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An investigation of social sustainability factors of e-learning systems

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Abstract

This study aims to investigate the social dimension factors related to the sustainability of e-learning during the COVID-19 pandemic. Drawn from the sustainable development literature, the study investigated the perspectives expressed by Twitter users by collecting 13,975 tweets on e-learning in six GCC countries. The empirical dataset based on Tweeter platform is collected in the days after the official statements given by the ministries of education of GCC nations in regard to the complete shift from the ordinary education to the e-learning system and the mechanisms by which the final exams for the second 2020 semester would be conducted in light of the COVID-19 pandemic. The empirical text data were analysed qualitatively by using the MAXQDA application. The data analysis revealed that e-learning sustainability is influenced by eleven social dimension factors. The study incorporates four social pillars (i.e., social capital, social infrastructure, social justice and equity, and engaged governance) to modelling the social dimension factors of the e-learning sustainability. The research model of the social sustainability of e-learning represents a novel contribution that advances the literature of social sustainability. The findings of this study can help educational policymakers and practitioners in finding potential opportunities to develop the social sustainability of e-learning during a pandemic.

Keywords: Covid-19, education, e-learning, GCC countries, pandemic, social sustainability.

1.0 Introduction

Education is one of the most important axes of sustainable development, as such, most countries have targeted it in their development plans (Setó-Pamies and Papaoikonomou, 2020). The United Nations Educational, Scientific and Cultural Organisation (UNESCO) has identified education as the fourth developmental goal of a nation's sustainable development (Setó-Pamies and Papaoikonomou, 2020). Although information and communications technology (ICT) contributes to enhancing education (De Medio et al., 2020), whether or not e-learning has actually produced a new educational model suitable to sustaining education is debatable (Otto and Becker, 2019; Panigrahi et al., 2020).

The COVID-19 pandemic is a global health crisis which poses challenges to all fields, including the education system (Minghat et al., 2020). COVID-19 caused a complete change in the education mechanism at the global level. During the COVID-19 pandemic, most countries have shifted to relying almost entirely on e-learning applications in an effort to manage the education system crisis. According to the UNESCO report, 109 countries have closed schools, affecting the education of more than 861.7 million children and young people around the world (Mailizar et al., 2020). However, Alharthi et al. (2019) explained that, in many countries, the sustainability of e-learning is still questionable because its dimensions had not been taken into consideration while developing the related systems. With the absence of academic research on the sustainability of e-learning, particularly in developing countries during a pandemic, investigating the social dimension of the sustainability of e-learning represents an appropriate setting for the study.

Some of the existing studies on the sustainability of e-learning highlighted the dearth of research in this area (e.g. Alharthi et al., 2019; Ziemba, 2017; Stepanyan et al., 2013), whereas others indicated that previous research on e-learning development had overlooked the social dimension of its sustainability (Aljarallah and Lock, 2018; Al Hinai and Chitchyan, 2014).

Economic, environmental, and social sustainability are the three main axes from which the sustainability of the fundamental development sectors is frequently examined. Due to the clarity of their variables and the ability to measure the fundamental factors affecting these variables, economic and environmental sustainability are the subjects of the majority of studies addressing the issue of sustainability for the fundamental development sectors. This is in contrast to social sustainability, whose variables are difficult to define or for which consensus models for the fundamental variables have not yet been developed. As a result, research on the social dimension of sustainability in the major development sectors became very rare, particularly in those development fields crucial to the renaissance of nations and peoples, like the education sector, as the education sector has the greatest impact on the growth and advancement of societies as well as the ramifications or overlap of its variables. Therefore, breaking down the sustainability of education into smaller parts (e.g., e-learning) and concentrating on social sustainability in an effort to build up a cumulative knowledge of the key components of the social sustainability of education is a useful way

for creating integrated models of social sustainability for the development sectors in which the previous studies lack.

This study aims to investigate the social dimension factors of the sustainability of e-learning. In doing so, we focused on the Twitter platform to gather user interaction from people in the GCC countries in the first week following the announcement that these countries' education ministries had decided to completely switch to e-learning due to the COVID-19 pandemic, in order to restart the second semester of 2020 at the level of general and academic education. Social media applications have become recently a fertile place for societies worldwide to raise common issues and concerns, and exchange some views and debate in these regards. Social media allows most of the spectrums of society affected by specific phenomenon, directly or indirectly, to participate freely with no restrictions (Barberá, 2016), thus making the investigation of the society's perspectives on this phenomenon available for the researchers to collect the empirical data (Yu and Muñoz-Justicia, 2020; Kumar et al., 2014). In addition, the statistic indicated to the remarkable 41% of the online population in GCC countries utilizes Twitter, a larger ratio than anywhere else in the globe among other social media platforms. Accordingly, the study tries to answer specifically the following questions:

- What are the social factors of the sustainable development of e-learning system, particularly in the developing countries?
- How can social factors of the sustainability of the e-learning system affect the pillars of social sustainable development?

To interpret, categorize, and explain the study's findings, as well as to demonstrate how social aspects of the sustainability of the e-learning system affect the overall of social sustainable development of education, the study used the social pillars drawn from the literature of sustainable development. In April 2020, A Twitter application program interface (API) was employed for tweet-scraping using the R language package (rtweet). This resulted of 13,975 retrieved Arabic tweets. The empirical dataset (i.e., the retrieved tweets) was then cleaned by means of Rule-Based Approach using an Arabic Spam Detecting Lexicon (ASDL). Consequently, the tweets were filtered from 13,975 to 9,583 tweets, which were later transformed into a file for further qualitative analysis using the MAXQDA application.

This study offers theoretical contributions and practical implications. The findings of this study will contribute to the body of knowledge on e-learning sustainability, especially in light of the crises that rendered e-learning crucial to the continuation of education on a national or global scale. In addition, other stakeholders such as e-learning developers, practitioners, and education policymakers can benefit from the outcomes of this study in relation to seeking possible improvement opportunities for the sustainability of e-learning systems. The structure of this study is outlined as follows. The literature on the sustainability of e-learning is illustrated in the next section. Next, the methodology section describes how the empirical data were collected from Twitter, cleaned, and analysed. Then, the data analysis and results are presented. Finally, the main findings are discussed, followed by this study's implications, limitations, and conclusion.

2.0 Literature review

2.1 Sustainability and e-learning

Sustainability is an essential component to ensure the continuity and development of societies. Numerous definitions of sustainability have been reported in the extant literature (Somogyi, 2016; White, 2013). The United Nations define sustainability as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (United Nations, 1987). The major dimensions of sustainability can be categorised as: environmental, social, and economic. In this regards, context could also influence and shape dimensions and intersections of sustainability (Aljarallah and Lock, 2018). One of the most crucial elements of a country's development is its educational system, which must be sustainable in order for it to achieve its present objectives and be able to meet its future demands in an adequate or even superior manner.

The rapid advancement of technology has spurred a considerable investment in ICT to enable the application of e-learning systems in education (Al-Fraihat et al., 2020; Cheng, 2019). Rodrigues et al. (2019, p.95) defined e-learning as “an innovative web-based system based on digital technologies and other forms of educational materials whose primary goal is to provide students with a personalized, learner-centered, open, enjoyable and interactive learning environment supporting and enhancing the learning processes”. Robertson (2008, p.819) defined sustainable e-learning as "e-learning that has become normative in meeting

the needs of the present and future". Stepanyan et al. (2013) explained that e-learning sustainability is the appropriate practice that clearly addresses current educational needs and accommodates continuous adaptation to change, while maintaining effectiveness and not outrunning its resource base.

Prior research conducted on e-learning investigated frameworks for its sustainability dimensions without reaching a consensus on any specific one (Stepanyan et al., 2013). For example, Trentin (2007) proposed a model for e-learning sustainability that consisted of eight interrelated dimensions—namely: pedagogical, professional, socio-cultural, informal, content-related, organizational, economic, and technological dimensions. Sridharan et al. (2010) considered three critical dimensions for the success of a sustainable e-learning system: pedagogical strategies, technologies and the management of learning resources. Sofiadin (2018) proposed a sustainable e-learning framework that relies on its economic, environmental, and social dimensions which were narrowed down to equality. Based on an extensive literature review of software development, Alharthi et al. (2019) studied sustainability dimensions of e-learning and utilised five previously identified dimensions of software sustainability; these include —the environmental, social, economic, individual, and technical dimensions (Becker et al., 2015; Penzenstadler and Femmer, 2013).

A glance at the literature on e-learning sustainability reveals that prior research had focused on the economic, technical, and educational dimensions, placing little emphasis on the social and environmental dimensions. In addition, the dearth of studies concerning the social dimension of e-learning sustainability was confirmed by Alharthi (2018). Similarly, some scholars indicated that the economic dimension has overshadowed most of the focus of prior research, despite the importance of social dimensions to drive the development of sustainable e-learning, which has been overlooked in existing studies (Ziemba, 2017; Stepanyan et al., 2013). This dearth of research is due to the lack of instructions and the complexity of the process involved in gathering and measuring social indicators (Aljarallah and Lock, 2018; Al Hinai and Chitchyan, 2014).

Therefore, this study is focussed on the social dimension of e-learning sustainability, which is concerned with society (people, organizations, etc.) and on finding ways suited to maintain societal trust and enhance solidarity among the members of a society by taking

care of many societal values—such as justice, social equality, rights, intellectual property, etc (Becker et al., 2015; Penzenstadler and Femmer, 2013).

2.2 The pillars of social sustainability

Despite the growing interest of academic research into concepts of sustainable development, prior research has clarified that the social dimension has been neglected in the related literature of sustainable development (Ajmal et al., 2018); thus, it has been the least conceptually developed (Cuthill, 2010). Social sustainability is concerned with prompting durable circumstances for human wellbeing (Hollander et al., 2016), which in turn requires achieving a set of basic social pillars linked to the continued wellbeing of human life (Serrano et al., 2016).

Within the sustainable development literature, there has been a fragmented approach to addressing the social dimension of sustainability, due to the difficulty in aligning the dynamic and long-term social objectives with diverse indicators for social sustainability (Ajmal et al., 2018; Buser and Koch, 2014; Dempsey et al., 2011). The integration of social approaches into a common conceptualization is therefore a key task for sustainability scholars (Hollander et al., 2016). For example, there has been considerable research characterizing social justice as a mainstay in the social dimension of sustainability (e.g., Arora et al., 2016; Boström, 2012; Fischer and Amekudzi, 2011), whereas other scholars (e.g., Ajmal et al., 2018; Hiedanpää et al., 2012) laid the social approaches of sustainability upon fundamental estimations of values and democracy.

Littig and Griessler (2005) emphasized that the social sustainability of a public service is guaranteed if it is developed around human needs and conditions, as well as its renewable capabilities being protected over a long period of time and situations while maintaining social justice. Ajmal et al. (2018) illustrated that social sustainability indicators from the societal perspective can be linked into three interrelated pillars; these include social development (i.e., equality, security, health and safety, education), social justice (i.e., social justice, engaged government, human skills), and social growth (i.e., social capital and network, accessibility, social cohesion and inclusion).

Murphy (2012) developed a conceptual model based on a systematic compilation of the social pillars reported on the literature of social sustainable development, which included public awareness, equity, participation, and social cohesion. The awareness of society in

relation to the sustainability issues is critical to encouraging alternative, sustainable consumption patterns. The idea of equity is about the equal human rights of everyone, of any gender, to have the chance of not only survival, but also achieving their goals and potential. Social participation concerns the enhancement of public engagement in decision-making processes pertaining to services and facilities to promote social cohesion and social sustainability. In the light of social cohesion, Murphy (2012) reported five characteristics pertaining to social cohesion, including: (1) fostering civic participation in public affairs, (2) strengthening community networks while reducing conflicts, (3) promoting tolerance, solidarity, and integration, (4) fostering a shared sense of social purpose, and (5) combating cultural intolerance.

Cuthill (2010) developed a social dimension model that consists of social pillars including: social capital, social infrastructure, social justice and equity, and engaged governance. In developing this model, Cuthill (2010, p.367) engaged in a long literature review plan and a two-year action research process—involving various public, private and community stakeholders in the South East Queensland region of Australia. Social capital involves a set of concepts—such as social networks, beliefs, norms, trust, and civic engagement.

Social infrastructure involves both ‘hard’ infrastructure (i.e., the physical components of e-learning systems) and ‘soft’ infrastructure (i.e., the non-physical services that are required to maintain the e-learning system). However, most global initiatives linked to social sustainability development tend to focus primarily on the ‘hard’ infrastructure, sometimes totally disregarding its ‘soft’ counterpart (Cuthill, 2010, p.367). Social justice and equity refer to the right of the whole population to have equal opportunities to genuinely participate and access to the social services and facilities. Engaged governance refers to the social participation in the decision-making processes and development of social activities.

In conclusion, this study will draw on the literature of sustainable development, since studies that address the sustainability of ICT, and in particular the social dimension, are very limited (Alharthi et al., 2019; Becker et al., 2015; Penzenstadler et al., 2014). We will adopt the social dimension model suggested by Cuthill (2010). As mentioned above, this model consists of four social pillars, including: social capital, social infrastructure, social justice and equity, and engaged governance. This model was empirically developed with a

long and rigorous action research process, and therefore it represents the starting point of social interaction to achieve the development of e-learning social sustainability that could be suitable for this study to be grounded in.

In this study, we referred to the social capital as the shared common-sense responsibility among the stakeholders, that develops effectiveness and positive relationship between the learners and e-learning system. The social infrastructure refers to the provision of the soft services that enhance the development of social capacity to ensure the social sustainability of e-learning, whereas the social justice and equity concern the right of learners to be provided with equitable access to e-learning systems and resources with the provision of a quality of service that is at least as good as that of ordinary education. Engaged governance should provide a foundation upon which all stakeholders in society can contribute to the strategy of the decision-making and informed action relating to the social sustainability of e-learning.

3.0 Methodology

This study aimed at investigating the social dimensions of e-learning sustainability based on the GCC society perspectives in the light of the COVID-19 pandemic. Such an approach is qualitative data-driven and aims at interpreting a phenomenon based on the explanations that stem from the perspectives of the participants in the case study (Wohlin et al., 2012). In the context of this study, we relied on data provided by Twitter users, who expressed and shared their opinions on the social issues affecting e-learning in the GCC countries during the COVID-19 pandemic. In recent years, social media have gained popularity among researchers as hotspot research data sources (Yu and Muñoz-Justicia, 2020) suited to the investigation of a society's perspectives on a specific phenomenon (Kumar et al., 2014), although It is difficult for the researchers to obtain detailed information of user socio-demographic characteristics, for instance Twitter's privacy policy gives the users the option of making their identity anonymous (Barberá, 2016). The authors will be able to identify the social factors that the GCC communities consider to be the biggest obstacles to the sustainable development of e-learning systems through the participants' tweets during the COVID-19 pandemic. They will then map the factors to the appropriate pillars

of social sustainable development in order to emphasize the significance of the social sustainable on the development of e-learning systems.

3.1 The case of the study

The case of this research is the GCC countries. The GCC consists of six countries within the Arabian Gulf region. The Kingdom of Saudi Arabia (KSA) is the largest in terms of both area and population (2,149,690km², 33.7 million), followed by Oman (309,500km², 4.8 million), the United Arab Emirates (UAE, 83,600km², 9.6 million). Kuwait (17,818km², 4.1 million), Qatar (11,581km², 2.8 million), and Bahrain (780km², 1.6 million) (David et al., 2017). The GCC countries share a wide range of social, economic, environmental, religious, and political characteristics and norms (Abou-El-Kheir and MacLeod, 2019). In addition, they are considered as the most important oil and gas exporting countries worldwide (Wiseman and Anderson, 2012), however, the GCC societies still depend on their governments in all economic activities (Tsai and Mezher, 2020). The GCC countries are young societies, with more than 50% of their respective populations being under 24 years old (Tsai and Mezher, 2020). In addition, the GCC countries have recorded advanced and good index in terms of digitalization and e-government at the global level (Alkrajji, 2020).

3.2 Tweets extraction and cleaning

The process of collecting raw data from Twitter users was divided into two phases—namely, data collection and data cleaning. A Twitter application program interface (API) was employed for tweet-scraping by means of the R language package (rtweet) (Kearney, 2019) taking into account the limitations of the Twitter platform for a free account. Several keywords were selected and used in the search processes in order to make the retrieved tweets as accurate and specific as possible for this study's aim.

During the data collection phase, the candidate keywords were selected based on the recommendations made by three school's teachers and three academic professors in Saudi universities who specialized in the field of e-learning. Then, fifteen (15) keywords were selected and set in an Arabic language string (i.e., GCC countries' main language), these included for instance the English words such as ("E-learning" OR "Distance learning" OR "Distance education" OR "Virtual Classes" OR "E-evaluation" OR "Distance evaluation" OR "iEN system" OR "National Education Portal" OR "Future Gate" OR "Blackboard" OR

"Zoom Application" OR "Microsoft Teams" OR "Noor system" OR "Black Board" OR "E-Training"). In April 2020, they were run through the Twitter API and 13,975 tweets were retrieved, which only included tweets in Arabic and excluded retweets. The source of the empirical data relied on a free Twitter account, which limits the API in retrieving data from only 18,000 tweets published over the past seven days. Therefore, we chose the period of the data collection to be days after the official statements given by the ministries of education of GCC nations in regard to the mechanisms by which the final exams for the second 2020 semester would be conducted in light of the COVID-19 pandemic.

After the dataset (tweets) was retrieved in a raw form and stored, the data cleaning process was conducted over two phases. The first involved the removal of any spam and non-relevant tweets—e.g., any commercial or advertisement tweets within the dataset—before exporting the remaining valid tweets for content analysis to be in useful and in a readable format. Thus, a rule-based approach (AITwairish et al., 2016) involving pattern matching and replacement was adopted, whereby all tweets containing Arabic spam were excluded using an Arabic Spam Detecting Lexicon (ASDL) of 273 words that we had developed. Moreover, the tweet dataset was cleaned of any blank tweets, and any tweets containing only emojis, hashtags, periods, or special characters, as well as excluding all letters and numbers from other languages. According to AITwairish et al. (2016), any tweet with four hashtags or more is considered spam within the GCC countries context. Therefore, any tweet with four or more hashtags were removed. Further, any extra lines, whitespaces, and duplicate tweets were removed. Consequently, the tweets were filtered from 13,975 to 9,583. Then, the final tweet list was exported to a text table (a pdf file) containing the fields: tweet sequence, tweet text, favourite count, retweet count, and hashtags combined with tweets and location, to make it easier for the content analyst to code themes with more information on the demographic characteristics of the tweet, and to make the content easy to analyse and classify. Finally, the pdf file was imported to the MAXQDA program for content analysis.

3.3 The qualitative analysis method

Following the qualitative analysis, we applied the content analysis method to the collected tweets concerning the social dimensions of e-learning sustainability in the GCC countries. Content analysis is used for the study of various types of texts. It enables the definition of

the core consistencies and basic meanings found in them and the understanding of the correlations between the data (Patton, 2002). Content analysis provides researchers with a degree of flexibility and with the freedom to make adjustments in relation to the relevance of the texts to the phenomenon under investigation (Dong et al., 2009). Therefore, before approaching the analysis process, researchers should immerse themselves deeply in the data and familiarise themselves with the content. In general, the content analysis process involves iterative procedures aimed at generating codes and sorting and collating any relevant ones into potential themes (Braun and Clarke, 2006).

4.0 Data analysis and results

4.1 The tweets' demographic information

Although Twitter data lacks user socio-demographic characteristics (Barberá, 2016), it provides a variety of demographic details for the tweets themselves, such as 90 attributes associated with each tweet. Taking into consideration Twitter's privacy policy, which provides its users the option of making their location, for instance public or not. The empirical data exposed that KSA, UA, Kuwait, Oman, Qatar, Jordan, Egypt, United States, United Kingdom, and Bahrain are the top ten locations of the retrieved Arabic tweets. In addition, the results showed that the GCC countries were those in the Middle East that contributed the most on the topic of e-learning during the COVID-19 pandemic. KSA was the highest tweeting country, and Bahrain was the lowest.

The empirical data showed that the dominant segment of device types used to produce the tweets in the retrieved dataset was smartphones, whereas tweeting from PCs only made up just under 7% of the total. The tweets texts were analysed based on word occurrences and top words. The most commonly occurring words were education, student, learning, and electronic. In addition, the results exposed that coronavirus was among the top words, indicating the influence of the pandemic on education and especially on the e-learning topic. Activation and management were of the top words reported by the tweets during the COVID-19 pandemic, which points at the existence of some e-learning issues related to these words. Grades, female students, and parents were another issue related to the students worrying about their grades and to the use of technology by girls and women, especially in regard to privacy and security issues.

4.2 The content analysis process

The content analysis, which was conducted using the MAXQDA software, focused on tweets related to the social issues of e-learning in the GCC countries context. To analyse the textual content, we adopted the framework proposed by Braun and Clarke (2006), which is based on six main steps: (1) reading the text more than once to understand its content, (2) coding the textual data, (3) reviewing and classifying the coding into basic groups based on the relationship between codings, (4) naming the groups (thematising) based on the objectives of the study, (5) reviewing the codings and groups to ensure their mutual consistency, (6) describing the groups. Thus, we read the text more than once to be familiar with the data (textual content) and understand them in more depth. This enabled the development of an initial coding and classification list. The coding classification process involved classifying or grouping all similar coding together. Once the content analysis had been completed, we reviewed the new codes and the classification lists and renamed the classification groups (i.e., thematising the group list).

In addition to investigating the factors of the social dimension of the sustainability of e-learning in the GCC countries, we incorporated the four pillars of social sustainability suggested by Cuthill (2010) to classify the factors based on them. The content analysis process revealed 11 factors that constitute the social dimension factors of e-learning sustainability in the GCC.

These were then classified based on the social capital, social infrastructure, social justice and equity, and engaged governance. Figure 1 presents these factors—with their percentages based on the number of supported tweets—and their links to the relevant dimension in the conceptual model. In addition, Table 1 demonstrates these factors with examples of the codings used in the analysis process and quotations of the tweets that supported them. The following section explains each social dimension factor found in regard to the sustainability of e-learning in the GCC countries.

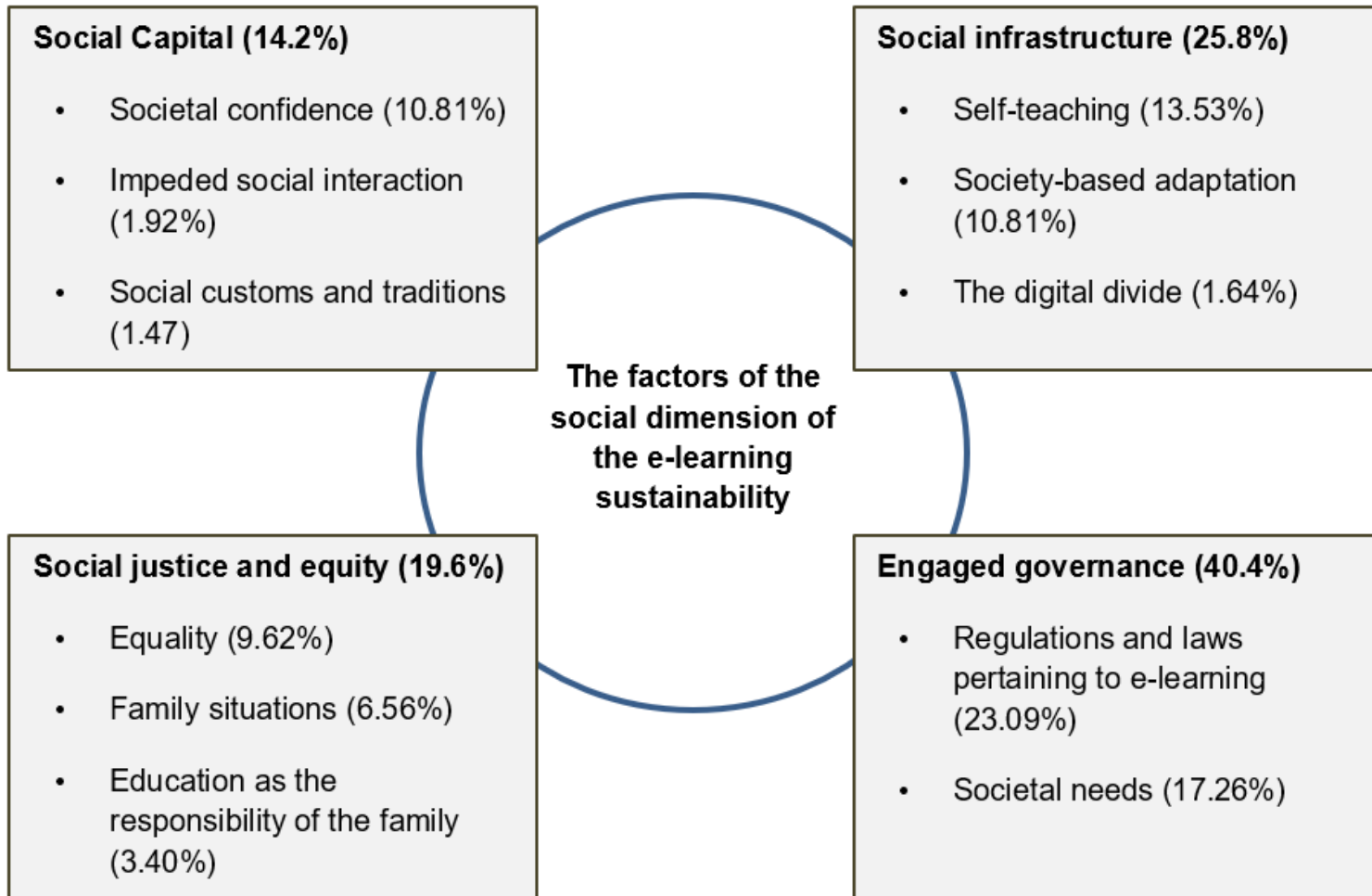


Figure 1. The research model of the social sustainability of e-learning

| No | Factor | No. of tweets | Examples of codes | Examples of tweets supporting the codes |
|-----------------------|--|---------------|------------------------------------|---|
| Social capital | Societal confidence in e-learning outcomes | 191 | <i>Cheating</i> | Twitter No. 381: "Everyone knows that family, friends, and private teachers are supporting the students, some students have created WhatsApp groups to exchange homework and test answers without even reading the questions." |
| | | | <i>Parents doing the job</i> | Tweet No. 4674: "Mothers do the homework and tests for their children; this is not education but loss!" |
| | | | <i>social relations</i> | Tweet No. 1607: "E-learning lacks the classroom environment that cultivates the values, principles, and foundations of social relations in the students." |
| | Impeded social interaction | 43 | <i>Social isolation</i> | Tweet No. 1692: "Technology will isolate people and transform them over time into machines that only do business, but people will lose the feeling of communicating with others, lose the skill of building relationships." |
| | | | <i>Social privacy</i> | Tweet No. 3930: "A faculty member asked me to download the IMO application and to open the video to test me. I refused and I said that I would only take the exam over the official Blackboard, but he refused to test me, he has no right to ask me to switch to another application!" |
| | Social customs and traditions | 26 | <i>Social caveats</i> | Tweet No. 8176: "Why are they creating education groups over social media, there shouldn't be any communication between teachers and students outside the school." |
| Social infrastructure | Self-teaching | 239 | <i>private teachers</i> | Tweet 2143: "I wish you could feel our suffering with distance learning, I understand it only with a private teacher and, at the moment, there are no teachers who come to the house due to the coronavirus pandemic." |
| | | | <i>Difficulty of self-learning</i> | Tweet 64: "distance education means teaching yourself! It is difficult for our children." |
| | Society-based adaptation | 189 | <i>Training</i> | Tweet 170: "E-learning cannot be applied overnight. Society must be prepared in many ways; such as in how to manage the e-learning system." |
| | | | <i>lack of familiarity</i> | Tweet No. 98: "We were overwhelmed by the grades, exams, and homework duties, as if they considered us to be very familiar with the e-learning system." |
| | The digital divide | 29 | <i>computer literacy</i> | Tweet No. 947: "In distance learning, how can a pregnant woman, or one who has a baby, or those women who are not familiar with technology, proceed with the learning process?" |
| | | | <i>computer maintenance</i> | Tweet 8288: "With computer maintenance stores closed due to quarantine, not all people have the ability to maintain and update their devices." |

Table 1. The factors of the social dimension of the e-learning sustainability in the GCC.

| No | Factor | No. of tweets | Examples of codes | Examples of tweets supporting the codes |
|----|---|---------------|-------------------------------------|--|
| 7 | Equality | 170 | <i>lack of PCs</i> | Twitter No. 8683: "You think that all people have PC devices or the ability to purchase them to carry out the process of distance education, this is not true!" |
| | | | <i>lack of internet</i> | Tweet No. 583: "I have a student who is excellent and at the top of the class. This student is from a small village and, during the pandemic, he is not able to participate and attend the e-learning classes because he does not have an internet and he does not have a PC." |
| | | | <i>family financial situation</i> | Tweet No. 8090: "Not every home has an internet. not every student has a computer due to the economic and financial differences between families. Some houses have only two or three rooms. Not every child can have his or her room and turn it into a virtual class." |
| 8 | Family situations | 116 | <i>family educational situation</i> | Tweet No. 6169: "I am a teacher, and I depend on the cooperation of the parents; however, some mothers are illiterate, so they do not even know what e-learning is." |
| | | | <i>relying on parents' support</i> | Tweet No. 4332: "During this pandemic, we tried distance learning, which involves live lessons and duties, but it 100% depends on the parents, the kids do not really know what is going on." |
| 9 | Education as the responsibility of the family | 60 | <i>relying on parents' devices</i> | Tweet No. 4332: " My son does not have a computer and he is working on my laptop, knowing that I need my computer when I go to work." |
| 10 | Regulations and laws pertaining to e-learning | 408 | <i>Legitimacy</i> | Tweet No. 187: "The MoE is against e-learning and does not approve degrees based on it." |
| | | | <i>intellectual property</i> | Tweet No. 7594: "E-learning without proper legislation protects the academic professor from cybercrime and protects his intellectual property." |
| | | | <i>special needs</i> | Tweet No. 2649: "My job in distance education is much harder than in normal education; I specifically work with people with children with special needs; imagine ome mothers are illiterate." |
| 11 | Societal needs | 305 | <i>Individual abilities</i> | Tweet No. 608: "Some students cannot understand in schools, do you expect them to understand from a ten-minute PowerPoint presentation, students differ in their abilities!" |

Table 1. The factors of the social dimension of the e-learning sustainability in the GCC (Continued).

4.3 Social dimension factors

4.3.1 Social capital

-Societal confidence in e-learning outcomes: This social element was a concern expressed in a wide segment of the tweets, with people articulating their various reservations in regard to the effectiveness of e-learning outcomes. For example, with the e-learning systems' current inability to control the learning process or administering tests, many tweets showed that the students had become dependent on others, whether in completing their homework and periodic tests, and that the quality of the outcomes was therefore questionable. In addition, other people indicated that the ministries of education, for example: those of the Saudi Arabia and Kuwait could have been responsible for undermining the confidence of the GCC community in e-learning through their repeated statements and ongoing reservations in regard to the effectiveness of e-learning, and for saying that they would not recognise any certificates issued on the basis of e-learning due to the assumed weakness of the outcomes.

-Impeded social interaction: The results revealed concerns that e-learning could affect the ability of students to establish the future social relationships necessary to build and promote community values, behaviours, self-confidence, self-development, and sound psychological health, especially among children. The tweets stressed the need for students to be immersed in a realistic school environment suited to help them hone the skills they need to build various social relationships. The analysed tweets revealed real societal concerns with technology, especially in relation to the younger generation spending a lot of time with it, thus possibly making school and university settings the only outlets for student social interaction. Indeed, some tweets revealed that undergraduate students were fulfilling their psychological and social requirements on campus with friends and staff members, and preferred this over e-learning.

-Social customs and traditions: The results revealed that customs and traditions influenced the social dimension of e-learning sustainability in the GCC, with some conservative groups of society expressing their reticence to let women or children participate in virtual environments. In general, women in GCC countries are still restricted by some social customs and traditions; for instance, some families still prohibit their female members from being active on social media or to show their faces while recording videos

or dealing with virtual environments. In addition, the data revealed that some families may not allow their members, especially women, to use e-learning. In some instances, this was found to be the case even if the affected family member was a teacher or a university faculty member. For example, some female students explained that they refused to participate in lessons through the Internet and social media for family privacy reasons, or because they were incapable of making the best use of the privacy and confidentiality features of these applications.

4.3.2 Social infrastructure

-Self-teaching: This element was one of most frequently referred to in regard to the social dimension in terms of number of tweets. The qualitative analysis of the sample tweets indicated that the GCC's societies is not centred on self-teaching at both the general and higher education levels. The data drawn from the sample tweets showed that students are highly dependent on schoolteachers, university faculty members, and private tutors in regard to learning and to the general acquisition of knowledge. In light of the COVID-19 pandemic, the tweets showed that learning had become the sole responsibility of the students and their parents; this presented large segments of the student population with great difficulties in understanding and absorbing lessons, causing many of them to experience ongoing feelings of anxiety, especially linked to their inability to self-teach and to that of their parents to support them by explaining and clarifying, and to impossibility to employ private tutors because of the quarantine.

-Society-based adaptation: Many tweets emphasized that the transition from traditional education to e-learning during the COVID-19 pandemic had been swift and unsettling, whereby the GCC education systems had become completely dependent on e-learning systems due to schools and universities having closed down mid-way through the second semester. The analysis of the tweets also made it clear that, before the COVID-19 pandemic, the use of e-learning systems had been very limited and thus society had not really been prepared to accept or totally rely on e-learning. In addition, the dataset revealed that a large number of GCC university undergraduates lacked the skills needed to use e-learning applications; for example, many students did not have personal e-mail accounts and did not therefore use email in their learning process. Further, the sample tweets exposed

that large numbers of parents and other family members were unable to understand or envision the concept of e-learning, or its mechanisms and applications, which pointed at a lack of awareness and training.

-The digital divide: The data revealed that the sustainability of e-learning is dependent on the elimination of the digital divide that exists between members of the GCC societies; this is because the e-learning process is intertwined and everyone is involved in it. For example, it emerged that it was not possible for the ministries of education of GCC to implement e-learning across the board, that parents and other family members were often technologically illiterate, and that the digital divide still affected many families, which in turn, affected students' reliance on their parents during e-learning lessons. In addition, the digital divide that was found to exist among education cadre members—who encompass three or four generations—should be noted in relation to the issue of e-learning sustainability. Further, the results revealed that, although they are immersed in technology on a daily basis, the younger generations do not have the technical skills needed to pursue e-learning. This is because their knowledge of technology is limited to electronic games or social media applications, and does not cover office applications (e.g., word processors, spreadsheets, file and folder management, email, etc.) and the ability to browse the Internet and navigate across information, content and resources.

4.3.3 Social justice and equity

-Equality: A large proportion of the sample tweets stressed that e-learning, as part of the GCC's education systems guaranteed learning equality—one of the main values related to social sustainability—among all members of their societies and the right of everyone to a quality education, without any discrimination or preference for one social class over another. Therefore, e-learning policies should ensure that all members of society enjoy equal rights of access to e-learning. However, the qualitative analysis of the sample tweets revealed disparities in internet communication quality between different regions and cities in the GCC, which affected equality in the learning process in relation to education in general or to the administering of tests. In addition, the results revealed that schools and universities alike varied in terms of their ICT readiness, which in turn affected learning equality among the students. Furthermore, the findings revealed that, due to economic

factors and large numbers of offspring, some families in the GCC countries were unable to provide all their children with computers or any other electronic devices required for e-learning or ensure that such devices could be consistently accessed by them during the times allocated for synchronised learning, for example Tweet No. 8090 mentioned that "What are the efforts and solutions of the Ministry of Education in Saudi Arabia to support families who are unable to provide computers or have no internet networks when it applied the distance education system?", while Tweet No. 8551 explained that "My experience and the experience of those around me with the distance learning, we have had a physical fatigue and financial difficulties because firstly if you have a number of children in different stages of schools, each of them needs a separate computer, and secondly, the availability and speed of the internet services, and absence of the internet network in some villages and desertsions." Therefore, during the COVID-19 pandemic, many students were dependent on their smartphones that did not fully support e-learning applications.

-Family situation: The analysis of the data revealed that family situations and circumstances should be taken into consideration as important factors for the social dimension of the sustainability of e-learning in the GCC. For example, some of the sample tweets mentioned the absence of family support due to divorce or to the death of one or both parents. In addition, the empirical data confirmed that students almost completely rely on their parents' ability to motivate and direct them in the e-learning process during the COVID-19, and therefore the weakness of parents in this aspect for any reason, such as illiteracy or working conditions, may make the children unable to interact with the e-learning process. Further, a large number of tweets revealed the important role played by social motivation in fostering student interaction with e-learning; a form of support that, during the COVID-19 pandemic, needs to be supplied completely by parents and other family members. The lockdown and self-isolation caused by the pandemic can also result in psychological health issues significantly affect parents, which in turn limits the parents' support their children. Furthermore, as explained by many tweets, the economic situations limited the support some families could provide their children in relation to essential e-learning equipment, such as computers and internet connections.

-Education as the responsibility of the family: During the COVID-19 pandemic, family plays a pivotal role in the education process. The results revealed that students in public

education, especially elementary level ones, are totally dependent on their parents for the learning process and for the attendance of virtual lessons, during which, issues relating to controlling the children arise. However, whereas this is not an issue in some families, it is in others due to the poor educational qualification of the parents, who may be illiterate or unable to teach for other reasons. For example, the data revealed that mothers working in the health field were unable to supervise their children's education. Therefore, some tweets questioned the effectiveness of the implementation and the success of e-learning in general education and in its elementary stage in particular.

4.3.4 Engaged governance

-Regulations and laws pertaining to e-learning: The qualitative analysis of the tweets indicated that e-learning should be part of the organizational structures of the ministries of education in the GCC countries. The tweets revealed that the need for e-learning systems should be clear and explicit, defining the rights and responsibilities of all parties of the educational process—such as intellectual property rights, confidentiality, and the privacy of the learners. For example, many Twitter users indicated that all their time was dedicated to e-learning, without clear timing and the schedules often found in traditional education. This issue had previously been identified as a source of psychological fatigue in the e-learning system (Pimenta et al., 2015) and it had also been recognized during the pandemic as “Zoom fatigue”, whereby teachers had been advised to divide their activities between live and recording lectures (Langford and Damşa, 2020). In addition, all school teachers and university faculty members had their own e-learning platforms (e.g., email and social media), which did not ensure privacy and confidentiality or the ability of the students to work on them. Further, many tweets explained that the ministries of education of the GCC countries still had not integrated e-learning in their educational system, and moreover they did not endorse academic certificates awarded on the basis of e-learning for reasons related to poor outcomes, which confirms that e-learning played a limited role in the education process in the GCC countries, and had only recently been adopted in order to help manage the educational crisis linked to the COVID-19 pandemic.

-Societal needs: The results revealed that, as e-learning lacks the direct sensory communication and face to face interaction between students and instructors, it should

involve interactive learning, social interaction, discussion groups, and virtual group interaction, while the role played by the instructors should mainly focus on managing, coordinating, and monitoring the education process. In other words, the success of e-learning relies on the students' independence and self-teaching (van Alten et al., 2020). Many tweets expressed concerns that e-learning might focus on the needs of the instructors in order to facilitate their job process, while ignoring those of the learners. The analysis of tweets revealed that e-learning should take into account individual differences between students, such as any special needs, abilities, and skills, as Tweet No. 2438 mentioned that "Adopting e-learning as a permanent strategic option and not just an alternative will be a turning point for children who do not absorb the lessons in the classroom as their peers." In addition, the data revealed the need for sustained e-learning to be tailored to each course and subject; e.g., including hands-on practice in applied disciplines such as engineering and medicine. Thus, before proceeding with the implementation of e-learning, the GCC countries' education policymakers should develop an in-depth understanding of the needs of society in general and of the education community in particular. Further, many tweets stressed the need for the ministries of education of GCC to set up training and awareness programmes for society at large and for the education community. Such programmes would be aimed at addressing the widespread lack of training and awareness that represents a major issue affecting e-learning in the GCC countries during the COVID-19 pandemic.

5.0 Discussion and conclusion

As illustrated earlier, the social pillars of sustainability are relatively unexplored territory in the normative literature of sustainable development (Ajmal et al., 2018; Murphy, 2012), although the social dimension is considered the essence of sustainable development. Previous studies indicated that interest in the technical and economic dimensions of the sustainability of e-learning had taken centre-stage in previous studies rather than the social aspects of it (Stepanyan et al., 2013; Ziemba, 2017). Our study attempted to address the gap in research in terms of focusing on the social dimension factors of the sustainability into a new area, namely e-learning system, whereas four essential social pillars (i.e., social capital, social infrastructure, social justice and equity, and engaged governance) were incorporated to classify the social issues identified in this study.

The COVID-19 pandemic provided a unique study setting and a realistic atmosphere to evaluate the sustainability of e-learning, as education institutions had significantly changed toward e-learning platforms on a global scale. The study's main focus was on the sustainability of e-learning. In order to collect user engagement based on perspectives from the GCC society, we concentrated on the Twitter platform. As the researchers relied on a free Twitter account, which restricts the API in retrieving published tweets for only the past seven days, the tweets were gathered in the days following the official statements given by the ministries of education of GCC nations to completely switch to the e-learning system.

After collecting and cleaning the tweets by means of some R language packages, the text data was then transformed for further quantitative and qualitative analysis using a set of packages of the R language and the MAXQDA software. Based on social pillars of sustainability literature, the study interpreted, classified, and explained the study's results. The analysis revealed 11 factors of concern related to the social dimension of the sustainability of e-learning. The factors were modelled based on four social pillars of sustainability included social capital, social infrastructure, social justice and equity, and engaged governance.

The social capital pillar comprised societal confidence, impeded social interaction, and social customs and traditions factors, whereas social infrastructure contained self-teaching, society-based adaptation, the digital divide factors. The social justice and equity encompassed equality, family situations, and education as the responsibility of the family, while engaged governance pillar embraced regulations and laws pertaining to e-learning and societal needs factors. The engaged governance pillar formed 40.4% of the overall concern of the tweets, whereas social infrastructure represented 25.8%, the social justice and equity pillar was 19.6%, and finally the social capital was 14.2%.

The study's findings might serve as the foundation for additional investigation targeted at bolstering and expanding the body of knowledge on the social sustainability of e-learning growth. The social dimension had been overlooked in the literature of sustainable development; therefore, this study's theoretical contribution advances the literature on "social sustainability" in general and "ICT development" in particular. The research model of the social sustainability of e-learning, as shown in Figure 10, represent a novel

contribution that advances the literature of social sustainability. In addition, e-learning practitioners, developers, and policymakers may benefit from the study's findings to make some legislative, organizational, educational, cultural, and social interventions and introduce reform aimed at assisting the deployment of e-learning on a national scale given the complexity of the social dimension and the inability to take into account all of its aspects while developing the sustainability of e-learning systems.

References

- Abou-El-Kheir, A. and MacLeod, P. (2019), "The Struggle for Balance: Policy Borrowing and Continuous Reform in the Practice of English Language Teaching in the Gulf Cooperation Council (GCC) Countries", *Second Handbook of English Language Teaching*, 1st ed., Springer, Cham, pp. 31–49.
- Ajmal, M.M., Khan, M., Hussain, M. and Helo, P. (2018), "Conceptualizing and incorporating social sustainability in the business world", *International Journal of Sustainable Development & World Ecology*, Vol. 25 No. 4, pp. 327-339.
- Al-Fraihat, D., Joy, M. and Sinclair, J. (2020), "Evaluating E-learning systems success: An empirical study", *Computers in Human Behavior*, Vol.102, pp. 67-86. <https://doi.org/10.1016/j.chb.2019.08.004>
- Alharthi, A.D. (2018), "Requirements Engineering Aspects for Sustainable ELearning Systems", RMIT University.
- Alharthi, A.D., Spichkova, M. and Hamilton, M. (2019), "Sustainability requirements for eLearning systems: a systematic literature review and analysis", *Requirements Engineering*, Vol. 24 No. 4, pp. 523–543.
- Al Hinai, M. and Chitchyan, R. (2014), "Social sustainability indicators for software: Initial review", *3rd International Workshop on Requirements Engineering for Sustainable Systems*, CEUR, Karlskrona, pp. 21–27.
- Al Hinai, M.A.S. (2019), "Integration of Social Sustainability in Software Requirements Using Requirements Pattern: A Case of Equality", University of Leicester.
- Aljarallah, S. and Lock, R. (2018), "An exploratory study of software sustainability dimensions and characteristics: end user perspectives in the Kingdom of Saudi Arabia (KSA)", *12th ACM/IEEE International Symposium on Empirical Software Engineering and Measurement - ESEM '18*, ACM Press, Oulu, pp. 1–10.
- Alkrajji, A.I. (2020), "An examination of citizen satisfaction with mandatory e-government services: comparison of two information systems success models", *Transforming Government: People, Process and Policy*, ahead-of-print. <https://doi.org/10.1108/TG-01-2020-0015>.
- AlTwaresh, N., AlTuwaijri, M., AlMoammar, A. and AlHumoud, S. (2016), "Arabic Spam Detection in Twitter Nora", *2nd Workshop on Arabic Corpora and Processing Tools*, Portorož, Slovenia.
- Arora, P., Peterson, N.D., Bert, F. and Podesta, G. (2016), "Managing the triple bottom line for sustainability: a case study of Argentine agribusinesses", *Sustainability: Science, Practice and Policy*, Vol. 12 No. 1, pp. 60-75.

- Barberá, P. (2016), “Less Is More? How Demographic Sample Weights Can Improve Public Opinion Estimates Based on Twitter Data”, Working Paper for NYU, New York.
- Becker, C., Chitchyan, R., Duboc, L., Easterbrook, S., Penzenstadler, B., Seyff, N. and Venters, C.C. (2015), “Sustainability Design and Software: The Karlskrona Manifesto”, International Conference on Software Engineering, Vol. 2, IEEE, pp. 467–476.
- Boström, M. (2012), “A missing pillar? Challenges in theorizing and practicing social sustainability: introduction to the special issue”, Sustainability: Science, practice and policy, Vol. 8 No. 1, pp. 3-14.
- Braun, V. and Clarke, V. (2006), “Using thematic analysis in psychology”, Qualitative Research in Psychology, Vol. 3 No. 2, pp. 77–101.
- Buser, M. and Koch, C. (2014), “Is this none of the contractor’s business? Social sustainability challenges informed by literary accounts”, Construction management and economics, Vol. 32 No. 7-8, pp. 749-759.
- Cheng, Y.M., (2014), "Extending the expectation-confirmation model with quality and flow to explore nurses' continued blended e-learning intention", Information Technology & People. Vol. 27 No. 3, pp. 230-258.
- Cuthill, M. (2010), “Strengthening the ‘social’ in sustainable development: Developing a conceptual framework for social sustainability in a rapid urban growth region in Australia”, Sustainable development, Vol. 18 No. 6, pp. 362-373.
- David, S.A., Taleb, H., Scatolini, S.S., Al-Qallaf, A., Al-Shammari, H. and George, M.A. (2017), “An exploration into student learning mobility in higher education among the Arabian Gulf Cooperation Council countries”, International Journal of Educational Development, Vol. 55, pp. 41–48.
- De Medio, C., Limongelli, C., Sciarrone, F. and Temperini, M. (2020), “MoodleREC: A recommendation system for creating courses using the moodle e-learning platform”, Computers in Human Behavior, Vol. 104, 06168. <https://doi.org/10.1016/j.chb.2019.106168>
- Dempsey, N., Bramley, G., Power, S. and Brown, C. (2011), “The social dimension of sustainable development: Defining urban social sustainability”, Sustainable development, Vol. 19 No. 5, pp. 289-300.
- Dong, L., Neufeld, D. and Higgins, C. (2009), “Top Management Support of Enterprise Systems Implementations”, Journal of Information Technology, Vol. 24 No. 1, pp. 55–80.
- Fischer, J.M and Amekudzi, A. (2011), “Quality of life, sustainable civil infrastructure, and sustainable development: Strategically expanding choice”, Journal of urban planning and development, Vol. 137 No. 1, pp. 39-48.
- Hiedanpää, J., Jokinen, A. and Jokinen, P. (2012), “Making sense of the social: human-nonhuman constellations and the wicked road to sustainability”, Sustainability: Science, Practice and Policy, Vol. 8 No. 1, pp. 40-49.
- Hollander, R., Amekudzi-Kennedy, A., Bell, S., Benya, F., Davidson, C., Farkos, C., Fasenfest, D., Guyer, R., Hjarding, A., Lizotte, M. and Quigley, D. (2016), “Network priorities for social sustainability research and education: Memorandum of the Integrated Network on Social Sustainability Research Group”, Sustainability: Science, Practice and Policy, Vol. 2 No. 1, pp. 16-21.

- Kearney, M. (2019), "rtweet: Collecting and analyzing Twitter data", *Journal of Open Source Software*, Vol. 4 No. 42, 1829. <https://doi.org/10.21105/joss.01829>
- Kumar, S., Morstatter, F. and Liu, H. (2014), "Twitter Data Analytics", 1st ed., Springer New York, New York, <https://doi.org/10.1007/978-1-4614-9372-3>.
- Langford, M. and Damşa, C. (2020), "Online Teaching in the Time of COVID-19: Academic Teachers' Experiences in Norway", *Center of Experiential Legal Learning (CELL)*, Vol. 2, Oslo, <https://www.jus.uio.no/cell/%0ACitation>.
- Littig, B. and Griessler, E. (2005), "Social sustainability: a catchword between political pragmatism and social theory", *International journal of sustainable development*, Vol. 8 No. 1-2, pp. 65-79.
- Mailizar, M., Almanthari, A., Maulina, S. and Bruce, S. (2020), "Secondary School Mathematics Teachers' Views on E-learning Implementation Barriers during the COVID-19 Pandemic: The Case of Indonesia", *Eurasia Journal of Mathematics, Science and Technology Education*, Vol. 6 No. 7, em1860.
- Minghat, A.D., Ana, A., Purnawarman, P., Saripudin, S., Muktiarni, M., Dwiyantri, V. and Mustakim, S.S. (2020), "Students' Perceptions of the Twists and Turns of E-learning in the Midst of the Covid 19 Outbreak", *Revista Romaneasca Pentru Educatie Multidimensionala*, Vol. 12 No. Supplement, pp. 15-26.
- Murphy, K. (2012), "The social pillar of sustainable development: a literature review and framework for policy analysis", *Sustainability: Science, practice and policy*, Vol. 8 No. 1, pp. 15-29.
- Otto, D. and Becker, S. (2019), "E-Learning and Sustainable Development", *Encyclopedia of Sustainability in Higher Education*, Springer International Publishing, Cham, pp. 1-8.
- Panigrahi, R., Srivastava, P.R. and Panigrahi, P.K., (2020), "Effectiveness of e-learning: the mediating role of student engagement on perceived learning effectiveness", *Information Technology & People*. <https://doi.org/10.1108/ITP-07-2019-0380>.
- Patton, M.Q. (2002), "Qualitative Research & Evaluation Methods", 3rd ed., SAGE Publications, London.
- Penzenstadler, B. and Femmer, H. (2013), "A generic model for sustainability with process- and product-specific instances", *Workshop on Green in/by Software Engineering - GIBSE '13*, ACM Press, New York, pp. 3-8.
- Pimenta, A., Gonçalves, S., Carneiro, D., Fde-Riverola, F., Neves, J. and Novais, P. (2015), "Mental Workload Management as a Tool in e-Learning Scenarios", *5th International Conference on Pervasive and Embedded Computing and Communication Systems*, SCITEPRESS - Science and Technology Publications, pp. 25-32.
- Resta, P., Laferrière, T., McLaughlin, R. and Kouraogo, A. (2018), "Issues and Challenges Related to Digital Equity: An Overview", *Second Handbook of Information Technology in Primary and Secondary Education*, 1st ed., Springer, Cham, pp. 987-1004.
- Robertson, I. (2008), "Sustainable e-learning, activity theory and professional development. ASCILITE 2008 - The Australasian Society for Computers in Learning in Tertiary Education", Deakin University, Melbourne, pp. 819-826.

- Rodrigues, H., Almeida, F., Figueiredo, V. and Lopes, S.L. (2019), “Tracking e-learning through published papers: A systematic review”, *Computers and Education*, Vol. 136, pp. 87–98.
- Serrano, M., Blondet, M., Rubiños, Á. and Mattsson, E. (2016), “Sustainable dissemination of earthquake resistant construction in the Peruvian Andes”, *Sustainability: Science, Practice and Policy*, Vol. 12 No. 1, pp. 22-33.
- Setó-Pamies, D. and Papaoikonomou, E. (2020), “Sustainable Development Goals: A Powerful Framework for Embedding”, *Ethics, CSR, and Sustainability in Management Education*. *Sustainability*, Vol. 12 No. 5, 1762. <https://doi.org/10.3390/su12051762>
- Sofiadin, A. and binti M. (2018), “Development and Evaluation of a Sustainable E-Learning Framework for Higher Education Institutions in Malaysia”, Curtin University. <https://espace.curtin.edu.au/handle/20.500.11937/73514>.
- Somogyi, Z. (2016), “A framework for quantifying environmental sustainability”, *Ecological Indicators*, Vol. 16 No. 2, pp. 338–345.
- Sridharan, B., Deng, H., Kirk, J. and Corbitt, B. (2010), “Structural equation modelling for evaluating the user perceptions of e-learning effectiveness in higher education”, 18th European Conference on Information Systems, ECIS 2010, AISEL, Pretoria, pp. 1–13.
- Stepanyan, K., Littlejohn, A. and Margaryan, A. (2013), “Sustainable e-Learning: Toward a coherent body of knowledge”, *Educational Technology and Society*, Vol. 16 No. 2, pp. 91–102.
- Thomas, D.R. (2006). A General Inductive Approach for Analyzing Qualitative Evaluation Data”, *American Journal of Evaluation*, Vol. 27 No. 2, pp. 237–246.
- Trentin, G. (2007), “A Multidimensional Approach to e-Learning Sustainability”, *Educational Technology*, Vol. 47 No. 5, pp. 36–40.
- Tsai, I.-T. and Mezher, T. (2020), “Rationalizing energy policy reforms in the gulf cooperation council: Implications from an institutional analysis”, *Energy Policy*, Vol. 142, 111545. <https://doi.org/10.1016/j.enpol.2020.111545>
- United Nations. (1987), “Development and International Economic Co-operation: Environment”, Report of the World Commission on Environment and Development. https://www.un.org/ga/search/view_doc.asp?symbol=A/42/427andLang=E (accessed 15 January 2020).
- van Alten, D.C., Phielix, C., Janssen, J. and Kester, L. (2020), “Effects of self-regulated learning prompts in a flipped history classroom”, *Computers in Human Behavior*, Vol. 108, 106318. <https://doi.org/10.1016/j.chb.2020.106318>
- White, M.A. (2013), “Sustainability: I know it when I see it”, *Ecological Economics*, Vol. 86 No. 2, pp. 213–217.
- Wiseman, A.W. and Anderson, E. (2012), “ICT-integrated education and national innovation systems in the Gulf Cooperation Council (GCC) countries”, *Computers and Education*, Vol. 59 No. 20, pp. 607–618.
- Wohlin, C., Runeson, P., Höst, M., Ohlsson, M.C., Regnell, B. and Wesslén, A. (2012), “Experimentation in Software Engineering”, 1st ed., Springer Berlin Heidelberg, Berlin, Heidelberg. <https://doi.org/10.1007/978-3-642-29044-2>

- Yu, J. and Muñoz-Justicia, J. (2020), “A Bibliometric Overview of Twitter-Related Studies Indexed in Web of Science”, *Future Internet*, Vol. 12 No. 5, 91.
<https://doi.org/10.3390/fi12050091>
- Ziemba, E. (2017), “The Contribution of ICT Adoption to the Sustainable Information Society”, *Journal of Computer Information Systems*, Vol. 59 No. 2, pp. 116–126.