Digitalization Challenges in The Higher Education Sector in Syria During COVID-19*

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Abstract

Coronavirus disease 2019 (COVID-19) has affected the educational environment globally because of social distancing, self-isolation, and quarantine regime requirements to prevent the epidemic's spread. Higher education institutions have faced many digitalization challenges of human and technological nature in a short period. The transformational processes from traditional face-to-face teaching into distance learning require the implementation of sustainable development measures in higher education institutions, as the direction and progress of the society highly depend on educational outcomes. This study aimed to analyze the digitalization challenges for sustainable development at Syrian higher education institutions from students' perspectives during COVID-19. Scientific literature analysis, Syrian distance learning case analysis during COVID-19, and higher education institutions students' survey (structured questionnaire) were used to identify the main problem areas in distance learning sustainability. Research results uncovered a central problem with the Syrian educational system that lies in its weak technological infrastructure and the necessity of quality assurance on the teaching materials and e-content. Additionally, this study has demonstrated that the main problems that Syrian students have faced in distance learning during COVID-19 were national (weak internet connection and lack of housing for distance learning) and institutional nature (lack of training on how to use the learning management system, technical assistance, and counseling and academic support). Hence, Syrian public and private universities should properly guide and support students with sustainable educational infrastructure (ICT infrastructure and software package, learning management system) to succeed in distance learning. The sustainable development goal of providing quality education will be undermined if these concerns remain unsolved.

Keywords: Digitalization, Distance Learning, Higher Education, Sustainable Development, COVID-19, Syria.

Introduction

The higher education sector has been constantly operated in a very dynamic environment where digitalization and the usage of a mix of blended and distance learning is common in changeable situations (Mcandrew *et al.*, 2009; Lai, Ahmad and Wan, 2016; Dalati, Raudeliūnienė and Davidavičienė, 2017; Isaac *et al.*, 2019). This includes the appliance of educational information and communications technology (ICT) and infrastructure during natural disasters, such as through the floods

following Hurricane Katrina (Hoover, Dopson and Drehobl, 2010) and Christchurch earthquakes of 2010 and 2011 in New Zealand (Mackey *et al.*, 2012; Tull, Dabner and Ayebi-Arthur, 2017). Additionally, a combination of blended and distance learning was requested during students' protests and campus shutdowns in South Africa 2015-2017 (Czerniewicz, Trotter and Haupt, 2019). Besides, online learning platforms were used in response to the Syrian refugee crisis (Gladwell *et al.*, 2016; UNESCO, 2018). Nowadays, dramatic actuality is Coronavirus disease 2019 (COVID-19), which has changed the all-world society's personal and professional lives from social, political, economic, technological, and other perspectives because of the quarantine regime, social distancing, and self-isolation requirements to control the spread of the epidemic (Razif *et al.*, 2020). The digitalization process, which helps to keep social distancing and stay self-isolated, affects all sectors globally, including higher education.

During the instantaneous transformational digitalization process, the educational environment has faced many human and technological challenges globally. These issues are related to the lack of government policy, the absence of national strategic plan and actions, rigid higher education institutions' procedures, insufficient instructions and support services for academic staff and students, inadequate distance learning infrastructure and ICT, the lack of distance learning academic staff competencies and experience, insufficient electronic materials for students, students' digital skills and distance learning tools, online training for academic staff and students, distance learning assessment and evaluation procedures, and unstable internet connection (Sahu, 2020; Zhang *et al.*, 2020).

The digitalization level at Syrian higher education institutions is still in its first beginning step except for the Syrian Virtual University, an online university. Driven by social objectives, the Ministry of Higher Education and Scientific Research adopts a full enrolment policy of secondary students. Therefore, public universities become the primary provider of higher education in Syria, accommodating over 90% of all higher education students (Syrian Central Bureau of Statistics, 2019).

The outbreak of COVID-19 disrupts the teaching activities in Syria. As universities close their doors to curtail the spread of coronavirus, online education emerges as a promising solution in a period where access to campus is impossible. However, distance learning infrastructure in public and the majority of private universities lacks essential digital tools such as learning management systems and classes for online learning. Additionally, the quality of internet services, as well as variations in Syrian universities' distance learning infrastructure, depicts different responses to this closure. The reactions range from uploading materials on webpages to holding synchronous sessions in specific disciplines.

During such a changeable educational environment, one of the higher education systems' sustainable development solutions could be the continuous implementation of digitalization into all Syrian higher education institutions' levels and activities starting from student education and finishing with administration functions. In this context, sustainable development was characterized as an advancement that satisfies current society's needs without compromising the ability of the next generations to meet their own needs (WCED, 1987; Fatoki, 2019; Raudeliūnienė, Tvaronavičienė and Blažytė, 2020). The curfew emerges as a wake-up call not only disrupting Syrian universities' activities but also providing them with precious opportunities to advance their online teaching towards full digital transformation.

The digitalization process accompanies the fourth industrial revolution. It is manifested in integrating Blockchain technology, artificial intelligence and data analytics, cloud computing, and digital platforms in all aspects of higher education institutions activities (Conole, 2012; AbuJarour and Krasnova, 2018; Isaac *et al.*, 2019). While higher education institutions are considered as the initiators and incubators of those technologies, the demand for these technologies returns to reshape the operations and activities of universities (Aldowah, Ghazal and Muniandy, 2015; Idris and Osman, 2015; Quadri *et al.*, 2017; Girdzijauskaitė, Radzevičienė and Jakubavičius, 2019). The digitalization of higher education is a critical element in providing quality education as it intersects with the fourth goal of the United Nations Sustainable Development Goals of providing quality education (United Nations, 2015; Alajmi, 2019; Vinichenko, Melnichuk and Karácsony, 2020). Digitalization creates unique and unprecedented opportunities for higher standards and innovative approaches in teaching and learning as well as turning them into enjoyable processes while ensuring high levels of students' engagement and attainment (Hrivnák *et al.*, 2019; Limani *et al.*, 2019; Maslennikova *et al.*, 2019; Xiao, 2019).

This study aimed to analyze the digitalization challenges for sustainable development at Syrian higher education institutions from students' perspectives during COVID-19. Scientific literature analysis, Syrian distance learning case analysis during COVID-19, and higher education institutions students' survey (structured questionnaire) were used to identify the main problem areas in distance learning in a dynamic environment for sustainability.

Situation analysis and theoretical model

The Syrian higher education system consists of 8 public universities (including the Syrian Virtual University), 23 private universities, and four institutes. Public universities mainly offer postgraduate studies except for the Arab Academy of E-Business, which offers a professional master's degree program. The majority of students are enrolled in public universities, with an increasing number of students registered in private universities. The total number of enrolled students in the academic year 2017/2018 was 490220 students distributed as 41560 for private universities, 8298 for the Syrian Virtual University,

and 440362 for the remaining public universities with 8675 of the academic staff disproportionally distributed among faculties (Syrian Central Bureau of Statistics, 2019).

The first national policy for science, technology, and innovation (2017) in Syria recognizes the importance of boosting universities' technological infrastructure and increasing awareness of the importance of e-learning (Higher Commission for Scientific Research, 2017). However, before the COVID-19 outbreak, public or private universities were not allowed to offer online or blended learning, and all classes must have been provided on a face-to-face basis. This condition discouraged both public and private universities from investing human, technological, and financial resources in developing their digital infrastructure, especially with the availability and spread of social networks that ease communication and exchange of information.

Until 2002, the only recognized mode of teaching at Syrian universities was based on face-to-face education. Distance learning was started by the Syrian Virtual University that experienced a substantial rise in the number of enrolled students of approximately twice as much as that of the largest private university, having 8298 students in the academic year 2017/2018, up from 7051 students in 2016/2017 (Syrian Central Bureau of Statistics, 2019). Many essential digital tools, such as learning management systems, are neither available at public universities nor used by most private universities. Subscription to e-libraries is recent in public universities, though limited to certain publishers, and unavailable in most private universities; despite that, it is a requirement of their accreditation.

The digitalization process in Syrian higher education institutions has slowed down during the Syrian conflict due to limited financial resources and security unrest that forced private universities to relocate away from their campuses. Universities have thrived to survive this uncertain environment and avoid new capital investment, which was considered luxurious. However, individuals are front-running higher education institutions in terms of using ICT. Mobile cellular subscriptions (per 100 people) increased from 61.271 in 2011 to 98.37 in 2018. This number is higher than that of Jordan and Lebanon with 88 and 64, respectively.

Additionally, individuals using the internet increased between 2011 and 2017 by 52.24% (The World Bank, 2018). During the COVID-19 outbreak, the Ministry of Higher Education and Scientific Research calls for the hangout of all teaching activities at public and private universities that require physical attendance in March 2020 due to the outbreak of COVID-19 (Syrian Ministry of Higher Education and Scientific Research, no date b). The Ministry of Higher Education and Scientific Research requires universities to proceed with courses' materials available online for students to ensure the teaching process's continuity (Syrian Ministry of Higher Education and Scientific Research, no date c). However, according to the Ministry of Higher Education and Scientific Research orders, all distance learning carried out during the hangout period will be repeated once the hangout is over (Syrian Ministry of Higher Education and Scientific Research, no date a). Syrian public and private universities have followed different approaches in response to this hangout of teaching activities. Public universities instruct their academic staff to record offline sessions and upload them along with teaching materials regularly. However, given that these universities do not have a unified learning management system, each lecturer has chosen a different ICT and platform to ensure distance learning availability. For instance, a Facebook group is used to exchange learning materials. At the same time, another academic staff has established a WhatsApp group for information exchange possibilities (an example of Damascus University). On the contrary, private universities with digital platforms held training sessions to academic staff on recording offline sessions and using synchronous meeting programs such as the Zoom platform (an example of Arab International University). Other private universities either have used Google Drive platform to upload course materials or have allowed their academic staff to select a suitable ICT tool to proceed with distance learning.

Private universities have diverse motives for adopting distance learning. They perceive this closure as an opportunity to be exploited by academic staff and students to examine different forms of distance learning ICT tools. Besides, private universities hope that higher education authorities will allow them to use distance learning, at least partly, in the future. The second motive is economical because private universities' financial resources are based on running three semesters each year. Continuing universities' closure will threaten the possibilities of running the summer semester, and offering distance learning through this closure period will keep these possibilities alive. Besides, fierce competition between private universities lets them recognize that their response to this pandemic outbreak will be valued by students and can be later employed to attract a potential target audience.

The response of students at both public and private universities to move into distance learning was also diverse. At public universities, one group of students find themselves in the middle of a new distance learning model, which requires more personal effort, discipline, and time to succeed. Another group of students welcomes the latest distance learning model. They actively participate in a new form of education (for example, they volunteer to make groups on social media for each study subject). A last group of students decided to wait until the end of quarantine because the Ministry of Higher Education and Scientific Research promises that distance learning during COVID-19 will be repeated. Based on the meeting protocol signed

by many Syrian private universities' rectors and the Vice Minister of Higher Education, authorities agreed that teaching materials used online during COVID-19 would only be quickly reviewed upon return to work (21 April 2020). This information has motivated a lot of students to be more focused on distance learning materials during COVID-19.

Based on the scientific research results, online education, which consists of online teaching and learning, has been analyzed for several decades (Hodges *et al.*, 2020; Poluekhtova, Vikhrova and Vartanova, 2020). According to Bozkurt and Sharma (2020), distance education can be described as "an interdisciplinary field" for "responding to learning needs" and "guiding open educational practices" (Bozkurt and Sharma, 2020). Hodges et al. (2020) underline that well-planned online learning outcomes are different from emergency remote teaching experiences during the COVID-19 crisis. Such aspects as university and team support or quick solutions processes differ from ordinary circumstances (Hodges *et al.*, 2020).

Scientists proved that distance learning effectiveness and efficiency depend on various indicators, such as universities and students role, e-content, university support, teaching, evaluation methods, and others (Osika, 2006; Means, Bakia and Murphy, 2014; Kuleva, 2017; Bozkurt and Sharma, 2020; Poluekhtova, Vikhrova and Vartanova, 2020).

Osika (2006) identified a spectrum of variables that support the distance learning program, such as community, faculty and student support, content and course management system support, technology, and program support (Osika, 2006). Means et al. (2014) identified nine moderating learning online variables: instructor and student role online, pedagogy, student-instructor ratio, online communication synchrony, modality, pacing, source of feedback, online assessments role (Means, Bakia and Murphy, 2014). Kuleva (2017) proposed a theoretical model to evaluate the effectiveness of the learning processes. This model integrates such leading variables as the study material topicality, teaching quality, presentation of educational materials in the platform, accessibility of the learning materials and resources, the flexibility of the learning, convenient virtual environment, usefulness of the acquired knowledge, online communication between student and lecturer (Kuleva, 2017). Stufflebeam and Zhang (2017) present the CIPP model (Context, Input, Process, and Product) concept where context evaluation focus on needs and issues assessment, input evaluations – strategy, action plan, process evaluations – monitor and implementation of plans, product evaluation – costs and outcomes (Stufflebeam and Zhang, 2017). Poluekhtova et al. (2020) analyzed distance learning effectiveness during COVID-19. The study underlined that a communication environment and sustainable communication between universities and students are essential (Poluekhtova, Vikhrova and Vartanova, 2020).

Based on research results, scientists do not always distinguish between distance learning effectiveness and efficiency concepts. In this study, the authors underline that effectiveness comes first compared to the efficiency concept. Effective distance learning management is related to identifying what has to be done, and after it arises the need to find a way on how to do it efficiently. Based on this principle, a mix of significant distance learning variables leads to distance learning efficiency.

As a result, the most critical distance learning components--students' readiness, e-content, university support, teaching, and evaluation methods--will be examined in this study, indicating the following hypotheses:

H_1: E-content positively affects the efficiency of distance learning;
H_2: Students' readiness positively affects the efficiency of distance learning;
H_3: University support positively affects the efficiency of distance learning;
H_4: Teaching methods positively affect the efficiency of distance learning;
H_5: Evaluation methods positively affect the efficiency of distance learning.

Research Methodology

In order to examine the distance learning situation in higher education institutions from students' perspectives in Syria during COVID-19, the survey (structured questionnaire) was applied. The structured questionnaire consists of three parts. The first part of the questions was related to students' demographic characteristics such as gender, age, higher education institution type (public or private university), education level (undergraduate or postgraduate), and faculty type. The second part of the questionnaire was linked to distance learning situation during COVID-19: students' awareness about Spring semester courses' materials being online, ICT communication preferences, students' possibilities to access online courses, ICT usage during distance learning, internet service accessibility, possibilities to work online at home, students' awareness and confidence level related to learning management system, communication channel, platform, and software(s) for accessing distance learning material. The third part of the questionnaire consisted of the statements associated with higher education institution's support, e-content characteristics (clarity, comprehensiveness, interest, structure, and value), teaching efficiency (comfort, easiness, and clearness), interactiveness level (possibility to ask questions and receive answers), and evaluation aspects (coordination, consistency, diversification, and suitability of evaluation methods). A Likert scale measured these statements from 1 to 5, where "1" had a strongly disagreed value and "5" strongly agreed. Furthermore, the last three questions were multiple-choice questions where students could select more than one answer. They were related to problems and barriers in distance learning, required higher education institutions' support, and students' abilities and skills development during the outbreak.

The sample size was 1137 students, where the confidence level is 99%, the confidence interval is 3.82, and the population (the total number of Syrian students in higher education institutions) is around half a million. The research was conducted in Syrian public and private universities between April and May 2020 during COVID-19. The questionnaire was distributed online through Syrian higher education institutions students' representatives and social media students' groups (e.g., Facebook). In this research, 1137 Syrian students from different higher education institutions participated. Students' demographical characteristics demonstrated that 59% of females and 41% of males were involved in the survey. 66.8% of respondents were in the age category between 21 and 25 years old. 75% of students have studied in Syrian public universities, and 95% of the survey participants have studied in the undergraduate study program (Table 1).

Table 1: Students' demographical characteristics (created by the authors)

Characteristic	Respondents number	Percentage (%)
Gender	*1137*	*100*
Female	670	59
Male	467	41
Age category	*1137*	*100*
Less than 21	291	25.6
21-25	759	66.8
26-30	66	5.8
31-35	14	1.2
More than 35	7	0.6
Higher education institution type	*1137*	*100*
Public university	856	75
Private university	281	25
Education level	*1137*	*100*
Undergraduate education	1075	95
Postgraduate education	62	5

Distribution results of students by higher education institution faculty demonstrate that most students (32.2%) have studied at Engineering Faculty, 26% of respondents have studied at Health Faculty, 23.7% of students at Business & Economics Faculty, and 12.3% of students at Science Faculty (Table 2).

Table 2: Distribution of students by higher education institution faculty (created by the authors)

Faculty	Respondents number	Percentage (%)
Engineering	366	32.2
Health	296	26.0
Business & Economics	269	23.7
Science	140	12.3
Literature	35	3.1
Architecture	25	2.2
Religion	2	0.2
Law	2	0.2
Fine Arts	1	0.1
Politics	1	0.1

In order to explore and assess the dimensionality of the scales in the questionnaire, two analyses were conducted. An exploratory factor analysis was utilized using the principal component analysis method (Table 3). The procedure ends with five factors with Eigenvalues and factor loadings that exceed 1 and 0.3, respectively, satisfy the minimum values suggested by Creswell (2012). Also were reported the variances explained by the component factor, where all exceeded 0.60. They indicate that the first component factor explained at least 60 percent of the intra-variation of each factor's dimensions. Second, Cronbach's alpha was applied to measure the internal consistency of the generated factors. The values exceeded 0.60 for all of the elements, which satisfied the minimum suggested by DeVellis (2012).

Table 3: Exploratory factor analysis and reliability test (created by the authors)

Construct/Item	Factor Loading				Variance Explained	Eigenvalue	Cronbach's Alpha
	F1	F2	F3	F4			
E-Content					0.609	4.264	0.891
The e-materials (PowerPoint, PDF, Word, etc.) for online courses are clear	.750						
The e-materials (PowerPoint, PDF, Word, etc.) for online courses are comprehensive	.739						
The e-materials (PowerPoint, PDF, Word, etc.) for online courses are interesting	.836						
The e-materials (PowerPoint, PDF, Word, etc.) for online courses are well structured	.819						
The knowledge I gain from the e-materials (PowerPoint, PDF, Word, etc.) are of similar value to that I get from face-to-face classes	.715						
The e-materials (PowerPoint, PDF, Word, etc.) contain class activities that help to learn	.797						
The e-materials (PowerPoint, PDF, Word, etc.) contain homework that helps to learn	.800						
Student readiness					0.725	1.453	0.623
How confident are you in your ability to use your institution's Learning management system (LMS) (for example, Moodle, Edugate, Eclass) for online classes?	.852						
How confident are you in your ability to use Zoom (synchronous meeting program) for online classes?	.852						
University support					0.722	2.889	0.872
There is suitable technical support from the university to ease the use of learning tools	.831						
There is suitable technical support from the university to ease access to learning materials	.862						
University provides enough information on how to access e-materials	.850						
University provides enough information on how to use the e-materials	.857						
Teaching methods					0.636	3.182	0.857
I can ask any questions during distance learning	.801						
I receive answers to all my questions during distance learning	.834						
Receiving e-learning materials happen without any problems	.791						
Sending e-learning materials happened without any problems	.780						
There is continuous coordination between the lecturer and me during distance learning	.781						
Evaluation methods					0.649	3.245	0.861
I was evaluated continuously during distance learning	.758						
Evaluation methods during distance learning are suitable	.867						
Evaluation methods during distance learning are diversified	.837						
I think that online quizzes are useful in evaluating progress	.788						
I think that online exams are useful in evaluating progress	.773						

Distance learning						0.768	3.838	0.922
Distance learning helps to understand study subject's material easily	.903							
Distance learning helps to understand study subject's material clearly	.910							
Distance learning improves digital skills	.862							
Distance learning improves analytical skills	.863							
I feel comfortable with studying the e-content in general	.841							

Note: Extraction method – Principal component analysis.

Research results and discussion

In order to assess the extent to which students perceive the contribution of each one of those factors towards their distance learning experience, means, and one-sample t-test is conducted. To examine the difference between observed and expected values when there is one variable, Cooper and Schindler (2011) recommend applying a one-sample t-test. In this study, the expected value is the study factor's neutral value computed as the middle of the scale used, three. Students perceive their distance learning experience during Covid-19 as unsatisfactory, with a mean of 1.936 (Table 4). This can be attributed mainly to their unpreparedness for this shift to distance learning, with a mean of 1.476. Other contributors can also be blamed for distance learning's unsatisfactory experience as they score below the neutral value of three.

Table 4: T-test for assessing the quality of distance learning and expected contributors (created by the authors)

Construct	Test value = 3			
	Mean	**t**	**Df**	**Sig.**
E-Content	2.178	-32.879	1136	0.000
Student readiness	1.476	-69.029	1136	0.000
University support	2.238	-27.906	1136	0.000
Teaching methods	2.129	-33.992	1136	0.000
Evaluation methods	1.959	-41.291	1136	0.000
Distance Learning	1.936	-39.529	1136	0.000

In order to investigate the impact of each of those contributors in the presence of other contributors, a multiple regression analysis was run to examine the effect of the six extracted factors: E-content, student readiness, university support, teaching methods, and evaluation methods on distance learning. As a result, the following multiple regression equation was run:

$$\begin{aligned} Distance\ Learning &= \alpha + \beta_1 Econtent + \beta_2 Student\ Readiness + \beta_3\ University\ Support + \beta_4\ Teaching\ Methods \\ &+ \beta_5 Evaluation\ Methods + \varepsilon \end{aligned}$$

Where: α is the constant while β_1 to β_5 are the coefficients of distance learning on E-content, student readiness, university support, teaching methods, and evaluation methods. ε represents the error term. The results from running this multiple regression documents a positive and significant impact of all contributors on distance learning apart from university support, which seems an insignificant determinant of distance learning quality for Syrian students (Table 5).

Table 5: Direct effects' coefficients (created by the authors)

The relationship	Estimate	P-value	Standardized coefficient
Distance Learning <--- E-content	0.312	0.000	0.406
Distance Learning <--- Student readiness	0.212	0.000	0.070
Distance Learning <--- University support	-0.044	0.130	-0.035
Distance Learning <--- Teaching methods	0.202	0.000	0.192
Distance Learning <--- Evaluation methods	0.343	0.000	0.321

It also shows that the E-content is the most influential variable, four times as important as student readiness and two times as important as teaching methods, as seen from the standardized coefficients column. Enhancing the four significant contributors will improve the outcomes for distance learning (Figure 1).
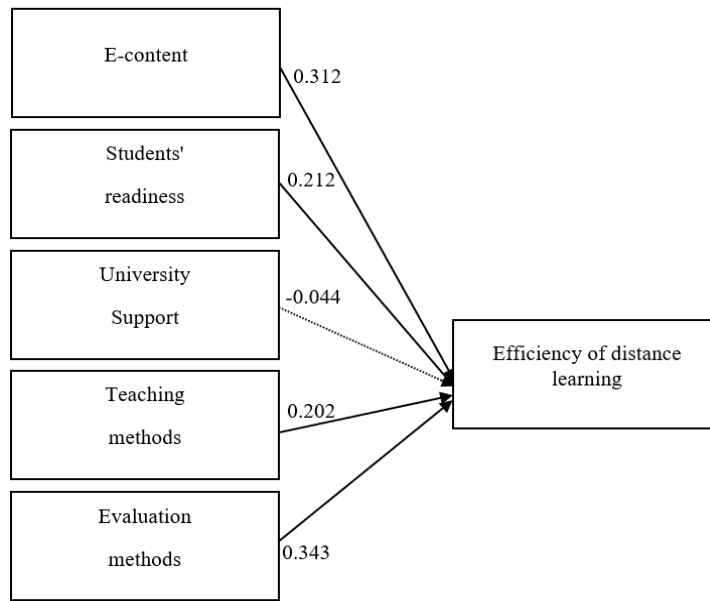
Fig 1. Tested research model (created by the authors)
Note: Dashed lines indicate an insignificance path at 5 percent.

Based on the research results, the situation related to Syrian students' preparation for distance learning during COVID-19 demonstrates that only 56% of respondents have a quiet place at home to do classwork. 45% of respondents have access to reliable internet service. 41% of respondents need software on their computers to access the learning materials. Besides, 69% of students are concerned about running out of credit on their phones. Additionally, 25% of respondents still face a challenge to participate in distance learning because of a lack of devices to access electronic materials and do classwork (Table 6).

Table 6: Students' preparation for distance learning during COVID-19 (created by the authors)

Question	Respondents number	Percentage (%)
Do you have access to a quiet place to do your classwork?		
Yes	635	56
No	502	44
Do you have a device on which you can access electronic materials and do your classwork?		
Yes	848	75
No	289	25
Do you have access to reliable internet service?		
Yes	511	45
No	626	55
If you will be using a smartphone for your classwork, are you concerned about running out of credit on your phone?		
Yes	780	69
No	113	10
Not sure	244	21
Do you need software(s) on your computer that you do not currently have access to the learning materials (e.g., Word, QuickBooks, Java, Excel, Adobe Suite, RAR (unzipping), etc.)?		
Yes	468	41
No	385	34

Not sure	284	25

The most frequently used device among students for distance learning during COVID-19 was identified, such as smartphones (71.3% of respondents) and laptops (23.4% of respondents) (Table 7). This is consistent with the World Bank report for Syria that documented an increase of Mobile cellular subscriptions (per 100 people) from 61.271 in 2011 to 98.37 in 2018 (The World Bank, 2018).

Table 7: Frequency of device usage for distance learning during COVID-19 (created by the authors)

Device	Respondents number	Percentage (%)
Smartphone	811	71.3
Personal laptop	266	23.4
Shared laptop	32	2.8
Personal tablet	14	1.2
Other (e.g., shared tablet, a mix of devices)	14	1.2

Students have used communication channels more frequently, such as Telegram Channel (34.2%), Facebook (28.8%), and Google Drive (15.6%) for sharing information related to distance learning during COVID-19 (Table 8). Such a result reflects a preference for communication channels that are easier to access than a learning management system that requires navigation into many layers before accessing distance learning materials.

Table 8: Frequency of communication channel usage for distance learning during COVID-19 (created by the authors)

Communication channel	Respondents number	Percentage (%)
Telegram channel	389	34.2
Facebook	328	28.8
Google Drive	177	15.6
WhatsApp	166	14.6
Other (YouTube, a mix of different communication channels)	49	4.3
Learning management system (e.g., Edugate, Moodle, E-Class, etc.)	28	2.5

Based on the survey results, the main problems and barriers that Syrian students have faced in distance learning during COVID-19 for sustainable development were identified at the national and institutional levels. The domestic nature issues were connected to a weak internet connection (14.59%) and lack of housing for distance learning (11.44%). At the institutional level, the critical problems and barriers were related to lack of training on how to use the learning management system (11.18%), lack of technical assistance if having trouble with online courses (10.27%), and lack of counseling and academic support from the university (8.50%) (Table 9).

Table 9: Problems and barriers in distance learning during COVID-19 for sustainable development (created by the authors)

Problems and barriers	Respondents number	Percentage (%)
Weak internet connection	1006	14.59
Lack of housing for distance learning	789	11.44
Lack of training on using the learning management system from university	771	11.18
Lack of technical assistance if having trouble with online courses	708	10.27
Lack of counseling, academic support from the university	586	8.50
Lack of psychological support from the university	573	8.31
Lack of feedback from the lecturer (consultation online, answering emails, etc.)	539	7.82
Lack of library resources online	521	7.56
Lack of personal device (computer, laptop, etc.)	489	7.09

Lack of e-material for study subjects from the lecturer	478	6.93
Lack of health services from the country	253	3.67
Other: lack of academic staff e-teaching skills, electricity cuts, costly internet connection, lack of engagement in asynchronous sessions, students' psychological problems, lack of self-commitment and concentration, and lack of university distance learning infrastructure and unified distance learning system.	106	1.54
Lack of food	76	1.10

Research results presented that Syrian students were in desperate need of quality internet connection (18.21%). From Syrian higher education institutions, students have expected training on how to use the learning management system (14.87%), technical assistance if having trouble with online courses (13.98%), and counseling and academic support (11.42%) for sustainable development (Table 10).

Table 10: Required services and support in distance learning during COVID-19 for sustainable development (created by the authors)

Service	Respondents number	Percentage (%)
Internet connection	933	18.21
Training on using the learning management system	762	14.87
Technical assistance if having trouble with online courses	716	13.98
Counseling, academic support	585	11.42
Personal device (computer, laptop, etc.)	562	10.97
Library resources online	522	10.19
Psychological support	480	9.37
Admissions and records (registration assistance, paying fees, etc.)	261	5.09
Health services	149	2.91
Food, housing	80	1.56
Other: quality assurance on the teaching materials and content, diversified teaching methods, unified learning management system, efficient electricity, reasonable study load for each study subject, e-content (detailed description and discussion)	45	0.88
Disabled student services	28	0.55

Syrian students have specified that the most abilities and skills they need to improve to succeed in distance learning were associated with digital skills (10.50%), self-motivation (9.71%), social skills (8.81%), concentration (8.74%), and teamwork (8.62%) (Table 11).

Table 11: Required students' abilities and skills to succeed in distance learning (created by the authors)

Students' abilities and skills	Respondents number	Percentage (%)
Digital skills	596	10.50
Self-motivation	551	9.71
Social skills (communication, public speaking, oral presentation)	500	8.81
Concentration (active listening)	496	8.74
Teamwork	489	8.62
Problem-solving	460	8.11
Adaptability	424	7.47
Analytical skills (critical thinking)	394	6.94
Organization (discipline)	376	6.63
Decision making	342	6.03
Confidence	331	5.83
Creativity	273	4.81
Leadership	216	3.81
Entrepreneurial	190	3.35
Other: personal development and networking skills	36	0.63

Survey results showed that students' abilities and skills related to entrepreneurial (3.35%), leadership (3.81%), and creativity (4.81%) were not critical for improvement in distance learning during COVID-19.

Conclusion

This study uncovered a central problem with the Syrian educational system related to national and institutional level problems and barriers and a necessity for implementing sustainable development principles and models into the higher education sector to succeed in distance learning.

Critical technological issues and barriers have currently hindered Syrian students' full engagement in distance learning concerning internet service and connection quality at the national level. This is due to the still massive variation of internet service quality between rural and urban areas in Syria, with cities better connected than the countryside. The current constrained financial conditions of an in-conflict country and costly internet connections are combined to make 69% of students concerned regarding running out of credit on their phones. Syrian higher education institutions should address this concern by making resources available in a cost-reasonable way and does not require substantial downloading capacities. Universities can also negotiate with internet providers to reduce the cost of accessing certain educational websites or increase their students' internet packages' download capacity. This will be extremely important to meet the United Nations Sustainable Development Goals of reducing inequality.

At the institutional level, weak technological infrastructure was identified, considering that 70.4% and 66.7% of students have not heard of learning management systems and video communication platforms, respectively. More prioritization and investment are necessary for establishing a learning management system that supports synchronous teaching and training students and academic staff to use it properly. This concern is more pronounced in Syrian public universities, where the learning management system concept has not yet been introduced. Such a system and platforms' unavailability will make any future movement towards adopting a blended learning model extremely difficult. Moreover, students needed to install specific software programs on their devices to open the available distance learning materials. Research results showed that it was not enough to submit learning materials online if they cannot be opened. As a result, Syrian public and private universities should inform students on software programs necessary for distance learning and guide and provide them on how they can get these software programs installed.

The results of this study revealed that students perceived the content of shared e-materials as uninteresting and the knowledge they acquired from distance learning as inferior to that obtained from face-to-face classes. Admittedly, the quick transfer to distance learning did not provide academic staff with enough time to develop quality e-resources. It has indicated that academic staff is unfamiliar with learning models and theories that enable the design of practical learning experiences. Also, posting e-materials is not enough to ensure students' understanding because engagement is as critical as the content. As the fourth goal of the United Nations Sustainable Development Goals, quality education requires engaging students in the authentic learning experience that develops their personal, social, and professional competencies. Therefore, providing lecturers with intensive training on e-learning models and engagement strategies is essential to meet this goal.

Notably, students are unfamiliar with distance learning, making them uncomfortable studying the e-materials and struggling to understand them quickly and clearly. Moreover, asynchronous classes do not offer enough space for interaction with academic staff. Understandably, specific disciplines, such as health, architecture, and fine arts, needed more interaction and were difficult to be accommodated with distance learning. However, upskilling students with digital literacies and analytical skills would help them overcome barriers that hinder their e-learning.

Additional challenges that have faced students in their current distance education were related to evaluation experience. Although formative evaluation is feasible in distance learning, the unavailability of sustainable digital infrastructure that accommodates synchronous exams questions the validity and trustworthiness of an online summative assessment. Such challenges require joint efforts from higher education authorities, universities, and academic staff to develop proper evaluation methods.

The results of this study have indicated that Syrian public and private universities would benefit from using mobile applications to keep students informed of news, updates, and possibly regarding their academic performance. Besides, more attention should be paid to improve the university website's content and quality as they are perceived as the third preferred source of information to students. A higher-quality website will benefit universities, especially with the current focus on university ranking (such as webometrics), where more significance is given to the university website's quality and content.

To conclude, the Syrian Ministry of Higher Education and Scientific Research and higher education institutions should consider this experience of moving to distance learning during COVID-19 as an opportunity to transform the higher

education system into a more sustainable online education model. A revision to the higher education law that recognizes blended learning as an acceptable model of education at public and private universities will pave the way to a higher quality of education, contributing to sustainable development in post-conflict Syria.

This study's main limitation is that it focused only on Syrian higher education institutions students and their distance learning experience during COVID-19. The future research area could be related to exploring the distance learning experience of Syrian higher education institutions' administration and academic staff during COVID-19 to perceive complexity approaches and propose recommendations on developing the Syrian higher education system for sustainability.

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