

# Digitalisation of the Teaching and Learning for International Students in Higher Education: A Systematic Review

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## Abstract

*During the COVID-19 pandemic, digitalisation in the international higher education sector was underlined by migration to online delivery across different educational contexts. However, research into the execution of digitalisation together with its impacts on the teaching and learning of international students in higher education is scattered and fragmented. This study aims to systematically review articles related to these topics based on a four-step refined process: initial search, filtering, screening, and in-depth review. Thirty-five identified articles were used to examine (1) the main forms of digitalisation of teaching and learning for international students, (2) the digitalization-related experience of international students in learning, (3) the opportunities of digitalisation of teaching and learning for international students and (4) the challenges of digitalisation of the teaching and learning for international students. Based on the findings, we discuss the implications of capitalizing on digital technologies and refining pedagogies in online and blended modes of delivery.*

Keywords: digitalisation, digital technology, experience, international students, international education, learning, teaching

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## Introduction

Digital tools have played an increasingly important role in the education of international students in both onshore and offshore programs over the past decades. However, the COVID-19 pandemic has demanded universities shift to online and/or blended delivery most often at very short notice. Numerous headlines and debates from higher education institutions, the media, and professional organizations underline how institutions, academics, and students are unprepared for such an unprecedented transition to the digitalisation of higher education. The large-scale shifts to online learning pose significant questions not only for the redesign and implementation of curriculum and pedagogy but also for the reimagination of the practices and values of higher education in an increasingly digitalised environment. In particular, the reimagination of teaching and learning in the digital landscape needs to consider the integration of technological tools into

course design as part of pedagogical and curriculum innovations in response to the changing context (McPhee, 2020). Despite significant challenges, higher education institutions have seized upon the “communicative, collaborative, and teaching power” digital technologies could potentially offer (Gomes & Chang, 2020, p. xxi).

The growing demand for online delivery unfolds universities’ struggles and simultaneously presents possibilities for the education of international students and the internationalization agenda of universities as international student mobility is a core component of international higher education globally. The fast-moving migration to online or blended delivery, coupled with COVID-19 and border closures, has had profound impacts on international students’ learning, welfare, and connectedness (Adachi & Tran, 2022). In particular, this increasingly digitalised higher education context poses an acute need to reconfigure the digitalisation of teaching and learning for international students. This reconfiguration is becoming more critical through institutions that are under pressure to relocate and revamp teaching and learning experiences in both spatial and temporal dimensions (Nixon et al., 2021). Yet, there is no formula for the internationalization of education and digitalisation of education that can fit all due to the varied purposes, aspirations, and characteristics of international students (Gomes & Chang, 2020; Tran et al., 2022; Tran, 2013a, 2013b).

To have a nuanced understanding of the forms, opportunities, and challenges associated with the digitalisation of teaching and learning for international students, this article aims to systematically review academic articles related to these areas by adopting a four-step refined process to answer four guiding research questions (RQs), namely (1) what are the main forms of digitalisation of the teaching and learning for international students?; (2) how do international students experience the digitalisation of teaching and learning?; (3) what are the opportunities of digitalisation of teaching and learning for international students?; and (4) what are the challenges of digitalisation of the teaching and learning for international students. While many of the 35 identified articles reviewed in this study were written prior to COVID-19, they present significant implications for the current digital environment. They provide fresh insights into the diversity of digital technologies and pedagogies used in teaching international students and mixed responses of international students towards digital learning.

## **Methodology**

This study systematically reviewed the literature related to the digitalisation of teaching and learning for international students in the higher education sector. The key principles underpinning the methodology of the study were aligned with the four-step systematic literature review originally proposed by Mun et al. (2020) which are (1) a systematic search from selected databases using terms and filters, (2) a primary screening of abstracts, (3) a second screening of the content, and (4) an in-depth review of identified literature. In this study, several minor changes were made to streamline the intended method. Specifically, as both abstracts and the content of articles were screened together, the third and fourth steps are merged into one to avoid repetition. Besides, the reviewing steps were split into discrete sections to highlight the process of filtering irrelevant articles. The four-step refined process in this study, therefore, was as follows: (1) an initial search using a variety of search terms that creates a relevant algorithm to find potential articles; (2) a filtering step to remove duplicates and exclude irrelevant articles based on a number of exclusion criteria; (3) a screening step on abstract sections to identify the relevance of articles from the previous step; and (4) an in-depth review of articles filtered from the third step. By using this four-step refined process, it is viable to keep this systematic review broad enough to include studies from interdisciplinary areas, yet simultaneously narrow enough to be focused on the chosen topic.

### **The Initial Search**

This step was to find relevant articles needed to conduct a systematic review. To cover a wide range of research from various directions of international education, three scholarly databases were put into consideration, namely Scopus, Web of Science (WoS), and Education Research Complete (EBSCO). The three databases are the most relevant and

reputable electronic academic platforms that potentially provide a wealth of academic publications on the digitalisation of teaching and learning. The chosen databases also have the same advanced structures using logical operators and algorithms as well as allowing the utilization of specifications that are essential to undertake a systematic review.

The same set of search terms was used on the three scholarly databases by using special characters, for example, asterisks together with AND or OR operators to form a relevant algorithm, namely (“international student\*” or “foreign student\*” or “overseas student\*”) AND (digital\* or online\* or virtual\* or \*reality or mobile\* or web\* or SNS or “Social Networking Sites” or “Computer-mediated communication” or CMC or “information and communication technology” or ICT or “social media” or MOOCs or internet or \*technology\* or computer) AND (learning or teaching). More specifically, the search term international student was used alongside other synonyms, such as overseas student and foreign student, to identify articles on the target students. A range of search terms related to digitalisation (e.g. digital, online, virtual, reality, or mobile) is used as hyponyms and hypernyms in the maneuvering for discovering articles containing relevant topics. Several search terms were put within the quotation marks to group compound words into specific phrases. Some prevalent acronyms of educational technologies, which are widely used as technical terms in research, were included in the algorithm, for example, SNS (Social Networking Sites), CMC (computer-mediated communication), ICT (information and communication technology), and MOOCs (Massive open online courses). The OR operators were used between the search terms inside parentheses to find research containing any of these terms. The AND operators were used outside parentheses as searching restrictions to narrow the result of the findings. There were several right-hand truncation characters used at the end of search terms to include the plurality of search terms, for example, student versus students, and experience versus experiences. In some cases, right-hand and left-hand truncation characters were also used to search for results that might be relevant to digitalisation. For example, the search terms digital\*, online\*, virtual\*, or \*technology\* allow the variations of digital devices, digitalisation, digitalize, online learning, online teaching, virtual technology, or virtual class.

### **The Filtering Step**

The filtering step was to remove extraneous articles found in the initial search. There were a number of filtration tabs executed after the initial search, for example, scholarly journals, peer-reviewed articles, full-text (or open access), and English language. These filtration tabs helped to narrow the scope of the results and check the relevance of identified articles. For example, scholarly journals and peer-reviewed articles filtration tabs were used to eliminate unpublished work, meeting papers, unofficial reports, and other grey literature which are unable to determine whether they were peer-reviewed or not. The use of full-text (or open access) and English language filtration tabs were to ensure the accessibility of the potential articles. There was no time limit required to allow the consideration of relevant studies in the past. All duplicates and inaccessible articles were removed.

### **The Screening Step and In-Depth Review**

In the last two steps, abstract sections were screened to identify the relevance of the articles. Apart from filtration tabs used in the previous step, three eligibility criteria of inclusion were taken into account to selectively choose articles related to the digitalisation of teaching and learning for international students: (1) target topics must be the execution of digital devices in teaching and learning for international students; (2) target learners must be international (or overseas or foreign) students who pursue full-time higher education degrees in a foreign country; and (3) the focus must be the teaching and learning experiences for international students. Compounded with the filtration tabs used in the previous step, to be eligible to be selected for this systematic review, articles must (1) be written in English, (2) be from academic sources, (3) focus on the execution of digital technology, (4) target international students in the higher education section, and (5) concentrate on the teaching and learning experiences. In this way, articles that do not meet all the five inclusion

criteria will be excluded. The inclusion and exclusion criteria are summarised in Table 1. All identified articles were scanned and skimmed to find relevant information to answer the four research questions.

**Table 1**

*Criteria for Inclusion and Exclusion*

<b>Examples</b>	<b>Inclusion</b>	<b>Exclusion</b>
Articles written in the English language	✓	
Articles written in other languages		✓
Articles from scholarly sources	✓	
Inaccessible articles		✓
Unpublished work, meeting papers, unofficial reports, and grey literature		✓
Articles related to the execution of digital technology	✓	
Articles not related to the execution of digital device		✓
Articles focused on international students in the higher education sector	✓	
Articles focused on other groups of students, such as domestic students, exchange students, high school students or unidentified target students.		✓
Articles focused on the teaching and learning experiences	✓	
Articles not focused on the teaching and learning experiences, for example, homesickness, mental health, university life, library experience, or university administration.		✓

**Results**

The initial search showed 1627 results from Scopus (123), EBSCO (285), and WoS (1219). After using filtration tabs in the second step, 1321 articles were found ineligible, while 306 articles went to the next stage. At the end of the screening step, only 35 articles proved eligible for the in-depth review. The list of the 35 articles is presented in alphabetical order in Appendix A.

**The Main Forms of the Digitalisation of the Teaching and Learning for International Students**

Based on the identified articles, there are various digital forms deployed in the international education setting. This indicates the complexity and diversity of the nature of digitalisation in teaching and learning for international students. In some circumstances, the issues of taxonomy arose when authors use equivocal and sometimes overlapping terms of digital technologies. Given the taxonomic ambiguity, this study classifies digital teaching and learning for international students into five categories: online learning, virtual reality technology, social networking sites (SNSs), other emerging technologies, and blended learning.

**Online Learning**

The term online learning refers to the teaching and learning practices taking place by means of computer-mediated communication technologies (CMC) and the internet (Lanham & Zhou, 2003; May & Tekkaya, 2016; Sleeman et al., 2019; Warring, 2013; Zhang & Kenny, 2010). Online learning can be classified into two categories: asynchronous and synchronous. In the asynchronous online learning environment, international students are able to access and study through online structured lessons, and asynchronously discuss with class members in online discussion groups. Asynchronous learning is delivered in many ways which include web-based resources (Lear et al., 2016; Oktriono, 2019;

Sloan et al., 2014; Watson, 2011; Yuhan, 2017), discussion platforms such as WebCT (Lanham & Zhou, 2003; Zhang & Kenny, 2010), Blackboard (Karkar-Esperat, 2018), or one-way audio/video podcasts (Geri, 2011; Geri, 2012). Synchronous online learning, on the other hand, allows the possibility of working and scaffolding knowledge among class members in real time with immediate and real-life interactions. Examples of synchronous online learning are two-way video lectures (Geri, 2011; Geri, 2012) or interactive web-based virtual classrooms (Wang & Reeves, 2007).

Based on the aforementioned ideas, there are a number of sub-forms of online learning mentioned in the identified articles which will be explored in the following sections: online learning platforms, web-based learning, video-based learning, mobile learning, and combined use of online resources.

### ***Online Learning Platforms***

Online learning platforms have been widely used as means to deliver educational instructions between teachers and students (Lanham & Zhou, 2003; Lear et al., 2016; Perren, 2010; Watson, 2011; Yuhan, 2017; Zhang & Kenny, 2010). More specifically, teaching content and learning activities take place on online platforms through the use of the Internet, computer, web browser, and program applications. For example, a number of academics made use of WebCT, FirstClass, and Blackboard Learning System with several features needed for the teaching and learning activities such as learning content, discussion areas, content-related links, assessment, and submission (Karkar-Esperat, 2018; Lanham & Zhou, 2003; Perren, 2010; Zhang & Kenny, 2010). Horizon Wimba is another type of web-based learning platform that enables simulation of real-world experiences to students, including discussion forums, private messages, and synchronous interaction between students and teachers as well as between students (Wang & Reeves, 2007).

### ***Web-Based Programs***

Web-based programs are one of the major aspects of online learning. Web-based programs lay the emphasis on independent and self-regulated learners who would like to study at their own pace and time. There are several programs mentioned in the identified articles that are developed for various purposes. Teaching academic culture and skills is the focus of Prepare for Success program that helps international students assimilate to new academic culture in the UK (Watson, 2011). Study Skills Success provides international students with essential academic literacy and skills (Lear et al., 2016). Dissertation Game Model supports postgraduate international students in understanding the conventions of writing a dissertation (Sloan et al., 2014). Web-based programs are also deployed to teach foreign languages to international students whose first languages are not the instruction language at host universities. Yuhan (2017) presented a multimedia website named Time to speak Russian, to convey a Russian language course to non-Russian international students studying in Russia. Mujico and Lasagabaster (2019), on the other hand, investigated the potential impacts of using e-Portfolios on motivation, self-regulation and language acquisition of international students in the UK. The web-based program is also used as a language proficiency test to measure the spoken and written Indonesian language skills of international students studying in Indonesia (Oktriono, 2019).

### ***Video-Based Programs***

Thirdly, online learning is also shown through the use of videos. This form of online learning offers international students an opportunity to study by watching a variety of videos. Generally, there are three types of video-based learning reported in the identified articles, namely video lectures, interactive video lectures, and live video sessions (Geri, 2012). In terms of the first type, video lectures are mainly used as a complementary means of supporting traditional face-to-face classes. Specifically, besides textbooks and educational materials, videos containing lesson content are created by lecturers and then uploaded to the learning platforms where students enrolled in a course are able to watch and study by

using their computer devices and the internet (Geri, 2012). Interactive video lectures, on the other hand, not only cover the lesson content via videos but also capture complete class sessions where students can see the interaction between lecturers and students that occurred in the class (Geri, 2012). Live (or two-way) video sessions are the more advanced application of videos in teaching international students. Through the use of computer devices and internet access, students can simultaneously interact and communicate with their lecturers and other classmates in real time (Geri, 2011; Geri, 2012). For this reason, live video sessions provide a more realistic learning experience vis-à-vis the first two types of video-based learning.

### ***Mobile Technology***

Due to the ubiquity of handheld mobile devices, mobile technology plays an important role in online teaching and learning for international students. Sevilla-Pavón (2015) listed a variety of handheld mobile devices that are essential and necessary for language learning: smartphones, personal digital assistants, palmtops, laptops, or tablets. Shao and Crook (2015) examined the use of mobile social software to support cultural learning for new-arrival international students in the UK. In their research, international students were provided with mobile phones installed with mobile blogging software (or moblogging in authors' terms) to blog about cultural experiences they had in the UK. In this way, moblogging offers an opportunity for international students to learn and gain language and cultural competence in the UK context.

### ***Combined Use of Online Resources***

Apart from the four forms of online learning mentioned above, the combined use of online resources is occurring in teaching foreign languages to international students. Azarova et al. (2020) investigated the application of combined information technologies in developing and enriching communicative skills, namely Ukrainian phraseology, for international students who are not native to the Ukrainian language. In their research, a range of information technologies was deployed in teaching practices, including PowerPoint-2010, Google-Forms application and online libraries, providing different search engines, website-based online resources, online dictionaries, and videoconferences. Lanham and Zhou (2003), on the other hand, presented the combination of synchronous and asynchronous learning that online synchronous lectures could take place at an arranged schedule and then, the records will be uploaded on asynchronous learning platforms where all students are able to access.

### ***Virtual Reality Technology***

In the context of international education, virtual reality (VR) technology enables international students to immerse themselves in a virtual environment where they are able to interact with other users via computing objects and virtual representation. May (2020, p. 6) defined desktop-based Cross Reality technology as “the integration of immersive, augmented, mixed, and virtual reality technology within physical reality”. In the study, a virtual laboratory for engineering international students was built to conduct physical experiments without physical presence. This virtual laboratory is set up with two main parts: a graphical web interface and a tele-operative testing cell. The graphical web interface has four areas where students can (1) set up parameters, (2) control the course of their experiments, (3) collect experimental data, and (4) observe experiments via a live video stream. The tele-operative testing cell is set up with two testing machines and one robot that are tele-operatively controlled by parameters from the graphical web interface.

### ***Social Networking Sites (SNSs)***

Social networking sites (SNSs) have a number of indispensable applications for international education settings. In several circumstances, SNSs (e.g. Facebook or Twitter) are deployed as an alternative to learning management

platforms facilitating the teaching and learning due to the connectivity between students and instructors and between students and classmates (Sleeman et al., 2019). Htay et al. (2020) scrutinised the potentials and challenges in using the Twitter platform for international students in the higher education context. Sleeman et al. (2019) investigated the experiences of international students using Facebook and Twitter to collaborate and carry out group assignments in an English for academic purposes course. Sleeman et al. (2020) underlined the positive implications of social media on academic achievements as well as social adjustments of international students. Zhang et al. (2020) introduced ZJU and DingTalk, prevalent social media platforms in China, in which a range of teaching and learning practices can be implemented by recording online sessions, publishing lesson materials, submitting assignments, or taking examinations.

### **Other Emerging Technologies**

With the advancement of technologies, there have been various educational instruments that can be potentially used for the teaching and learning for international students. Within the scope of this study, two emerging technologies have been applied in the international education milieu, namely Automatic Speech Recognition (ASR) and Intelligent Cloud Computing (ICC).

ASR is an advanced technology that has been mainly used in the field of language teaching. This technology enables the recognition of speech in terms of various acoustic features (Zhao, 2017). The applications of ASR mainly revolve around pronunciation training for non-native speakers (Zhao, 2017) and automatic pronunciation grading (Wang & Kawahara, 2009).

ICC has great capabilities to exploit computer system resources that are potential for teaching and learning of international students. “Cloud computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the data centers that provide those services to students” (Chen et al., 2015, p. 55). Chen et al. (2015) found two outstanding merits of ICC for international students: (1) enhancing sharing resources and personalised information service; and (2) improving the extendibility that enables the parallel service among international students and instructors.

### **Blended Learning**

Besides applying digital devices and technologies to the teaching and learning for international students, a number of studies shed light on the combination of digital and traditional education. Blended (or hybrid) learning is defined as “the combination of characteristics from both traditional learning and e-learning environments” (Lanham & Zhou, 2003, p. 286). McPhee and Pickren (2017) presented two cases of blended learning that were examined at GEO 121 and GEO 122 classes. For the former case, international students were allowed to use phones or tablets with GPS, map applications, and MP3 audio files to make a walking tour discovering locations in Vancouver before doing a post-tour assignment. For the latter case, a flipped classroom was carried out through the use of videos prior to using i-Clickers for classroom discussions.

### ***How International Students Experience the Digitalisation of Teaching and Learning Practices***

As presented in the previous section, digitalisation provides a wide range of potentially pedagogical means to support the teaching and learning for international students. However, the reception from international students shows mixed results with both positive and negative experiences. This section addresses the second research question regarding how international students experience the digitalisation of teaching and learning practices.

## **Positive Experiences**

### ***Flexible and Convenient Experiences***

Flexibility and convenience are the most common feelings that international students have when experiencing digital learning. Due to the support of asynchronous technologies, international students are able to have unrestricted access and increase their learning autonomy while avoiding unnecessary pressure of physical and temporal matters which is prevalent in traditional learning (Karkar-Esperat, 2018). A number of international students reported that “I don’t need to be in the classroom” (Karkar-Esperat, 2018, p. 1731); or “we could do this tour by ourselves, and not as a whole group” (McPhee & Pickren, 2017, p. 427). The adjustability of time and location, in effect, results in flexibility in learning style and study pace (Ericksen & Bolliger, 2011; Karkar-Esperat, 2018). Flexibility also forms the sense of ownership of international students associated with the capability of self-regulation and literacy achievement (Mujico & Lasagabaster, 2019). In this way, digitalisation is a key driver in helping international students become more active and independent learners (McPhee & Pickren, 2017).

### ***Interactive Real-Life Experiences***

Interactive real-life experience is another distinguishing characteristic that digital learning brings to international education. According to McPhee and Pickren (2017), the use of digital devices in a blended learning class (i.e. a walking tour lesson) greatly helps international students engage with a real-world environment in association with learning resources provided by teachers. Similarly, Shao and Crook (2015) found that the execution of mobile group blogs between learners facilitates the acquisition of real-world authentic information which is critical for cultural learning for international students. Another study indicated that the online remote laboratory creates a chance for interactive experiences which can be found in transnational collaboration in virtual real-time experiments (May & Tekkaya, 2016).

### ***Unimpeded Experiences***

Digitalisation for teaching and learning offers international students a range of approaches to overcome barriers they might be facing in traditional classroom settings together with enhancing learning self-management. Regarding language and culture impediments, Kang and Chang (2016) found that asynchronous online learning alleviates power asymmetries in which international students are more confident to express their opinions to their classmates through the use of text-based online discussion. In addition, the use of digital devices allows for multiple repetitions of instructions or extra information resources that help international students better navigate any language barriers and understand lessons (Hughes, 2013; McPhee & Pickren, 2017; Wang & Reeves, 2007). Besides, the repetition of asynchronous learning tasks also erases the fear of making mistakes during the learning process, as “I could go back and think about my answers and correct them” (Lear et al., 2016, p. 18). Furthermore, Sleeman et al. (2020) highlighted that using SNSs in teaching not only constitutes academic achievement but also consolidates interpersonal relationships among international students.

## **Negative Experiences**

### ***Disconnected Experiences***

Isolation and uncertainty are the most common experiences that international students encounter in digital learning. Digital learning, which allows the ability to study without physical and temporal issues, results in reducing face-to-face interaction that, to some extent, affects the learning experiences of international students (Karkar-Esperat, 2018). In this regard, Wang and Reeves (2007) clarified that the nature of synchronous online courses hinders informal



interactions between students which occur mostly in the form of short greetings. For this reason, disconnected experiences appear due to the dearth of interpersonal communication and interaction between students in online classrooms. The disconnected experiences are demonstrated in several interview responses of international students, for example, “I am doing the minimal interaction” (Karkar-Esperat, 2018, p. 1729) or “I hate staring at the computer” (Erichsen & Bolliger, 2011, p. 320).

The feeling of disconnectedness also results from the lack of contact between instructors and students which usually happens to international students (Chen et al., 2008; Warring, 2013). Chen et al. (2008, p. 315) reported that several students are frustrated by the absence of teachers as they do not know “whom to listen to” together with difficulties to have in-depth discussions with teachers after class. The invisibility of teachers in asynchronous platforms is also the cause of uncertain experiences for international students, as peer discussions fail to work properly (Chen & Bennett, 2012). As a result, students are unable to verify their understanding and interpretations of lessons.

### ***Experiences of Language Barriers***

Many international students are not native speakers of the language of instruction which greatly hampers them from engaging in digital classes. A cohort of international students reported that they are unable to fully express their ideas to other students due to language barriers which to a large extent consequently affect academic achievements (Hughes, 2013; Lanham & Zhou, 2003; Liu et al., 2010; Wang & Reeves, 2007; Zhang & Kenny, 2010). Accordingly, a number of international students told they have to increase their time and effort to compensate for language limitations which consequently causes negative experiences of digital learning (Hughes, 2013; Liu et al., 2010). For example, “I need to think and work hard on my writing and spend so much time. I get discouraged sometimes” (Karkar-Esperat, 2018, p. 1729) or “sometimes I have to check the spelling and stuff, so it takes a lot of time” (Zhang & Kenny, 2010, p. 25). In some cases, the language barriers also trigger inferiority feelings for international students that undermine their confidence (Zhang & Kenny, 2010).

### ***Experiences of Digital Illiteracy***

With the increasingly important role of digital technologies, digital literacy becomes crucial more than ever, especially for international students who are highly exposed to the digital world. However, the level of digital literacy greatly differs in that some international students have no or very little knowledge of using digital devices and technologies due to their backgrounds (Habib et al., 2014; Htay et al., 2020). This consequently causes restraints on the learning experiences of international students. Hughes (2013) listed a number of obstacles caused by digital illiteracy, including the unfamiliar experiences of using searching databases, online journals, and learning-help services. Accordingly, digital illiteracy leads to other issues that are detrimental to learning experiences, for example, time-consuming (Hughes, 2013), confusion, and distraction (Hughes, 2013; Wang & Reeves, 2007).

### ***Experiences of Health Issues***

Health issues, as a result of lengthy exposure to digital technologies, emerge as a significant concern for international students. Hughes (2013, p. 135) noted that a number of international students suffer from fatigue and sore eyes as “too much computer makes you feel sick”. Apart from physical health problems, a significant number of mentality-related adjectives regarding digital learning are reported by international students, for example, upset, frustrated, anxious, depressed, lost, uncertain, isolated, and lonely (Chen & Bennett, 2012; Kang & Chang, 2016). Too much information offered by digital learning along with the disconnected experiences altogether overwhelms international students, especially those whose digital literacy is deficient (Mujico & Lasagabaster, 2019). For example, “too much

information” (Hughes, 2013, p. 135) or “I felt sad [...] I was very anxious [...] I kept saying to people I was frustrated” (Chen & Bennett, 2012, p. 688). In the context of synchronous online courses, the experience is even exacerbated due to nerves as international students have to instantly respond to other peers associated with the fear of making language mistakes (Wang & Reeves, 2007).

## **New Opportunities for the Teaching and Learning of International Students in Higher Education**

This section is dedicated to answering the third research question concerning opportunities for digitalisation of the teaching and learning for international students will be synthesized based on the identified articles. There are three main themes revolving around (1) more opportunities for global cooperation and interpersonal collaboration, (2) fewer learning constraints for international students, and (3) narrower cultural and linguistic gaps.

### ***More Opportunities for Global Cooperation and Interpersonal Collaboration***

The connectivity supported by digital technologies is crucial in enhancing global cooperation and interpersonal collaboration. The promise of Cross Reality Spaces in creating an online laboratory opens up an opportunity for international students from various countries around the world to undertake cooperative and collaborative engineering experiments (May, 2020; May & Tekkaya, 2016). The online laboratory, therefore, is prospective for future global education contexts where theory and practice are connected on digital platforms which are pivotal for practice-oriented fields, such as engineering education (May, 2020). Apart from Cross Reality Spaces, ICT and asynchronous digital technologies also facilitate a sense of collaboration among international students in group work (Sevilla-Pavón, 2015; Zhang & Kenny, 2010). In this regard, ICT and asynchronous digital technologies offer pertinent platforms not only furthering collaboration in group work (e.g. dividing works, discussing lessons, or sharing ideas) but also reinforcing connections with other classmates (Demuyakor, 2020; Lear et al., 2016; Sleeman et al., 2019).

### ***Fewer Learning Constraints for International Students***

The widespread availability of the internet together with the sense of interaction and collaboration supported by digital technologies significantly increases learning autonomy for international students by removing detrimental barriers to the teaching and learning for this group of students. Digital learning modes extend educational opportunities to a vulnerable population of students, including international students, as they can study, synchronously or asynchronously, without any time-space restraints (May, 2020; Sevilla-Pavón, 2015; Wang & Reeves, 2007). As such, digital education provides international students with more learning autonomy, as they are able to choose ideal learning settings (Mujico & Lasagabaster, 2019), learning pace (Karkar-Esperat, 2018), or learning strategy (Lear et al., 2016; Wang & Reeves, 2007).

### ***Narrower Cultural and Linguistic Gaps***

International students have diverse individual learning needs, as they come from different cultural and linguistic backgrounds. Regarding this aspect, digital learning is able to satisfy the diverse needs of learners by offering a range of learning techniques with various levels of digitalisation, for example, self-learning (Geri, 2012; Sloan et al., 2014; Watson, 2011), two-way interactive learning (Geri, 2011; Wang & Reeves, 2007), practice-oriented learning (May, 2020; May & Tekkaya, 2016), or blended learning (Lanham & Zhou, 2003; McPhee & Pickren, 2017). Besides, the ability to revisit and revise learning material of asynchronous learning is also beneficial for students from Asian backgrounds, who prefer memorizing ideas in acquiring knowledge (Lanham & Zhou, 2003). In terms of language matters, Kang and Chang (2016) explored that a number of international students from China feel more confident in taking asynchronous online

classes as they have more opportunities to express their ideas mostly through the use of written language while avoiding other cultures and language barriers which they would have had in face-to-face settings.

## **Key Challenges for The Teaching and Learning for International Students**

This section will address the final research question focused on key challenges for teaching and learning for international students. Within the scope of this study, there are three main themes, including cross-cultural challenges, technical problems, and other challenges.

### ***Cross-Cultural Challenges***

Digital education engages a great variety of international students from diverse backgrounds who might have different learning styles and techniques, which in turn, creates cultural and linguistic gaps in teaching and learning practices. Zhang and Kenny (2010) found that online learning is not culturally neutral because of the central paradox between the diversity of international students and the homogeneousness of epistemologies, teaching philosophies, and learning objectives. For that reason, there are a number of challenges in online classrooms due to different educational philosophies from diverse education systems, for example, assessment criteria, classroom instruction and interaction, roles of teachers, student collaboration, academic conduct, language instruction, teacher-student relationship, and learning styles (Chen et al., 2008; Kang & Chang, 2016; Lanham & Zhou, 2003; Liu et al., 2010; Wang & Reeves, 2007).

### ***Technical Problems***

Although offering numerous benefits, digitalisation with evolvingly advanced technologies also brings a number of technical problems that challenge the teaching and learning for international students. For example, doing online collaborative experiments requires a strong and stable Internet bandwidth (May, 2020) while a number of international students have been faced with disruptions and slow speed of the Internet (Demuyakor, 2020; Hughes, 2013; May & Tekkaya, 2016). In other cases, international students are also challenged by hardware breakdowns and software incompatibilities among digital devices (Hughes, 2013; Mujico & Lasagabaster, 2019) which greatly disrupt the teaching and learning process. Furthermore, international students also raise a concern about cyberspace security as they sometimes have to use their personal social media accounts or share online documents in online classes (Htay et al., 2020; Mujico & Lasagabaster, 2019; Sleeman et al., 2020).

### ***Other Challenges***

Besides the above-mentioned issues, there are several digital challenges affecting the teaching and learning of international students. Firstly, given digital education takes place in cyberspace, the partial absence of real-world elements is ineluctable. A number of researchers reported that the conspicuous lack of paralinguistic features in online courses, such as facial expressions, frowns, reactions, body language, or using drawing graphics, puts more pressure on international students in communicating with other classmates which, in turn, affects their learning experiences (Karkar-Esperat, 2018; Wang & Reeves, 2007). Secondly, taking synchronous online classes from different locations around the world causes time-zone challenges for international students which is commonly neglected by course designers (Demuyakor, 2020; Liu et al., 2010; May & Tekkaya, 2016; Zhang & Kenny, 2010). Thirdly, the affordability of accessing digital learning could also be an economic matter for international students from countries where database use and internet data are expensive (Demuyakor, 2020; Hughes, 2013).

## Discussion

With regard to the first research question, there are five main forms of digitalisation applied in international education. Firstly, online learning with the support of CMC emerges as the dominant form of digitalisation of the teaching and learning for international students. This mode of delivery is generally viewed as the alternative to classroom teaching or face-to-face learning. The term online learning is used as an umbrella term covering other sub-categories such as online learning platforms, web-based programs, video-based programs, mobile technologies, and combined use of online resources. Secondly, the emerging application of VR technology for international education, particularly for teaching engineering subjects, is futuristic and pedagogical. Thirdly, the widespread use of SNSs leverages the importance of social media platforms in teaching and learning for international students. Fourthly, ASR and ICC show great prospects for international education although research on them is relatively limited. Lastly, several studies present the use of digital technologies combined with traditional teaching methods, which is otherwise known as blended learning.

In terms of the second research question, international students have mixed responses regarding how they experience digital education. On the one hand, a number of students have positive experiences that are attributable to flexibility, real-life interactions, and unimpeded feelings. On the other hand, some reported negative experiences owing to disconnectedness, language barrier, digital illiteracy, and health issues.

In light of the last two research questions, digitalisation brings various opportunities together with numerous challenges to international students. On the beneficial side, digitalisation facilitates global cooperation, interpersonal collaboration, learning autonomy as well as possibilities to cater to international students' diverse learning needs. Nevertheless, digitalisation also poses a handful of challenges for international students, such as cross-cultural issues, technical problems, expenditure, time-zone differences, and paralinguistic absence.

The findings of this study provide several implications for teachers, academics, education providers, students and policymakers in utilising digital technologies and adapting pedagogies in digital and blended delivery for international students in higher education. Firstly, the findings from the third and fourth research questions show that each form of digitalisation has its own pros and cons. This finding underscores the importance to ensure the flexibility of the execution of digitalisation for international higher education. More specifically, Whalley et al. (2021) highlighted that hybrid-flexible forms of course design should be put into consideration in order to include a wide range of students from diverse backgrounds. Besides, teachers and education providers should also be considerate with regard to the affordances of digital technologies in teaching and learning activities to ensure "the learner at the heart of any pedagogical intervention" (Bonfield et al., 2020, p. 243).

Secondly, the negative experiences analysed in this systematic review elucidate how human factors, namely the technology-related readiness of both teachers and students, play a critical role in applying digital technologies to the international education sector. However, a number of researchers revealed that the opposites happened in practice. Amirault (2021, p. 19) asserted that "educators are always situated at the later end of the technology lifespan continuum". Chang et al. (2020), on the other hand, alerted that digitalisation creates intricate and novel information ecologies where international students become disadvantaged vis-à-vis their domestic counterparts. Therefore, equipping teachers and international students with proficient digital literacy should be viewed as a matter of urgency in ensuring all stakeholders fully benefit from digitalisation.

Thirdly, based on the findings summarised in the proceeding section, research on digitalisation for the teaching and learning of international students disproportionately focuses on language teaching for non-native speakers. This, therefore, reflects an urgent need for a more comprehensive understanding of the applications of digital technologies to other wider international education areas, such as teaching university subjects or vocational training. Also, most identified articles pay attention to the execution of online learning in teaching international students while research on the use of VR technologies, which have transformative potential in this regard (Schmidt & Tang, 2020), is scanty. This study calls for

extensive research on the application of VR technologies for education in general and the international education sector in particular.

### Concluding Remarks

This study examines 35 articles to explore the digitalisation of teaching and learning for international students. It focuses on the forms of digitalisation, international students' experiences as well as opportunities and challenges posed by digitalisation. This research highlights the need for flexible application of digitalisation for the international education sector, with hybrid-flexible course designs recommended to accommodate diverse international student backgrounds. This study emphasizes the need to invest in human resources, especially digital literacy, to ensure that international students are placed at the center of the digitalisation. This review also stresses the urgent need for a more comprehensive understanding of how the latest digital technologies, for example, VR, can be applied to other areas of the international education sector, such as university subject teaching or vocational training.

This systematic review has several inevitable limitations. Firstly, as this study searched relevant data only on WoS, Scopus, and EBSCO, articles on other databases, therefore, could have been missed. Future studies, therefore, should extend the scope of research on this topic to other scientific databases, such as Proquest or ERIC. Secondly, because the focus of this study is the digitalisation of teaching and learning for international students in the higher education sector, several major digital technologies, which are widely applied to other groups of students, could have been excluded from this study.

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**Appendix A**  
**Thirty-Five Articles for the In-Depth Review**

1	A model of independent learning applied to the online context, Warring (2013)
2	Blended learning with international students: A multiliteracies approach, McPhee and Pickren (2017)
3	Computer assisted language learning and the internationalisation of the Portuguese language in higher education contexts, Sevilla-Pavón (2015)
4	Coronavirus (COVID-19) and online learning in higher institutions of education: A survey of the perceptions of Ghanaian international students in China, Demuyakor (2020)
5	Cross reality spaces in engineering education - Online laboratories for supporting international student collaboration in merging realities, May (2020)
6	Cultural differences in online learning: International student perceptions, Liu et al. (2010)
7	Cultural issues in online learning - Is blended learning a possible solution?, Lanham and Zhou (2003)
8	Developing academic literacy through self-regulated online learning, Lear et al. (2016)
9	Effective prediction of errors by non-native speakers using decision tree for speech recognition-based CALL system, Wang and Kawahara (2009)
10	Enhancing L2 motivation and English proficiency through technology, Mujico and Lasagabaster (2019)
11	Examining culture's impact on the learning behaviors of international students from Confucius culture studying in western online learning context, Kang and Chang (2016)
12	Experiences and challenges of international students in technology-rich learning environments, Habib et al. (2014)
13	If we build it, will they come? Adoption of online video-based distance learning, Geri (2011)
14	Intelligent cloud learning model for online overseas Chinese education, Chen et al. (2015)
15	International graduate students' challenges and learning experiences in online classes, Karkar-Esperat (2018)
16	International students using online information resources to learn: Complex experience and learning needs, Hughes (2013)
17	International students' transition to university: Connection and disconnection in online group work interactions, Sleeman et al. (2019)
18	Internet supplements for English vocabulary and reading development to empower autonomous international students, Perren (2010)
19	Introducing 'Prepare for Success', a web-based learning resource to help international students get ready for study in the UK, Watson (2011)
20	Learning in an online distance education course: Experiences of three international students, Zhang et al. (2010)
21	Multimedia technologies of teaching "Russian language" to foreign students at the initial stage, Yuhan (2017)
22	Postgraduate students' perspective on using Twitter as a learning resource in higher education, Htay et al. (2020)
23	Social media, learning and connections for international students: The disconnect between what students use and the tools learning management systems offer, Sleeman et al. (2020)
24	Study on the effectiveness of the ASR-based English teaching software in helping college students' listening learning, Zhao (2017)
25	Synchronous online learning experiences: The perspectives of international students from Taiwan, Wang and Reeves (2007)
26	The adaptation of Chinese international students to online flexible learning: Two case studies, Chen et al. (2008)
27	The evaluation of online course of Traditional Chinese Medicine for MBBS international students during the COVID-19 epidemic period, Zhang et al. (2020)
28	The potential of a mobile group blog to support cultural learning among overseas students, Shao and Crook (2015)
29	The resonance factor: Probing the impact of video on student retention in distance learning, Geri (2012)
30	Towards understanding international graduate student isolation in traditional and online environments, Erichsen and Bolliger (2011)
31	Transnational connected learning and experimentation - Using live online classes and remote labs for preparing international engineering students for an international working world, May and Tekkaya (2016)
32	UKBI: Experimental development of web-based Indonesian language proficiency test for foreign speakers, Oktriono (2019)

33	Use of information technologies in studying phraseology in the course of Ukrainian as a foreign language, Azarova et al. (2020)
34	Using e-learning to support international students' dissertation preparation, Sloan et al. (2014)
35	When Chinese learners meet constructivist pedagogy online, Chen and Bennett (2012)