced the concept of FP in its 9th Strategic Plan (2020–2025). Among the benefits of FPs is the generation of enhanced value creation from R&D in areas of expressed national priority, such as the case of the pandemic. Thus, an FP is initiated in response to health crises, with the aim to identify emerging challenges in Kuwait, assess responses, and propose solutions through scientific innovative research. The

purpose is to enhance Kuwait's preparedness by supporting the health sector to reduce disease impacts on society in the future. The approach is to provide solutions that are sustainable, applicable, and affordable based on lessons learned from the current global crisis. The expected outcome of the planned research is the development of tools, technologies, and research capabilities to support the country during future similar crises.

2 Background Information on the Pandemic

Infectious agents such as the current coronavirus have caused global panic and confusion. Its impact has touched all sectors of life with many unexpected challenges. The lack of knowledge of the new virus, SARS-CoV-2, is the main reason for the uncertainties [3–5]. Challenges arose and countries responded with measures to control and counteract the disease in collaboration with the WHO. However, many countries lacked preparedness to face the challenges and impacts of the COVID-19 outbreak [6]. The situation highlighted the need for research and innovation to enhance Kuwait's preparedness and manage the impact of the pandemic.

COVID-19 first occurred in China, Wuhan, on December 31, 2019 [7], and was declared a pandemic on 12 March 2020, by the WHO [8]. The declaration of COVID-19 as a pandemic is based on the risk factors that determine the potential danger of an outbreak [9]. According to the Global Challenges Foundation (GCF) the factors include the virulence of the microorganism to cause illness and death; the infection spread in a population and the incubation period of the virus [10]. The transmission of the virus occurs through closeness with an infected person whether symptomatic or asymptomatic, or through touching infected surfaces then touching the mouth or nose [11].

The rapid outbreak of the COVID-19 pandemic worldwide was due to several factors, mainly the limited knowledge of the new virus, its high and rapid transmission, its unpredictable behavior, and the lack of cure or vaccine. The length of time between the infection and the symptoms appearance is another factor that is more likely to cause considerable rapid transmission and damage. Moreover, future forecasts are hard to predict due to the asymptomatic transmission, length of time of infection and the uncertainty around the demographic attitude of the virus regarding age, gender, and ethnicity. The lack of preparedness and government policies also play a key role in contagions. International research work is still ongoing on identifying the risk factors associated with the transmission of the virus, which may include different environmental elements besides direct contact with infected people [12].

The race has been fierce to develop a vaccine against COVID-19. Most vaccines were developed through genetic engineering, such as HPV (Human Papillomavirus Vaccine), hepatitis B vaccine, a vaccine for Ebola, and the rotavirus vaccine. The average time to develop a vaccine is 10 to 15 years, however with the advancement of biotechnology tools, the time of vaccine development has been shortened significantly [13]. The development of a new COVID-19 vaccine was estimated to

take 12–18 months, compared with the time taken for the development of the Ebola vaccine (5 years), which was the fastest developed vaccine. The production time was ambitious given the fact that the product must go through clinical trials to prove its safety in addition to the time it takes to produce billions of doses [14]. By April 2020, there were 90 vaccines that were developed against SARS-CoV-2 across the world [15], and as of January 2022 only 12 vaccines obtained Emergency Use Listing (EUL) [16]. By March 2022, there were more than 10.5 billion vaccines doses administered worldwide [14].

3 Consequences of the Pandemic

The COVID-19 pandemic has caused considerable damage to the social, economic, education, food, and health sectors. The crisis caused the worst global economic recession since World War II. The industrial sector failed to meet local demands in the health and food sectors. Many gaps were exposed in several government systems, which have forced governments to rethink their policies. Uncertainties appeared in policies of climate change, trade, travel, transportation, food, and the allover sustainability of the governments' systems [17].

With respect to public health, 7 billion infections and 40 million deaths were predicted if no interventions were taken, while mitigation strategies, if applied, may save 20 million lives. However, if more aggressive suppression strategies are applied, 38.7 million lives would be saved equivalent to 0.2 deaths per 100,000 populations per week. These predictions were based on statistics reported by different countries [18].

Developing and poor countries are in a worse position to deal with the speed of contagion and its consequences due to limited capacities, facilities, and inadequate planning. Some countries had difficulties in dealing with the implementation of safety measures like social distancing due to dense populations and limited facilities [18]. According to the International Monetary Fund (IMF) there are more than eight hundred million people malnourished in developing countries with weak immune systems, reflecting a situation that makes any outbreak uncontrollable. The Gulf Cooperation Council Countries (GCC) may not be considered developing countries for their wealth, however they had to deal with the additional challenge of the crash in oil prices particularly in 2020.

4 Combating COVID-19 Consequences

The alarming rate of the spread of COVID-19 across the globe prompted many governments to take stringent isolation strategies including complete lockdown of affected regions with closure of border and schools and cancellation of public events, in an effort to limit the transmissibility of the virus and contain its spread among

populations. Most countries responded rapidly and took the necessary measures to boost their health system to care for the patients and protect the public. The European Union (EU) and the Association of Southeast Asian Nations (ASEAN) developed an integrated comprehensive system regarding the prevention, control and medical preparedness of treatments and vaccines. Taiwan, Singapore, and South Korea demonstrated effective readiness capacities in the face of COVID-19 by implementing thorough testing, contact tracing of patients, and different schemes of social distancing and lockdown. These measures have significantly slowed down the spread of the disease.

After few months of lockdowns and relaxed restrictions, uncertainties remained on the path of recovery from the pandemic and its consequences. A range of actions has been proposed by governments, such as stimulus financial packages as the ones announced by the US, and the European and GCC countries as an immediate action for economic recovery [19]. However, future policies must address plans for the prevention of future pandemics and crises responses focusing on the role of science, technology, and innovation.

5 Global Research Trends

With the occurrence of the COVID-19 pandemic, several challenges prevailed worldwide to mitigate its effects to prevent its resurgence. However, the challenges proved to be multi-sectorial and quite complex to be addressed through individual research projects or organization. The establishment of scientific approaches in tackling such complex pandemic problems requires interdisciplinary research methodologies that cross boundaries through various aspects of sciences, engineering, and technologies. To produce strong real-world solutions, cooperation among institutions, governments, private sectors, and international organizations is much required. Such an approach has been adopted indeed by many countries to face the challenges of the pandemic.

The rapid spread of the disease has put tremendous pressure on scientists, institutions, and countries to produce effective solutions that are rapid, affordable, sensitive, and easy to use such as diagnostic kits, vaccines, therapeutics, and personal protective equipment. The availability of sufficient products was a main issue, given the demand and the rapid spread of the virus, and as many countries were not able to meet their own local demands. A global approach was adopted with the establishment of the COVID-19 Clinical Research Coalition by a group of scientists, physicians, funders, and policy makers from over seventy institutions in thirty countries to accelerate research in countries with fragile health systems and vulnerable populations. The WHO, with other foundations, launched the SOLIDARITY response fund to help countries respond to the pandemic and contribute to global response efforts [20]. The R&D Blueprint was also activated by the WHO to accelerate diagnostics, vaccines, and therapeutics. The purpose of the R&D Blueprint is to accelerate the research and

development process, develop new norms and standards, and coordinate between scientists and global health professionals [21].

Early in the pandemic and to date, research and innovation globally were focused on the development of diagnostic kits as the most important and urgent tools required to combat the disease. Diagnostic kits must be robust, fast, affordable, and based on immunoassays [22].

The ongoing research is to develop a point-of-care diagnostic device integrated with a smartphone which can reduce the cost and minimize disease spread [23, 24] The latest innovation in diagnostics was the development of a virus-specific-nano-sensor that detects the nucleocapsid protein and gives results in one minute [25, 26].

Studies on the indirect impact of the pandemic are being conducted globally on issues of environment, industry, food, and economy. Information technology also plays an essential role in any crisis. The European Commission has established a European COVID-19 Data Platform to enable the rapid collection and sharing of research data to provide a global environment where researchers can share data, such as DNA sequences, protein structures, and clinical and epidemiological data.

6 Flagship R&D Research Projects

"Flagship projects" are multidisciplinary research partnerships that align capabilities to tackle big, and transformative goals in areas of major national significance. Their large scale, longer timeframes, and clear focus on adoption of research outputs and outcomes are designed to maximize delivery of positive impact for a country. Flagship Projects (FPs) for the State of Kuwait are defined as follows: research and development projects that are strategically and scientifically specified to address largely the national development plan and in accordance with Kuwait's long-term vision and strategy, technological advancement, and innovation.

The pandemic has exposed shortages in products and facilities; self-sufficiency has proven to be a high priority in any country because of closedowns and slowdown of trade and industry. The aim of the FP is to provide support to the health sector in combating health crises and their impacts, including the COVID-19 pandemic, through research and innovation. Direct and indirect challenges and the impacts of pandemics are taken into consideration. The scope of the research must address and mitigate the challenges risen during the combating measures taken by the government to control the pandemic.

KISR took the necessary steps to develop a Flagship R&D consisting of studies that meet national needs with emphasis on two solution areas. The first solution area focused on deploying cyber technologies for testing, tracking, and knowledge awareness. Information Technology (IT) in general and Artificial Intelligence (AI) are recognized as especially important tools in the research front. An innovative approach is required to develop online applications, and databases that alleviate the pressure on the health system. The second solution area was related to developing technologies

to prevent and control the spread of diseases including the establishment of biosafety facilities. This area would provide solutions to test, diagnose, and provide protection from infectious agents. Examples included microbial detection and tracking in air, waste, and domestic water as an indicator to apply preventive measures along with therapeutics development. Other research areas were related to the indirect effects of the pandemic on the economy, food security, financial system, trade, and energy.

6.1 General Objectives and Outcomes

The objectives of the FP were based on lessons learned that could be pursued and translated through science-based-solutions. Specific objectives are listed within each specific research proposal. The general objectives of the Flagship are as follows:

- To enhance Kuwait's preparedness through innovative research and cooperation.
- To develop applicable and affordable solutions supporting the health sector in order to meet the local needs of society at times of crises.
- To deploy AI/IT technologies to provide insights and accelerate the knowledge flow on the disease spread, tracing and testing.
- To establish a national center with suitable medical and research capacity to enable KISR to participate more actively in developing diagnostic tools and therapeutics for infectious diseases.

The project will provide solutions for sustainable recovery and combat challenges arising from infectious diseases, and that meet the needs of a changing world. Specific outcomes are listed within each specific research proposal. The outcomes of the FP are as follows:

- Framework and regulatory measures to enhance the preparedness and responses to the unexpected occurrence of infectious diseases.
- Innovative tools and facilities to support the health and related sectors based on scientific innovative and translational research.
- Communication channels with the government and all other relevant entities to serve a sustainable healthy society.
- Information generation, prediction tools, statistics, and online applications for the different vital sectors in the country.

6.2 The Approach

Since the COVID-19 outbreak, many countries have entered a recession with uncertainties on recovery. Pharmaceutical companies and research institutions have focused on the development and production of therapeutic drugs and vaccines. Others have accelerated the production of ventilators, protective materials, and medical equipment. In this respect, developing countries including Kuwait, have been hit

hard due to the lack of such industries, effective planning, policies, and preparedness to meet its local needs and obligations in a sustainable manner.

Finding applicable solutions and innovative ideas will contribute to reducing disease spread and improve its control measures and impact on all sectors in a sustainable manner. A science-based-solution is the most appropriate approach to tackle any pandemic and generate knowledge to accelerate the recovery of the society and hence the country. The introduction and promotion of innovative products will aid the country to deal with crises and future pandemics while minimizing the overwhelming confusion period and maximizing preparedness. FPs provide an umbrella to tackle specific problems and find solutions that are focused, and set priorities based on the national needs and benefits. The approach was as follows:

- To establish a national, international, and internal cooperation of partnerships and capacity building, with the emphasis on promoting multi-disciplinary cross-organizational collaboration
- To develop applicable and affordable solutions with a clear pathway to impact framework incorporated in each of the research proposal (research proposals are listed below)
- To develop of web-based information dissemination system and establish an IT infrastructure
- To involve the education system (e.g., introduce a curriculum on biosafety and biosecurity)

An integrated interdisciplinary scientific approach was adopted to enhance local capabilities to assess, control, and mitigate the impact of pandemics. The approach included several activities as follows:

(a) **Flagship oversight committee and task force**

A flagship oversight committee functions as the governing and technical body of the FP to manage and organize institutional efforts for the implementation of FPs and other studies. It is assisted by a task force and its key role is centered around:

- Call for proposals:
  - Setting guidelines.
  - Evaluating, reviewing, and assessing the submitted proposals, according to the guidelines.
- Assessment of the progress of the research studies:
  - Following-up on the progress of the research projects.
  - Assessing the results within the scheduled time.
  - Solving problems or obstacles.
  - Carrying out final assessments of the research outputs and outcomes.
  - Coordinating with the different collaborative bodies.

(b) **Execution of research studies**

The submitted research proposals were executed upon the final approval granted by the flagship oversight committee. Potential ideas, which serve many sectors in the country, included:

- Studies on assessment and counter-action measures addressing the country's responses and their effectiveness in the management of the pandemic. Others addressed the impact of the measures taken by the government on the economy, industry, engineering, and related sectors. The economic crisis has been claimed to be the worst since World War II. The recovery time is unknown and unpredictable.
- Innovative scientific research on the development of tools and technologies in the prevention, detection, and methods to combat the disease. Examples included the development of surface coatings and techniques to detect infectious agents in the air, water, and wastewater, and on surfaces and packaging to control the transmission of the virus
- The development of tools using AI, IT, and other cyber technologies to support the government in different sectors. This concept included developing applications to be used for tracking patients, and the spread of the disease. The development of databases and networks plays an essential role in pandemic management. Local and international communication and big data are part of the global response, for assessment and information sharing in times of crises. The international community, societies, institutions, and scientists came together and created platforms to share the virus sequences, tracing, and vaccine development.
- The establishment of a national center for infectious diseases. The facility is to include a Biosafety Level 3 Laboratory, with a capacity for research, and which functions as a support for the health sector. The laboratory is to provide tools, consultations, and plans for disease control. It will also participate actively in the government decision-making processes and provide applicable solutions.

(c) **Implementation and transnational plan**

The FOC evaluates the outputs and outcome of all research projects and provides an implementation plan. It is also to provide a strategy for the delivery of solutions to stakeholders and works closely with national entities.

(d) **Prospects**

This involves the development of future policies and standards in view of the achieved work to support decision makers in terms of alternative economic and business solutions for trade and small and medium enterprise business.

(e) **Risk management**

The proposed research studies were set according to the recommended guidelines of the WHO on risk assessment at containment facilities of Biosafety Level 2 (BSL-2) and according to the level of risk of microbes. Coronavirus is of high-risk infectivity that requires a high biocontainment laboratory. Biosafety level facilities (BSL-3 and 4) are the minimum requirements for culturing,

propagation, or isolation of coronavirus work [27]. No such work has been conducted at KISR nor in Kuwait. Such facilities do not exist in Kuwait nor in many developing countries. A BSL-3 facility is already in plan to be established. Maximum biosafety measures taken while some of the work, when necessary, will be conducted in cooperation with the Ministry of Health and within their premises. Other work may be done in collaboration with international institutions.

7 Flagship Proposed Research Ideas on COVID-19

The research centers at KISR (Water Resources, Energy and Building, Environment and Life Science and Petroleum Research Centers) submitted a total of forty research ideas that were reviewed by the TF and FOC. The proposals have been executed upon the final approval and availability of funds. The topics addressed the pandemic challenges from different angles:

(a) **Diagnostics**
The ideas of the proposed studies included viral loads in aerosols and on different surfaces, in addition to the identification and detection studies on SARS-CoV-2 and other respiratory viruses.

(b) **Prevention**
This area included four proposals on modifications of surfaces and membranes as well as big data applications and Internet of Things (IOT).

(c) **Environment**
Proposals addressed the transmission of the virus in the air (indoor and outdoor), and in sewage and wastewater. Proposed studies also included applications of graphic information system (GIS) technology to track the spread of the virus in the State of Kuwait.

(d) **Engineering and economics**
Proposals addressed the impact of the pandemic on Kuwait's overall economy and society, its sectors, and business-level firms, and proposed recovery plans. Other issues addressed were the effect on energy consumption and building resilient cities. Policies for trade and small and medium size businesses were also proposed for the mitigation of pandemic-related challenges.

8 Examples of the Results and Outcomes of Research Conducted

A baseline study on indoor air from three major hospitals accommodating COVID-19 patients reported concentrations of SARS-CoV-2, other respiratory viruses, and pathogenic bacteria. In COVID-positive areas, aerosol samples showed 12–99 copies

of SARS-CoV-2 per m^3 of air. Two non-SARS-coronavirus (strain HKU1 and NL63), respiratory syncytial virus (RSV), human rhinoviruses, Influenza B (FluB), and enteroviruses were also detected. Pathogenic bacteria such as *Mycoplasma pneumonia*, *Streptococcus pneumonia*, and *Haemophilus influenza* were also found in the hospital aerosols. The results suggest that the existing interventions such as social distancing, use of masks, hand hygiene, surface sanitization, and avoidance of crowded indoor spaces are adequate to prevent the spread of SARS-CoV-2 in enclosed areas. The study also showed that the concentration of SARS-CoV-2 can be significantly reduced with increased ventilation [28].

A study on online education recommended that post pandemic actions should be considered, and Kuwait should assess its general rules prohibiting or limiting online education, both within and outside of Kuwait. In addition, the country may consider adopting new regulations and ensuring that e-learning may continue to be utilized [29].

To explore the temporal and spatiotemporal dynamics of the COVID-19 pandemic in Kuwait, data on daily confirmed cases was collected between February 23 and May 7, 2020. This provided deeper insights into the epidemiology of COVID-19 in Kuwait and provided an important platform for the rapid guidance on decisions related to intervention activities [30].

A cross-sectional survey was conducted between June 18 and July 15, 2020, to understand the impact of the pandemic on the physical activity and dietary behavior among adults living in Kuwait. The study revealed an increased consumption of vegetables, fruits, and carbohydrates, and a decreased consumption of fish and sugary drinks. Also, physical activities were positively correlated with vegetable consumption and quality of sleep. The study suggested that the overall negative impact of the COVID-19 pandemic in Kuwait necessitates the development of health promotion interventions to support positive physical activity and dietary behaviors using alternative coping strategies among the residents of Kuwait [29].

A study on the poultry industry in Kuwait revealed that the industry was affected by the global COVID-19 crisis because of global and local transportation bans and lockdown. It recommended the establishment of a poultry value chain in Kuwait, to minimize the dependence on importation and increase integrated relationships between research institutes, policy makers, stakeholders, and other bodies related to food security [31, 32].

9 Conclusions

The COVID-19 pandemic has put tremendous pressure on countries worldwide to face and mitigate its challenges, which have affected all sectors including economy, health, environment, and food security. The situation drove countries to apply many restrictions to combat the spread of the virus. Despite that, and in recognition of the importance of R&D, Kuwait's higher education sector, government, and industry

established collaborations and links to fast-track new projects to address COVID-related challenges, such as developing diagnostic kits, providing ventilators, and coordinating the supply of personal protective equipment. The urgency of the situation implied a united aim and collective efforts to mitigate the pandemic challenges at an unprecedented speed.

KISR initiated an FP, in response to the health crisis caused by the COVID-19 pandemic, to identify emerging challenges in Kuwait, assess responses, and propose solutions through scientific innovative research. The aim is to enhance Kuwait's preparedness and to support the health sector in reducing disease impact on the society in the future. The approach is to provide solutions that are sustainable, applicable, and affordable based on lessons learned from the current global crisis. The expected outcome of the planned research is the development of tools, technologies, and research capabilities to support the country in future similar crises. Cooperation on national and international levels has been emphasized. Based on the scope of the FP, a call for proposals was announced, reviewed, and evaluated through a selected FOC. The implementation and applications of the achieved outcome is to be delivered through working closely with government entities. The application of FPs at research institutions like KISR is necessary and highly recommended to direct the efficient and productive use of institutional resources in terms of workforce, facility, and finances. FP objectives should assist governments in solving problems and issues that have significant impact to the national needs and benefits.

Exposure to new and sudden challenges requires countries to emphasize preparedness and sustainable strategies to face unprecedented crises. In addition, countries are to recognize the importance of research and innovation and allocate funds for fast-track translational research. Moreover, there is a growing need for a challenge-led program that can tightly integrate research with its translation and commercialization into applications. Collaboration is also as key to achieve timely aims and adopt modern technologies and processes that are necessary for efficiency and productivity improvements. Moreover, capacity building in terms of workforce development and facility development for crisis management is necessary to deal efficiently with future crises whenever they occur.

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