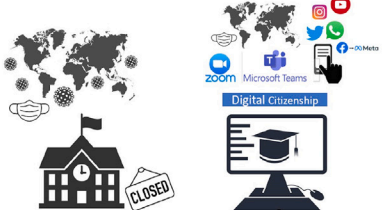**Article**

University students' and educators' perceptions on the use of digital and social media platforms: A sentiment analysis and a multi-country review

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Highlights
A global sentiment analysis based on educators' and students' perceptions is provided

Results showed disparity between developed and underdeveloped countries

Results emphasized the importance of boosting blended learning using digital and social media tools

Article

University students' and educators' perceptions on the use of digital and social media platforms: A sentiment analysis and a multi-country review

Maryam Al-Hail,[1,2,*] Mariem Fekih Zguir,[1] and Muammer Koç[1,*]

SUMMARY

Due to Covid-19, an inevitable restructuring of higher education teaching and learning pedagogies ensuring the continuous and effective learning of students is deemed important. Despite such vitality, a prevalent disparity worldwide on the usages and gains of digital and social media integration is still noticeable. Following a Scoping Literature Review and using the *Atlas.ti* software for a Grounded Theory qualitative analysis, this study aims to ascertain the significance of digital and social media tools during and after the Covid-19 pandemic. The study explains the common challenges and opportunities both students and educators faced in thirty countries. Drawing on the sentiment analysis of these stakeholders, results indicate that despite the acceleration of digital education into a flexible, and student-centered didactic approach, various barriers in effectively fulfilling online learning still exist. Findings also revealed the lack of, and therefore need for, proper teaching and learning material and strategies suitable for digital education.

INTRODUCTION

Digital and social media (DSM) designate tools and platforms that are of an internet-based application nature established on the technological features of Web 2.0.[1,2] In many higher education institutes (HEIs), DSM technologies are being used as means and mediums that can facilitate learning and teaching via more interactivity, collaboration, and interaction among different education stakeholders, notably educators and students, in an ongoing effort to attain sustainable and accessible education.[3] The term DSM comprises two essential components: "digital" and "social" media. Digital learning refers to a wide range of themes and methodologies to adopt various learning forms. The term 'digital education' is used to explain a broad range of educational opportunities that advocate the use of digital technologies in terms of software tools and applications, including information communication technologies (ICT), that can be utilized to collect, store, and process data in the educational field.[4] Some digital learning themes and methodologies can refer to online learning, online collaborative learning (OLC), cooperative learning, blended learning, flipped classroom using digital media, technology-integrated teaching methods, digital storytelling, gamification, digital problem–based learning, authentic learning, personalized learning, Understanding by Design (UBD), Universal Design for Learning (UDL), and synchronous and asynchronous online learning. Table S1 provides a summary of these learning methodologies and themes that are based on digital education. Accordingly, concepts such as e-learning, massive open online courses (MOOCs) such as Coursera, edX, and Udemy, distance learning, and learning management systems (LMS) such as Blackboard and Moodle, as well as numerous other learning and educational applications and websites have emerged.[5–7]

The second important component of DSM is social media. Referred to as social network sites or services (SNSs) or online social networks (OSNs), today, the value of online social networks is being recognized by HEIs as potentially effective tools of communication, networking, and collaboration among students and faculty.[2,8,9] Social networking sites including Facebook, Instagram, Snapchat, YouTube, and WhatsApp, to name a few, are being used as an intrinsic and integral element to complement the learning process, notably in enhancing communication and interaction between students and faculty members. Due to the increase in the usage of social media as a supporting tool for learning, faculty and educators are exploring how to best integrate DSM into education settings to supplement the teaching and learning process.[2,8] There is a substantive scholarship that suggests that social media platforms can be effective and
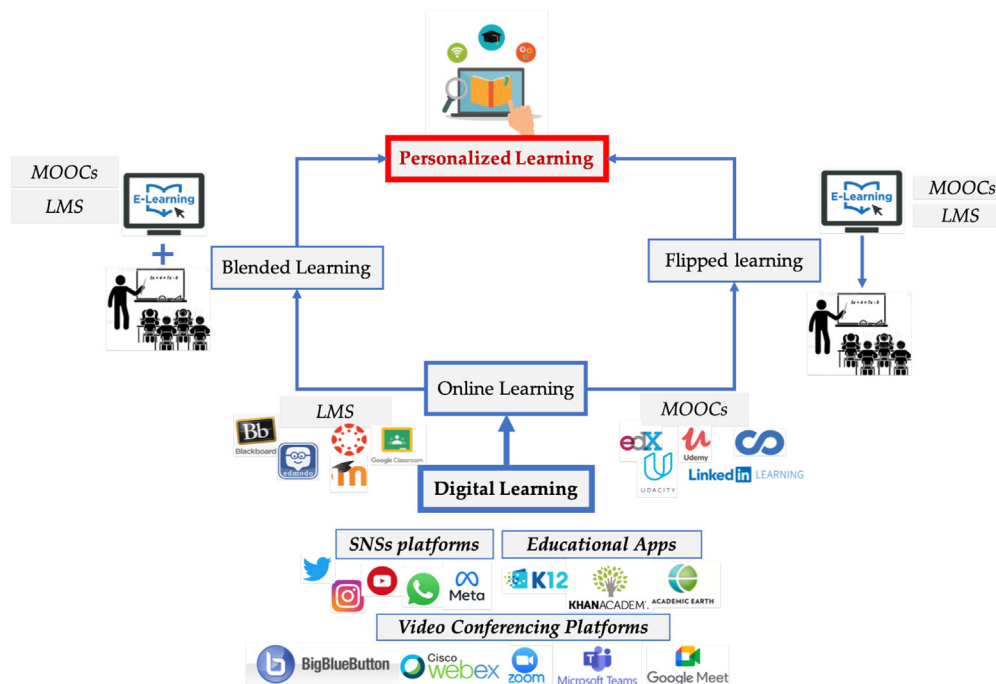
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Figure 1. Graph demonstrating online learning's main components that endorse personalized learning

powerful tools for improving student's learning outcomes, developing communications skills, enhancing motivation and developing awareness of learning, and facilitating lifelong learning.[2,8–11] Since independent and personalized learning are highly regarded traits for students' success, embedding digital and social media tools effectively into designing and developing teaching strategies and curricula is currently a priority for multiple HEIs.[12] The Figure 1 (see also Table S1) below is an infographic illustrating different key elements of digital learning combining various types of educational methodologies based on digital and social media, in the aim to achieve personalized learning.

The increasing reliance on such digital learning nowadays is mostly justified by the effectiveness of online education, where students can have a plethora of learning opportunities and options through the insurance of an easy access to knowledge and content, especially those situated in the developing world.[13,14] Nevertheless, this bears the question of the usefulness and the relevance of traditional education institutes with the outburst in digital educational applications and tools, as well as the issue of digital divide between the developed and developing world and the level of ICT preparedness along with the infrastructure availability to utilize these digital technologies by educators and instructors, let alone by the students.

Another problematization of DSM education in HEIs is related to curriculum incompatibility,[15] and the lack of hands-on practice prospects and the way in which content and material are presented to students. This concern was further exacerbated with the closure of many HEIs due to the novel coronavirus. With the recent emergence of the Covid-19 pandemic, these questions and dilemma have resurfaced again, especially that various HEIs have converted to distance learning and students and educators alike found themselves compelled to rely exclusively on DSM learning during this health crisis. The digital transformation of traditional (face-to-face) education during the pandemic era signified a hurried transition process of adaptation to sustain the teaching and learning process. In many instances, this meant that HEIs enforced online learning without providing proper training for professors to familiarize them with the use of digital platforms.[16–18] Rather, they were expected to sustain the teaching process without any disruption.[16,19] Figure 2 below illustrates visual representation of COVID-19 phases and waves impacting the traditional classroom teaching of HEIs starting from December 2019, until the WHO declared the availability of treatments and vaccines.[20–22]

As it stands, there is a dearth of reviews and treatises conducted to explore the academic use of DSM platforms in higher education, particularly after the outbreak of COVID-19. Despite the fact that the vast body
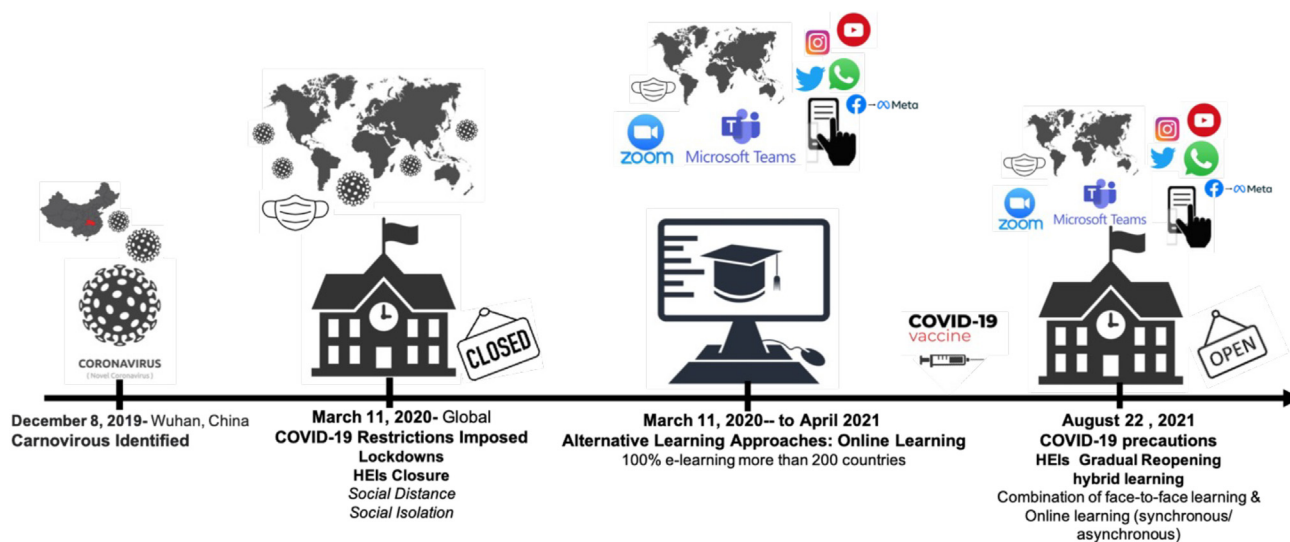
Figure 2. COVID-19 Impacts on HEIs closure and precautionary reopening worldwide

of literature has addressed digital education, there is still scarcity of studies looking into the use of social media in formal digital education specially in HEIs.[2,3,12,23,24] Additionally, to the best of the authors' knowledge, only few studies have included both educators' and students' perceptions, opinions, and sentiments from using DSM in formal education during and after the pandemic. From this angle, as technology continues to evolve and as the number of digital/social media users are increasingly growing worldwide, it is becoming more and more vital to study how educational stakeholders resort to DSM tools for educational purposes. Learning about the importance of DSM platforms as an agent in accelerating student-focused and dynamic learning by creating supportive and autonomous learning environment in HEIs is imperative to sustain adaptive learning technology stimulating student self-learning and self-regulated learning; hence, allowing equal opportunities of learning and enhancing technologically equipped students to adapt to the current trends of education.

To mend such gaps in the literature, and to provide further insights to advance the research on DSM in HEIs, the present study aims to answer the following questions.

(1) How did different HEIs across 30 countries respond to the pandemic and the subsequent closure policies, and how did they strive to maintain and sustain the ongoing learning of their students?

(2) What are the perceptions of students and educators about DSM and online learning during and after the Covid-19 pandemic?

(3) What are the main perceived challenges and opportunities faced by HEIs students and educators?

(4) What could be learned from this experience to build an improved, properly developed, accessible, inexpensive, progressive and sustainable teaching, learning, and assessment (TLA) environment, using platform(s), pedagogy, content, and materials for digital learning?

Following a scoping literature review approach, this study aims to divulge the perceptions and sentiments of students and professors toward emergency online learning during the pandemic, to explain the challenges and opportunities of DSM. Furthermore, the aim of this paper is to anchor the main themes related to DSM in HEIs that are being reported in the literature. The rest of the paper is constructed as follows: in the Results section, research questions are addressed and further explanations and analyses on the existing sentiments, challenges, and opportunities from using DSM in HEIs during this current health crisis are offered. The Discussion section elucidates the main takeaways from the previous findings and earmarks potential research areas and directions for future qualitative, quantitative and experimental studies in this field. The STAR Methods section includes a peruse of the existing literature through scoping literature review. This same section also presents the essential tools and methods used to analyze and code the obtained qualitative data.
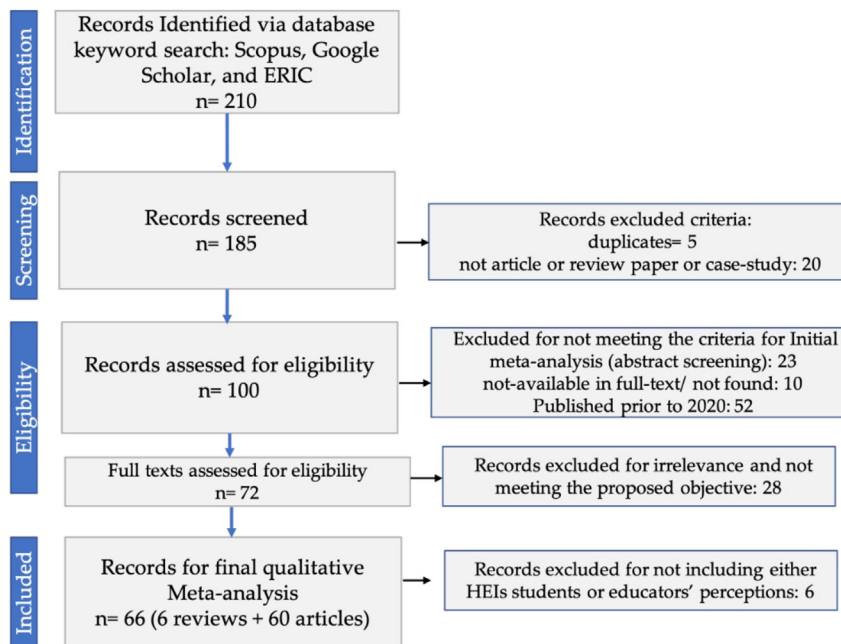
Figure 3. Scoping literature review procedure and steps followed for this review study
(See Tables S3 and S4, related to Figure 3).

As is elaborated in the STAR Methods section, the scoping literature review approach was followed using these steps as shown in Figure 3 (see also Tables S3 and S4). The countries included in the findings are detailed in Table 1 and Figure 4 (see also Table S2).

RESULTS

A grounded theory style text analysis was followed for this study. As explained in [25], grounded theory is an inductive research approach that helps researchers discover and explore theories through coding and organizing data. This consists of coding the data following three stages, notably, open coding, axial coding, and selective coding. These three stages facilitate the allocation of relationships within data and codes and, thus, lead to generating various theories from this qualitative analysis, in the aim to provide ways of data conceptualizations.[26] Using this approach is deemed helpful in quantifying qualitative data, which can enable authors to compare and visualize the frequencies of these codes at a later stage.[27] Figure 5 explains these steps in more details.

Following the steps illustrated in Figure 5, and to provide insights on the 66 reviewed records and select appropriate codes and themes for the text analyses, *Atlas.ti* was first utilized to generate a word cloud based on the most recurring concepts of the input. The resulting concepts are shown in Figure 6.

Based on the word cloud, themes such as students and educators' perceptions, satisfaction, communication, training, access, sustainable learning, and performance, to name a few, were among the recurring themes in the reviewed articles. For the grounded theory approach (i.e., axial coding or categorization), main themes used to code the texts qualitatively fall under these four categories: sentiment (either positive or negative), stakeholders (students or educators), challenges (such as lack of motivation, lack of training, no ICT preparedness, Internet, and other technical issues, among others), and opportunities (more interaction, better feedback, more suitable assessment and grading, and more flexibility, among others). Table 2 delineates the overall codes and sub-codes used in the analysis.

Each of these codes was assigned a distinct color to make data visualization more appropriate and appealing as shown in Figure 7. Following the data coding stage, relationships between these codes, extracts from specific codes, and the cited article from where they were extracted, were obtained through the network feature in the software. This is illustrated in Figure 8.

Table 1. Overview of the 30 countries included in the study

WHO Regions	Countries
African	Ghana and South Africa
American	United States of America, Brazil, Mexico, Chile
South-East Asian	India, Nepal, Indonesia
European	France, Italy, Romania, Turkey, United Kingdom of Great Britain, Russia, Poland, Croatia
Eastern Mediterranean	Jordan, Egypt, Lebanon, Qatar, Saudi Arabia, Iraq, Morocco, Pakistan, Afghanistan
Western Pacific	China, Malaysia, South Korea, Australia

The discussion section discusses further the results obtained in this study.

DISCUSSION

DSM in HEIs following COVID-19

According to UNESCO,[20] by March 11, 2020, a total of 166 countries globally observed closure of their educational institutes—at all levels starting from kindergarten to universities and colleges—which affected the learning process of more than 83.7% of the world's students following the decision of many countries to shift to alternative modes of learning and teaching.[28] This closure resulted in disrupting the learning for the majority of students, especially those residing in developing and underdeveloped countries. This review covers 66 articles including 6 reviews that address this issue for HEIs. The list of all covered articles is included in Appendices 3 and 4.

Based on these reviews and articles, an elaborated scheme delineating the digital tools used before and after the pandemic for 18 countries selected from the list of the 30 countries included in the reviewed literature was drafted. More sources published prior to the years of pandemic were also referred to with the aim to provide an accurate reporting of the exact tools used by these countries. These 18 countries were

Figure 4. Number of articles included in the scoping literature review per country

Figure 5. Grounded theory procedures using thematic coding

selected based on their human development index (HDI) to underline the discrepancies of DSM tools across countries with different HDIs as shown in Table 3.

As illustrated in the Table 3 above, findings suggest that whereas countries with a high HDI such as the UK, the US, and South Korea, among others, are acquainted with the concept of DSM in HEIs and have a relatively adequate infrastructure and servers in place, such as those for MOOCs and LMSs;[31,34] others like Ghana, Morocco, and Iraq had little or limited exposure to these tools before the pandemic. This resulted in a more strenuous adaptation to embedding DSM in HEIs and to converting to digital learning with the emergence of the pandemic. This uneven allocation of digital resources resulted in a further digital divide in developing countries that affected students' connectivity and access to digital platforms. In fact, such digital divide can also be observed between different regions and sections within the same high HDI countries, or even within the neighborhoods of the same cities in these developed countries. In this regard, educators suggest that HEIs, ministries of education, ministries of communication, as well as tech companies from the private sector should collaboratively find cost-effective solutions to merge DSM platforms in the educational field and to enable an efficient use of a variety of DSM tools for students, educators, and academic institutions without overbearing an additional financial burden that can be caused by installing these tools and software.[2,66,67,78] These findings are congruent with those discussed in the study of Babbar and Gupta[79] where the authors highlighted that poor internet infrastructure and connectivity, unavailability of proper equipment and devices, and the unpreparedness of the academic institutions are among the main reasons why a transformation to digital and online learning during the pandemic was difficult, especially for developing countries such as India, Bangladesh, Jordan, Nepal, South Africa, and more. Another study by Hossain et al.,[80] also confirms this point where it was proven through a bibliometric analysis that digital divide is among the main challenges related to DSM integration within HEIs.

Figure 6. Word cloud of the records generated using Atlas.ti

Table 2. Codes and sub-codes used to code data

Main codes	Sub-codes
Stakeholders	Students, educators
Sentiment	Negative, positive
Challenge 1	Anxiety, stress, time constraints
Challenge 2	Assessment and grading: negative
Challenge 3	Curriculum incompatibility
Challenge 4	Distractions
Challenge 5	Ethical concerns
Challenge 6	Feedback issues
Challenge 7	ICT preparedness: negative
Challenge 8	Internet and technical issues
Challenge 9	Learning challenges
Challenge 10	Low engagement
Challenge 11	Low human interaction
Challenge 12	Low mentorship
Challenge 13	Low motivation
Challenge 14	Low practice
Challenge 15	Low self-confidence
Challenge 16	Privacy concerns
Challenge 17	Training
Opportunity 1	Assessment and grading: positive
Opportunity 2	Better teaching
Opportunity 3	Effective communication
Opportunity 4	Flexibility
Opportunity 5	High engagement
Opportunity 6	High motivation
Opportunity 7	High self-confidence
Opportunity 8	Human interaction
Opportunity 9	ICT preparedness: positive
Opportunity 10	Independent learning
Opportunity 11	Less anxiety, stress, time constraints
Opportunity 12	Sustainable learning
Opportunity 13	Up to date and accessible learning
Opportunity 14	Varied modes and styles

Clustering the analysis of the role of DSM in HEIs based on the HDI indicator, and further to the discussion above, there are significant differences of how developed countries smoothed the rapid transition of online learning in a better way when compared to developing and under-developed countries. To begin with, developed countries excelled in the digitalization of education many years prior to the pandemic. Countries such as the UK, the US, South Korea, France, and Italy, to name a few, had the necessary mechanisms and preparedness level to embed DSM into HEIs.[31,32,79,81] Furthermore, professors and educators, through trainings and professional development opportunities had advanced skills that allowed them to utilize different types of online platforms and to convert traditional learning materials into advanced e-format as highlighted by Camilleri and Dost et al.,.[82–84] Moreover, developed countries have advanced technical infrastructure, servers, and ICTs unlike other developing countries, as discussed earlier. Internet infrastructure with high speed of internet bandwidth played a significant role in enabling students to access multiple platforms whether in synchronous or asynchronous manner.[32,85] Coupled with the ability to possess appropriate hardware gadgets and resources such as computers and laptops, students and educators had no issues connecting to classes online and continuing their learning. Finally, with the provision of dedicated

conducted numerous counselling sessions (Sahu, 2020).

However, even after countless obstacles faced and efforts made by teachers and administrators, achieving socio-economic equity in education during the COVID-19 crisis remained a big challenge. Accommodating students from diverse and disadvantaged backgrounds such as students with disabilities, those residing in rural areas with no Internet connectivity, migrants, refugees, etc. has been a major concern for the entire education system (Dorn et al., 2020; Mpungose, 2020; Oyedotun, 2020; United Nations Children's Emergency Fund, 2020). It was anticipated that due to prolonged shutdown of educational institutions, and an increasing digital divide among students, many may drop out of the system, thus affecting literacy, employment and the economy at large (Dorn et al., 2020). However, despite numerous challenges faced by students, teachers and administration, virtual education had its own merits and COVID-19 pandemic created an opportunity to explore and leverage those.

Merits and opportunities

The inconvenience caused by the COVID-19 pandemic pushed various stakeholders to explore different alternatives associated with remote teaching and learning (Mbiydzenyuy, 2020). The prolonged use of such alternative digital platforms led to identification of various merits and opportunities of virtual teaching–learning as presented in Table 5.

Despite innumerable efforts in past decades, universities were struggling to shift parts of their curriculum online and introduce e-courses since it was predicted earlier that digital learning environments may disrupt education (Beech and Anseel, 2020). But left with no choice, the inevitable catastrophe helped educational institutions to quickly explore virtual learning platforms and shift to online modes of teaching (Beech and Anseel, 2020). Fortunately, online learning was accepted immediately by students and many reported its worthwhile advantages. For example in Nepal, students reported that online courses were more convenient and they induce lifelong learning (Paudel, 2021). Likewise, in India,
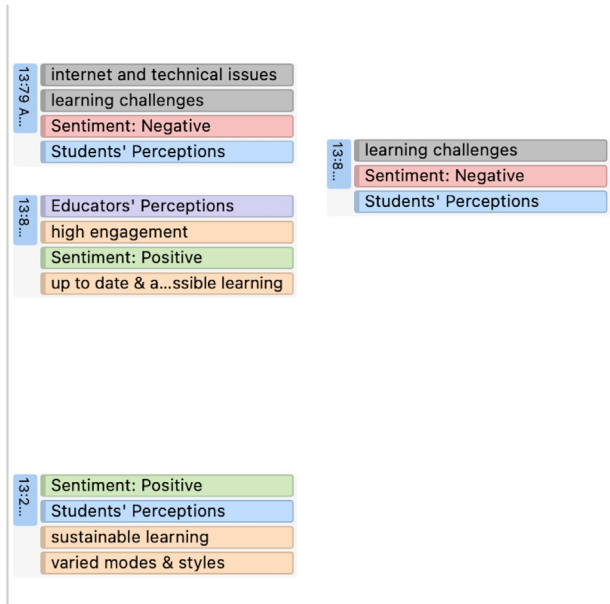
Figure 7. Screenshot of a coded passage in Atlas.ti

centers specializing in assisting both professors and students with technical support, known as centers for distance education (CDE), a smoother and more effective delivery of learning content, assessments, and assignment submission was achieved.[18,79] Mostly, challenges and barriers of DSM in HEIs in these countries are more related to the pedagogies used to deliver and assess learning outcomes than it is about to how to access this content in the first place.

On the topic of infrastructure suitability, and availability of technological gadgets, tools, and learning software, the same (i.e., ability to easily access these resources by students and instructors) can also be said for rich countries such as Qatar and KSA and other Gulf countries—as found from the literature—albeit studies show that these tools and platforms have not been leveraged to their full potential in these countries.[5,43] Prior to the pandemic, HEIs in this region were equipped with different LMS platforms such as Blackboard, Moodle, Canvas, and D2L to ensure an efficient asynchronous learning. The presence of these technical solutions though did not equate that both educators and students were proficient and familiar with using them and integrating them into teaching and learning.[86] This is why, following the pandemic, although colleges have introduced more platforms to ensure an ongoing learning and interaction between educators and students, e.g., Zoom, Webex, and Microsoft Teams, for lecturing and synchronous learning, faculty
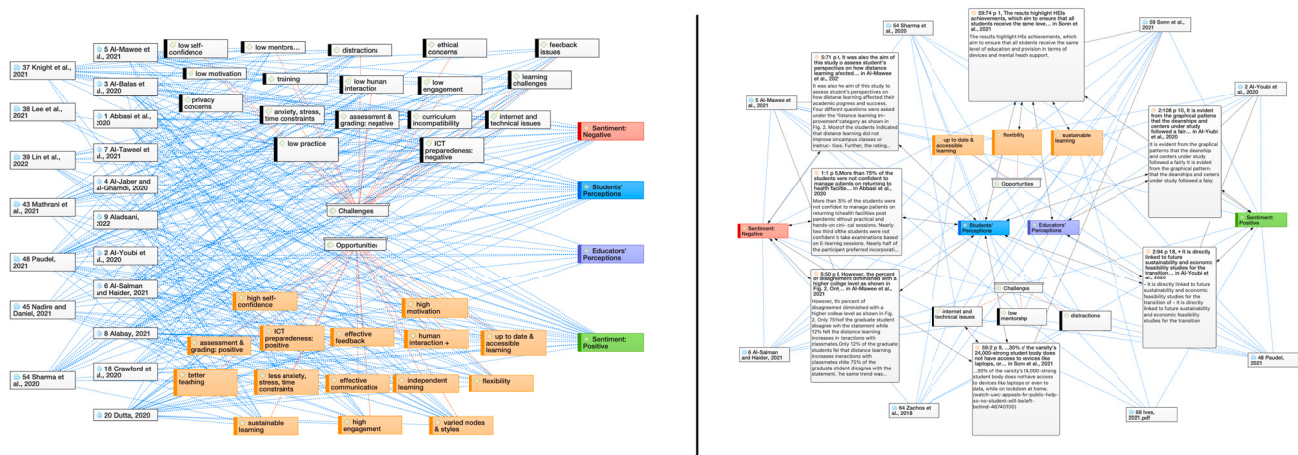
Figure 8. Screenshots demonstrating relationships between coded data, codes, and cited articles

Table 3. Summary of digital learning tools used in different countries before and after the pandemic

Country	Human Development Index (HDI)	Citations	Initial Digital Tools Before the Pandemic	Additional tools used during and after the pandemic
United Kingdom	0.932	Khan.et al., Paudel, and Watermeyer et al.[29–31]	Virtual Learning Environment (VLE) Moodle Canvas Blackboards Coursera	Zoom Microsoft Teams Facebook
United States	0.926	Al-Mawee et al. and Armstrong-Mensah et al.[32,33]	Wide range of Learning Management Systems (LMSs) Coursera	WebEx Zoom Microsoft Teams
South Korea	0.916	Kim et al., Romero, Tinmaz and Ozturk, and UNESCO.[34–37]	KERIS e-Learning Massive Open Online Courses (MOOCs) South Korea Educational Broadcasting System (EBS)	WebEx Zoom Microsoft Teams YouTube Google Hangout KakaoTalk
France	0.901	Alabay, Badeau et al., Gaebel, Motte-Signoret et al. and Salles et al.[38–42]	LMS such as Moodle Webinars	Zoom Microsoft Teams Google Meet Meta/Facebook WhatsApp YouTube
Saudi Arabia	0.854	Aldiab et al., Alzahrani, Al-Youbi et al. and Hoq.[5,28,43,44]	Rwaq Blackboard Moodle Canvas D2L	Twitter Meta/Facebook Zoom
Qatar	0.848	(MENAFN, 2020; MOEHE Qatar, 2020)[45,46]	Canvas Blackboards	Mzeed Q-Learning Cisco WebEx Zoom Microsoft Teams WhatsApp
Romania	0.828	Butnaru et al., DIMA et al. and Iurcov et al.[47–49]	AeL ASK online learning eLearn	Zoom Microsoft Teams Google Meetings Skype Meta Instagram
Turkey	0.820	Keskin et al., Bilgic, and Karadag et al.[15,50,51]	Moodle Canvas Blackboards MERGEN	Zoom Perculus Adobe Connect Microsoft Teams BigBlueButton Google classroom WhatsApp Skype Viber

(Continued on next page)

Table 3. *Continued*

Country	Human Development Index (HDI)	Citations	Initial Digital Tools Before the Pandemic	Additional tools used during and after the pandemic
Malaysia	0.810	Chung et al., Rahim and Ali, and Syahid et al.[52–54]	i-Learn MOOCs	UFuture Meta WeChat Weibo WhatsApp YouTube Telegram Google Classroom
China	0.761	Xiong et al., Carey, He and Wei, Wang et al. and Zhang et al.[7,11,55–57]	Edx Coursera XuetangX iCourse Chaoxing Learning	XuetangX Global iCourse International SWAYAM DingTalk Zoom Cloud WeChat
Jordan	0.729	Al-Balas et al., Al-Salman and Haider, and Al-Shboul and Alsmadi[58–60]	Edraak Moodle Blackboards	Zoom Microsoft Teams YouTube WhatsApp Group University website/e-mail
South Africa	0.709	Mashau and Nyawo, Mpungose[61,62]	Moodle	Moodle Facebook WhatsApp YouTube Twitter
Egypt	0.707	Dakroury, El-Sayad et al.and Sobaih et al.[63–65]	Unix platform video conferencing using on-demand (VOD)	Facebook WhatsApp YouTube Twitter Zoom Google classrooms
Morocco	0.686	Elfirdoussi et al. and Anigri[19,66]	Moodle	Zoo, Microsoft Teams G-Drive Gmail Google Classroom Google Hangout WhatsApp YouTube
Iraq	0.674	Makki and Bali, Elameer[17,67]	–	MOOCRDD Baghdad-learning platforms Facebook Viber Zoom YouTube Telegram Skye Instagram

(Continued on next page)

Table 3. Continued

Country	Human Development Index (HDI)	Citations	Initial Digital Tools Before the Pandemic	Additional tools used during and after the pandemic
India	0.645	Alvi, Dutta and Jena[68–70]	e-Yantra SWAYAM National Digital Library	Virtual Labs Zoom Google Meet Jio Meet YouTube Facebook Instagram Twitter Blogger Google Meet
Ghana	0.611	Asunka, Butakor and Ceasar, Manu et al. and Adzaku and Adzakpa[71–74]	Sakai eCampus (Claroline)	Edmodo Ghana 2021 Twitter YouTube Facebook Pinterest Blogging
Pakistan	0.557	Nasir and Hameed, Abbasi et al., Adnan et al., Farid et al. and Khan.[14,75–78]	EdmodoOpen Courseware	Facebook WhatsApp Skype Zoom Microsoft teams Google Classroom

members reported they lacked training and preparedness to use these tools effectively and to integrate them into their teaching and assignments.[44,87–89] Moreover, even though many of these HEIs collaborated with local parties to solve technical issues that might arise due to virtual learning—for instance, one of the local universities in Qatar Hamad Bin Khalifa University in Qatar (HBKU) has established virtual private network (VPN), and virtual desktop infrastructure (VDI), as well as a dedicated support team (HBKU IT support) to guarantee the continuity of academic research during the crisis[90]—some studies, such as those by Aladsani, Alqurshi et al., still reported the hurdles of a full immersion in online learning by these universities.[65,87,91,92] Hence, the availability of these tools and platforms does not suggest that faculty members or students were familiar with using these technological solutions, as many HEIs had these software on the backburner in a standby mode.[87,89,92] More empirical studies and scholarship tackling best lessons and models to integrate both digital and social media solutions into HEIs—from institutional, infrastructural, and technical perspectives—are necessary at this stage, especially for countries in the Gulf region.

In the case of Turkey and other European or Asian countries such as Romania, Poland, Malaysia and China, which are considered as technologically advanced countries that already promoted technological competences in HEIs curricula,[15,38,93–96] online learning had already been provided in some universities, including various LMS and asynchronous modes of teaching. Additionally, the literature reports the established centers in these HEIs dedicated to providing technical assistance, such as the Continuing Education Center (CEC) in Turkish universities or the Center for Distance Education (CDE), specialized in carrying out online education services. During the pandemic crisis, these universities witnessed growth of CDEs. Despite the mobilized resources to assist these HEIs, the most prevalent issue was assessing and grading students' assignments and maintaining the integrity and robustness of these HEIs and their programs, primarily through proctoring and attenuating any breaches of ethical misconducts, which were among the main challenges faculty members reported.[7,49,97,98]

For the last category, i.e., countries with low HDI such as Afghanistan, Pakistan, Iraq, India, Morocco, and Jordan, studies show that the resources needed from facilities to basic needs of online learning tools to support their students and educators are the main hurdles and barriers to the conversion of these institutes to online learning.[17,30,74,78,99] Studies show that HEIs at these countries grappled to maintain the continuity

of their students' learning either because of infrastructure challenges or because the inability of students to access courses outside of these establishments.[78,100,101] In the case of Jordanian universities, despite the acceleration to use online learning tools including the incorporation of LMSs such as Moodle and Blackboard and other accessible MOOCs platforms such as "Edraak"—which is a collaboration project with edX to produce Arabic language content—both students and instructors were left out unprepared to continue online learning effectively during the pandemic.[58,60] Essentially, there is an urgent need to (1) improve infrastructure of digital platforms, (2) provide students with necessary hardware resources to conduct online learning, and (3) provide students and faculty members with sufficient ICT training and Internet bundles for connectivity.[67,102] In countries such as Pakistan and Nepal, another intriguing observation was established from the literature review, which is the different impact of online learning on both male and female students. As Mathrani et al.,[13] demonstrated, due to cultural practices across five developing countries, namely India, Pakistan, Bangladesh, Nepal, and Afghanistan, females had more constraints adjusting to online and remote learning and maintaining the same level of motivation. ON the one hand, this is due to their inability to obtain stable internet connection especially in remote regions, and on the other, given the additional distractions they were confronted with at their households, it was deemed hard to maintain high attendance and engagement levels during the pandemic, unlike their male counterparts. Cultural barriers are not restrained to this region, as in many other Muslim conservative countries—such as KSA, Qatar, and more—using the webcam for synchronous learning was among the main issues why a face-to-face experience could not be emulated in the virtual realm. As many students and faculty members alike—mostly females—choose not to turn on their cameras, due to privacy and cultural constraints, a full learning experience could not be achieved in many of these settings.[83,94,103,104] In the following Section 3.2, there is more perusal of the challenges learners and educators faced and the opportunities that emerged from the crisis, as well as a sentiment analysis are depicted.

Educators' and students' perceptions and sentiments

To better understand the stances of these two stakeholders (students and educators) about using DSM in HEIs, the authors first computed two word-clouds tackling the main recurrent themes and concepts based on the sentiments expressed by students and educators. The output is illustrated in Figure 9. Whereas topics on technical issues, lack of human and social interaction, and challenges of conducting assessments and assignments online are among the most recurring negative sentiment themes; having access to more resources, being more engaged, and having the flexibility to take courses online are among the positive ones.
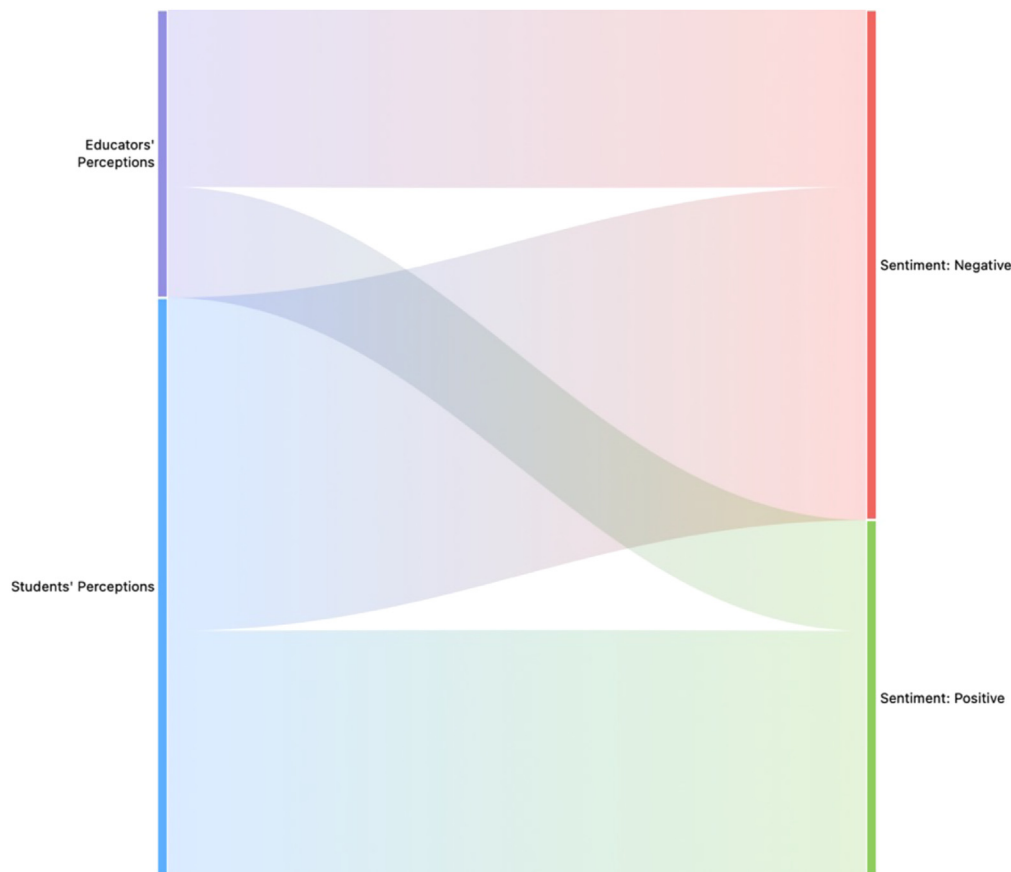
Delving more into understanding the stances of these two stakeholders from DSM integration in HEIs separately, it is observed that the prevalent sentiment on the use of DSM among educators and students is negative. This is better illustrated in the code co-occurrence Table 4 and the Sankey chart in Figure 10.

Figure 10 demonstrates that, largely, there is a prevalence of negative sentiments from DSM in HEIs. To quantify these observations using the values from the code co-occurrence table, notably, there are 61.5% instances of coded statements where educators expressed negative sentiments about DSM versus 38.5% where a positive sentiment was expressed. For students, even though this group of stakeholders held a more accepting perception toward DSM uses in HEIs, the majority (i.e., 57% of coded statements) reflected a more negative sentiment toward this integration, versus 42.3% of instances where students expressed their receptivity of DSM in HEIs. These results align with Al Balushi's review[105] where findings show that most studies and articles written on the topic of DSM integration dealt with students' perception more than that of educators. Al Balushi's review also reveals that the prevalent perception among educators from SM integration is more negative than that of the students, which confirms the findings in this present study.

Students' and educators' negative sentiments

When investigating the data to better understand the main challenges prevalent for most educators and students, the authors used the following Sankey graph in Figure 11 to highlight these occurrences. Table 5 is the code co-occurrence table of coded instances based on the which the aforementioned figure was exhibited. From the Table 5, it is clear that ICT preparedness (59 instances), curriculum compatibility (42 quotes), and anxiety, stress and time management (36 quotes) are the most stated perceived challenges according to the educators involved in this review. Other recurring themes that were covered by these educators are the issue of grading and assessment, lack of training, and ethical and privacy issues when using

Figure 9. Word clouds depicting overall themes from expressed negative and positive sentiments from DSM in HEIs

online platforms with their students. As for students, Internet and technical issues, learning challenges, and low human interaction are the mostly perceived challenges by this category.

To analyze these findings related to educators, lack of preparedness and adequate training for educators to fully support online learning during the crisis was indicated by an extensive number of studies.[19,79,82,87,92] Although many HEIs have had a fair share of experience using online learning platforms, very few were fully ready to manage and adapt the rapid shift from classroom learning environment to distance or remote learning environment.[15,17,41,73,79] Mostly, and in different parts of the world, faculty members were not prepared or guided on how to access various digital platforms or online instructional materials to proceed with the learning process with sufficient digital skills.[49] Mostly for HEIs in developed countries, converting traditional learning content into online format and developing material to facilitate online learning using clear, distinct and innovative online learning guides was a barrier that many educators faced and grappled with.[32,57,106] Subsequently, given this curriculum incompatibility, many felt demotivated to deliver content to their students as the medium of teaching and the pedagogy to be followed was constricting them from meeting their students' expectations and their course learning objectives.[15,87,98] This in its turn resulted in a feeling of a burnout among many educators, both from the developing and developed world, who experienced multiple burdens and stresses to adjust to synchronous and asynchronous learning, especially in terms of maintaining constant communication with their students.[18,30,55,107,108]

Another reason why educators were feeling worried to use online learning is privacy and ethical issues. For the former, mostly in conservative societies, female faculty members were ambivalent about turning on their cameras or sharing their screens with their students due to cultural reasons.[87] In the case of less conservative societies though, sharing screens with students through turning on video options or through

Table 4. Code co-occurrence table on sentiment of DSM among educators and students

|	Educators' Perceptions	Students' Perceptions
Sentiment: Negative	187	352
Sentiment: Positive	117	259

Figure 10. Sankey chart illustrating educators' and students' sentiments from DSM based on the code co-occurrence table

communicating with them using social media platforms posed another form of challenge and problematization, which is online piracy, hacking, and data theft.[17,73,109,110]

In tandem with this issue, grading and assessments were particularly challenging for educators and HEIs who wished their students to maintain the same level of integrity when submitting their assignments and/or exams. Hence, ethical challenges were redundant for educators. Mainly, establishing the authority to ensure that students were submitting their work as their own was a priority for many HEIs, especially during examinations.[15,51,55,98] In addition to unethical behavior in terms of exam dishonesty that enables students to cheat behind the screen,[18,49,111] other concerns educators had are related to proxy attendance[104] uncertainty of students' identity since credential could be shared with third persons, especially when submitting exams with scanned ID via e-mails,[57,98] and the inability to purchase or obtain access to licensed software which increased the use of pirated version of that software.[15,98] As a remedy, Hayashi et al.,[112] proposed that online assessment and exams should be carefully evaluated along with ensuring protection of user credentials by the use of new technology such as blockchain, for instance. Other solutions are related to continuous training needed for educators to ensure their mastering of DSM and ICT tools and to ensure an ethical use of digital technologies.

Regarding students, even though results from the literature show that they also share similar concerns with the educators in terms of: increased anxiety and stress when interacting with their faculty members through a new mode of communication and learning,[59,75,83,113] the feeling of unpreparedness with using ICT,[32,58,61,114] and the displeasure they face about the way lessons are designed and delivered;[56,57,75,111] they, however, expressed different concerns as main challenges. For students, especially in underdeveloped countries—but even in developing and some developed countries depending on the families' socio-economic status—internet and technical issues were the predominant barriers to learning. Students in
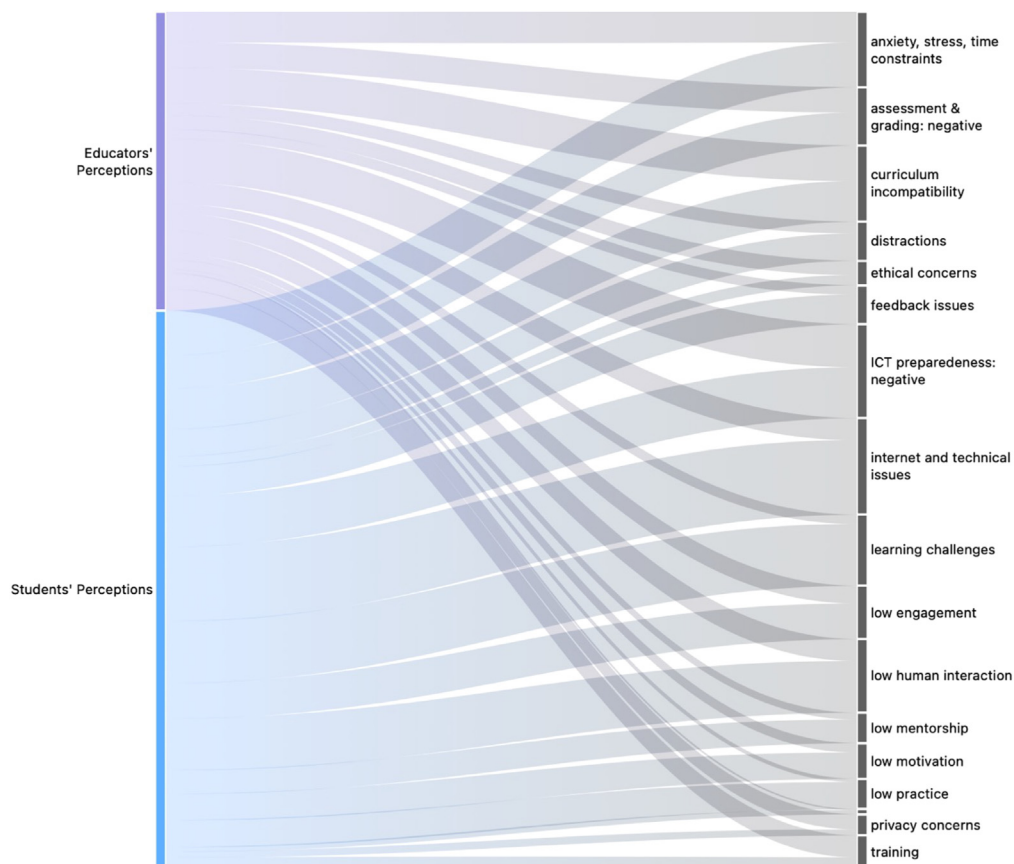
Figure 11. Sankey chart illustrating the intensity for each coded challenge among students and educators

remote and underprivileged areas face tremendous challenges in connecting to their class or to watch re-coded videos.[19,30,57,102,115] Based on the literature, students stress the significant urge to have IT support teams to solve technical issues they face.[31,76,116] Furthermore, students indicate limitations they are confronted with when using certain LMSs such as Moodle, for example, since it does not allow for live chatting/lecturing to enhance the engagement and collaborative learning experience.[116] Therefore, students suggest that more integration of LMSs with other platforms is essential to provide interactive online lectures. They recommend that LMSs and formal education should be supplemented by other digital platforms (such as Zoom) and social media sites (such as WhatsApp, Instagram, Twitter, and Facebook). To address this, in a recent empirical study by Zablith[117] conducted in Lebanon, the author reports how embedding some APIs from social media sites such as Facebook, Twitter, or YouTube has made learning more interactive and encouraged collaboration among students with their peers as well as their instructors. With an increase reliance on social media sites, mostly by students, such practice can introduce new ways for educators to render their lessons more interactive and exciting and can foster new ways of collaborative and engaging learning. This is why more research on this topic is deemed essential, especially in the post COVID-19 pandemic era.

The second main issue expressed by a large number of students in the literature is lack of preparedness to learn online (either via synchronous or asynchronous modes), which exacerbates their learning challenges.[32,102,118,119] Some students in under-developing countries declared that online learning was completely new and there was a need for sufficient training on how to use LMSs to sustain the learning process.[19,66] Many stated their needs for ample training on how to best use online resources to support their learning for educational purposes.[28,49] Moreover, many among them indicated that online learning did not provide them with the same level of in-depth understanding of learning content or materials as traditional learning does.[56,59,108,114] Other students, including students from developed countries, emphasize that the quality of emergency online learning was not as the same as traditional learning.[28,32] On this topic, there

**Table 5. Code co-occurrence table used to highlight main challenges for students and educators**

Challenges	Educators' Perceptions	Students' Perceptions
anxiety, stress, time constraints	36	53
assessment & grading: negative	30	39
curriculum incompatibility	42	48
distractions	14	32
ethical concerns	17	12
feedback issues	11	35
ICT preparedness: negative	51	60
internet and technical issues	26	88
learning challenges	11	73
low engagement	21	42
low human interaction	26	61
low mentorship	8	28
low motivation	11	31
low practice	4	32
low self-confidence	1	5
privacy concerns	18	7
Training	26	13

was a disparity of perceptions among students from different backgrounds and levels (i.e., students from medical schools versus those from social science, or undergraduate students versus PhD students). In a study conducted by[120] based on dentistry and medical treatises, it was noted that while older and more senior students preferred blended or traditional learning since their courses involved procedural knowledge and hands-on practice, younger students preferred online learning as they were satisfied with independent learning. In other disciplines, however, whereas senior students preferred independent and asynchronous learning, freshmen and sophomore students tended to find synchronous and traditional learning more lucrative to them, especially because they can have more opportunity to access their professors' timely feedback.[49,121] As a rule of thumb, courses requiring laboratory experiments and work were regarded important to be conducted in an in-person fashion than online.[30,96,122,123] For this reason, students belonging to these programs usually reported challenges in learning and lack of practice for courses that demanded more hands-on practice and experience.

Finally, on the question of low human interaction, even though students found the use of technology to be more engaging and motivating, at times they expressed the need to have face-to-face interactions with their professors and instructors.[32,92,101] This is mostly significant among students with low performance levels or freshmen who struggle to keep up with course demands and requirements.[30,51,95] Mostly, students who grappled with assignment instructions and needed more in-person assistance to better understand these assignments and the course material urged HEIs to consider designing distance learning classes that allowed for a more interaction with the instructors.[83,92,101] Other challenges students reported in the literature concern the need for a better mentorship, better designed exams and assessments with appropriate and constant feedback, and less distractions when studying online.[2,13,57,124] For the latter, these can be intrinsic (i.e., students are easily distracted by other websites and irrelevant social media content), or external (i.e., having a crowded household and limited access to computers or laptops where these are shared with other individuals).

Students' and educators' positive sentiments

Figure 12 and Table 6 depict the most mentioned DSM in HEIs' opportunities as perceived by students and educators covered in the literature review. To begin with the educators, in terms of positive perceptions, the most common positive perceptions among educators are flexibility, effective communication, and maintaining sustainable learning. Numerous educators hold the same view that online teaching saved their time and provided flexibility both for them and their students, allowing them to deliver classes at their ease
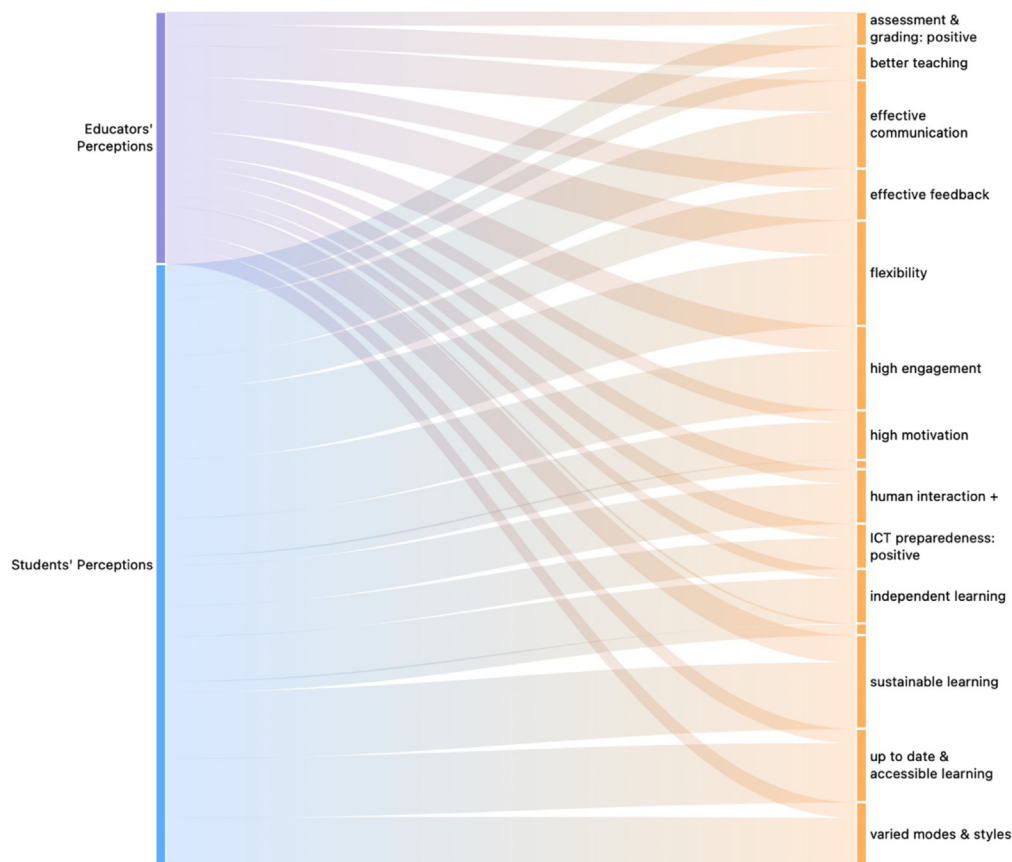
Figure 12. Sankey chart depicting more recurring opportunities in the literature

and for their students to access learning materials anywhere and anytime.[58,75,82,85] The flexibility in online learning helps to sustain the learning process during crisis situations and addresses the needs to shift from traditional classroom learning to 21st century learning by means of using technology.[115] Keskin et al.[125] revealed that LMS was the major educational platform utilized during the pandemic that provided flexibility to ensure students access to learning materials for an asynchronous learning, with Moodle found to be the most preferred open learning source during emergency online learning. The use of social networking or DSM platforms had also played a crucial role during the pandemic to maintain communication between students and educators and to promote further collaboration and cooperation among them.[34,109] Despite the stated barriers in the previous section, educators found that online learning can have some convenient sides, especially in emergency learning. Furthermore, they also claimed that online teaching helped in exchanging information and opportunities with other colleagues.

Another prevailing theme in opportunities is the ability to maintain effective communication with students through DSM. This is manifested in the perception that DSM platforms, and in particular SNSs, allowed educators to established cooperative communities and interact with their students beyond classrooms.[69] Moreover, educators find these tools to be useful and convenient to reach out to their students especially that they are free and accessible through mobile phones.[126] This leads to both increasing level of engagement among students and to sustaining their learning. Regarding engagement, mostly embedding YouTube videos into class materials was appreciated by students, which prompted educators to use them more often. Faculty members and instructors in under-developing countries tended to use existing videos in YouTube to help their students better visualize the learning contents.[87,123]

From their side, students agreed for the most part about the flexibility and the ability to sustain their learning through DSM, especially in under-developed countries. In addition, students emphasized that online learning enhanced self-management skills and it enabled independent and personalized learning as

Table 6. Code co-occurrence table used to highlight main opportunities for students and educators

Opportunities	Educators' Perceptions	Students' Perceptions
assessment & grading: positive	11	18
better teaching	18	11
effective communication	26	48
effective feedback	17	27
flexibility	29	60
high engagement	21	50
high motivation	10	32
high self-confidence	0	8
human interaction +	12	34
ICT preparedness: positive	12	26
independent learning	8	38
less anxiety, stress, time constraints	1	9
sustainable learning	23	56
up to date & accessible learning	12	50
varied modes & styles	13	41

students became more responsible and self-directed toward learning.[38,58,83,120] With the presence of tools and software that enabled them to access learning sources and keep up-to-date and that did not cost high prices, many students mainly from under-developed countries admitted that this created better opportunities for them to learn and be more engaged in their learning.[43,79,83]

Conclusions and future work

Based on a scoping literature review and a grounded theory approach, this study attempted to investigate the overall perceptions and sentiments among students and educators alike in HEIs across different countries vis-à-vis the use of DSM platforms and tools for TLA, which was mostly catalyzed following the Covid-19 pandemic in an imposing manner on the institutions, governments, students, educators, and parents. Notably, the authors endeavored to address the following points: HEIs' response to remote/distance/online/digital learning due to the pandemic, the perceptions and sentiments of students and educators from such conversion, and the challenges and opportunities that are mostly highlighted in the literature. The findings provide an insight in terms of the readiness, preparedness, and familiarity with online teaching and learning of HEIs in different countries.

Findings suggest countries' HDI was a critical factor for how HEIs in these countries responded to the pandemic. While developed countries with high HDI faced little to no issues in transitioning to online/remote/distance learning, as both faculty members and students had a high degree of ICT preparedness, and as an adequate infrastructure has already been installed prior to the pandemic in these areas, under-developed countries with low HDI in particular faced multiple challenges connecting with their students and ensuring a sustainable learning and education; including taking exams, attending lectures, and receiving feedback. When it comes to richer countries such as Gulf countries, or technologically adept countries such as Turkey, Malaysia, or Romania, infrastructure adequacy and technology availability were not as challenging as the lack of ICT preparedness among educators and students. Furthermore, since these tools had not been used as intended by HEIs prior to the pandemic, it was mostly tedious for educators to incorporate them in their synchronous teaching during the pandemic. Nonetheless, a few pertinent aspects to DSM embedding still stand even in the more developed countries, among which are the pedagogies to be used to deliver course content online and the question of maintaining and improving students' participation and engagement while ensuring a life-work balance for educators, as many tend to feel stressed out and overwhelmed. Results emphasized the importance of boosting blended learning using the right combination and integration of technology, pedagogies and modes of TLA to fit the current, ever-challenging, and demanding trends of learning in the digital era. It is also crucial for faculty members to be provided with clear strategic plans and training by these HEIs. To enhance the effectiveness and delivery of online learning, it becomes increasingly important to improve the quality of educational content,

material, and resources via technological pedagogical tools to meet the objectives of learning and make students more engaged. Some factors that can help in measuring the quality and functionality of the online education platforms include: (1) their simple interface design, (2) their user-friendliness, (3) their quality of picture, video, and sound, (4) their access speed, and (5) their security and reliability.

This study insinuates that due to the imposed restrictions of COVID-19, most elements of HEIs from pedagogical approaches, curriculum, assessments, materials, and resources were deemed improperly established for digital learning. Future steps to be undertaken by the authors to advance academic and scientific research in the area of DSM and education is to focus on online assessment using social media platforms. Online assessment is historically associated with the growth of online learning platforms, and it has received more attention since the pandemic forced the rapid transition to online learning where there was a need to properly assess the learning outcomes of students. Therefore, it becomes important to rethink educational assessments with the emphasis of aligning them to learning objectives and curriculum priorities. For future research, we aim to look into how to properly assess or develop digitally reliable and valid assessments for students that ensure accessibility to educational settings, as most states are moving toward knowledge-based economies. Future studies will be conducted in Qatar as a case study, where digital assessments and principles have already been designed and embedded in various local and international HEIs in this state. The authors will focus on considering local context and needs of students and faculty members. Based on global comprehensive literature reviews, comparative analysis, qualitative and quantitative research, interviews and surveys to be conducted using design thinking approach, online assessments for specific fields and education levels will be developed and evaluated to cater to the local needs of students and educators in this state.

Limitations of the study

Even though the authors relied on a scoping review as reported in the Star Method section to allow for a wider synthesis and analysis of the existing literature, this treatise does not come without limitations. First, a substantial number of the studies were related to students from medical colleges or HEIs of other medical-related fields. Due to the nature of these disciplines that require hands-on practice, and as laboratories or clinics were significantly impacted because of the pandemic, more reporting on these fields was observed in collected data, which restrained data diversity and generalization. Besides, most of the papers used for the analysis covered students' perceptions not educators' or faculty members' perceptions. An ampler overview of educators' views and used strategies is essential then for a better understanding. In addition, it is worth mentioning that graduate students majoring in computer science were more comfortable with online learning and had sufficient technological competence and skills when compared to others such as social science or medical students. More studies need to scrutinize such comparative analysis of undergraduate and graduate students of different disciplines with more comprehensive assessments of students' readiness. This analysis needs to be nuanced according to students' college level and discipline.

STAR★METHODS

Detailed methods are provided in the online version of this paper and include the following:

- KEY RESOURCES TABLE
- RESOURCE AVAILABILITY
  - Lead contact
  - Materials availability
  - Data availability
- METHOD DETAILS
  - Scoping literature review approach

SUPPLEMENTAL INFORMATION

Supplemental information can be found online at https://doi.org/10.1016/j.isci.2023.107322.

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STAR★METHODS

KEY RESOURCES TABLE

REAGENT or RESOURCE	SOURCE	IDENTIFIER
Software and Algorithm		
Atlas.ti	ATLAS.ti	https://atlasti.com/
Other		
Journal Articles (Appendix 3 and 4)	Scopus	www.scopus.com
Journal Articles (Appendix 3 and 4)	Google Scholar	https://scholar.google.com/
Journal Articles (Appendix 3 and 4)	ERIC	https://eric.ed.gov/

RESOURCE AVAILABILITY

Lead contact

Further information and requests for data and resources used should be directed to and will be fulfilled by the lead contact, Maryam Al-Hail (moaalhail@hbku.edu.qa).

Materials availability

This study did not generate any new nor unique material.

Data availability

- This paper analyzes existing and published papers from the following databases: Scopus, Google Scholar and ERIC using the Scoping Literature Review method. The reviewed articles are listed in the Excel Tables S3 and S4.

- Atlas.ti software was used for the analysis and the file is available from the lead contact upon reasonable request.

- Any additional information required to reanalyze the data reported in this paper is available from the lead contact upon reasonable request.

METHOD DETAILS

Scoping literature review approach

Customarily, review studies consist of a systematic literature review methodology where scholars follow a systematized approach to allocate and analyze relevant studies to answer specific research questions.[127,128] Recently however, a new approach regarded as a precursor to the systematic literature review called scoping literature review has emerged in the scientific field.[129,130] Unlike the systematic literature review that is used to collate, refine, and synthesize findings of studies to clearly address the formulated research questions, this approach is conducted to "identify knowledge gaps, set research agendas, and identify implications for decision-making" on a wider and less nuanced scope.[130] Similar to the systematic literature review, though, a scoping review can be conducted following a similar systematized procedure: identifying sources based on a keyword search and specific themes, using eligibility criteria (i.e., inclusion and exclusion criteria), screening sources, and analyzing the resulting sources based on less nuanced research questions. For this present study, the authors sought to follow a scoping review approach given on the one hand the novelty of the topic (i.e., DSM in education during and after the pandemic), and on the other, the need to inspect how research is conducted on this topic and the broader themes that are being tackled.

To do so, the authors followed the five-step Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) for 2019.[131] The initial search was conducted on three different databases, notably Scopus, Google Scholar, and ERIC. Diversifying the databases was essential to capture most of the sources addressing the research theme and questions. Keyword search consisted of the following Boolean searches for Google Scholar and ERIC: (((("perceptions of educators") OR ("perception of students")) AND (online learning in HEIs)); (COVID-19 impacts AND HEIs); ((("digital

learning" OR "ICT") AND ("HEIs")). For Scopus database, the following Boolean expressions and statements were used: ((online AND learning) AND (hei*) AND review), and ((online AND learning OR digital AND social AND media AND learning) AND (review)). A total of 210 records were initially retrieved to conduct the research. Subsequently, only relevant files that strongly address the research objectives were included in the review.

The authors focused on collating both peer reviewed articles and reviews from these searches. Regarding the time frame, the search was limited to research studies and papers published from 2020 to April 2022 (the date by which the authors started gathering and organizing data). Still though, a few articles published earlier on, as well as other resources such as credible websites were utilized to support the findings of the literature. The total number of treatises used for the scoping review in this study is 66; 60 of which are research articles and 6 are reviews. The authors synthesized obtained data using a computer-assisted qualitative data analysis software (CAQDAS) called the *Atlas.ti* software for qualitative and sentiment analysis. Various visualization features found in the updated version of the software such as word cloud generator, co-occurrence tables and charts were also used.[132] The Figure 3 (see also Table S3) provides an outline of the steps followed for the scoping literature review to collate, compile, and synthesize the resulting 66 articles (see also Table S3). Table 2 presents the total 30 countries covered in the review and their corresponding World Health Organization (WHO) regions. Figure 4 exhibits the number of articles included in the review per country, and Table S2 combines these countries in one table along with their number of appearances in the scoping literature review (see Table S2).

Another form of analysis that was conducted in this study is sentiment analysis. Having gained considerable attention recently, sentiment analysis is used to formulate meaningful understanding of perceptions and preferences based on expressed feelings and emotions.[133] A large number of software rely on this feature through natural language processing and automatic analysis of verbal communications to produce general understanding of the most recurring sentiment in a given set of texts.[134] As one of the popular CAQDAS tools for qualitative analysis, an updated version of *Atlas.ti* has embedded this feature within its parameters.[135] Currently, this software can fetch and code passages that contain positive, negative, or neutral sentiment expressed in the imported textual data. Although the software contains a features that generates such associations automatically, it is recommended to filter these automated assigned codes manually as the output might contain various flaws and inconsistencies. For this study, two rounds of reviewing automatically assigned sentiment codes were executed manually by two separate authors to yield an outcome with a high level of agreement.