

Effective Factors and Issues in Online Learning in Covid-19: A Global Review

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Abstract : The unexpected outbreak of covid-19 caused education centers to halt their physical classes and rashly switch to online classes. This review paper has as its primary objective identifying related issues faced by different countries and comparing them to get a global overview, and debating whether the dissemination of Covid-19 has adversely affected the educational process in different countries the same way or not. Internet connection, lack of technological devices, deficiency in ICT competencies, and insufficient power supply are reported by most African, South American, and Asian countries as their significant issues. Mental health issues, concerns for future jobs, and discrimination among students are reported as significant issues in North America. Lack of teacher/student training, inaccessibility to stable internet connections, and digital devices are the main problems for European countries. The other reason behind this review is to find out the most significant factors in computing an effective online learning experience. In this sense, four factors are acknowledged in this paper as influential factors in online learning classes. This review found out that in undeveloped countries success of online education is highly correlated with the financial status of countries, whereas, in developed countries, its success has other areas of concern among people..

Keywords: Online education, covid-19, technology, online learning issues, online methodology

INTRODUCTION

On account of the reactive maneuvers to facilitate the dampening of the viral spread, questions about student vulnerabilities and educational emergency preparedness emerged ¹. According to UNESCO ², the viral pandemic affected about 1.5 billion students, and 87% of the students in 165 countries have been affected by the temporary closure of schools ³. The Covid-19 pandemic has coerced educational institutions worldwide to suspend physical learning to help manage the infection

¹ Aras Bozkurt and Ramesh C Sharma, "Digital Transformation and the Way We (Mis)Interpret Technology," *Asian Journal of Distance Education* (2022).

² UNESCO, "Events Canceled/Postponed - Coronavirus Outbreak," 2020, last modified 2020, accessed April 5, 2020, <https://en.unesco.org/events/events-canceledpostponed-coronavirus-outbreak>.

³ Hans d'Orville, "COVID-19 Causes Unprecedented Educational Disruption: Is There a Road towards a New Normal?," *Prospects* (2020); Maya Puspita Dewi and Muh Barid Nizarudin Wajdi, "Distance Learning Policy during Pandemic COVID-19," *EDUTEC: Journal of Education and Technology* 4, no. 3 (2021): 325–333.

spread⁴. Closing academic centers to promote physical distancing initiatives was also a means of easing the health sector's burden that many countries have decided to pursue⁵.

Universities were forced to adapt the educational process to exclusively online teaching and learning, which required educators to use various digital tools and resources to solve problems and introduce new approaches to teaching and learning⁶. Numerous other research studies have focused on online teaching and learning theories and evaluation criteria for quality online learning and online course design⁷. The amalgamation of technology into education has changed teaching methods by transforming the learning environment to such an extent that digital literacy has become a functional requirement and challenge of our time⁸. Merging digitalization into higher education required the ICT departments of educational institutions to make a tremendous effort to create electronic platforms, integrate current external and native applications, as well as migrate to distance learning solutions⁹. Digital technologies are often presented as the most appropriate form of learning by those that consider today's students to be digital natives¹⁰.

Due to the disturbance of COVID-19 on society¹¹, institutions such as universities and colleges are now employing digital technologies such as emergency remote teaching (ERT) and virtual learning (VL) for educational activities¹².

Section 1: What factors make an online learning experience effective

Student engagement

⁴ Zayapragassarazan Zayabalaradjane and Thomas V Chacko, "Interaction Analysis of FAIMER Mentor-Learner Web Online Collaborative Learning Session," *Malaysian Online Journal of Educational Technology* (2020).

⁵ S. Khan and A. Mian, "Medical Education: COVID-19 and Surgery," *British Journal of Surgery*, 2020; Wim Van Lancker and Zachary Parolin, "COVID-19, School Closures, and Child Poverty: A Social Crisis in the Making," *The Lancet Public Health*, 2020.

⁶ Birgit Eickelmann and Julia Gerick, "Lernen Mit Digitalen Medien," in „*Langsam Vermisse Ich Die Schule ...*“, 2020.

⁷ Olayinka Rasheed Ibrahim et al., "Epidemiology of COVID-19 and Predictors of Outcome in Nigeria: A Single-Center Study," *American Journal of Tropical Medicine and Hygiene* (2020).

⁸ Wahab Ali, "Online and Remote Learning in Higher Education Institutes: A Necessity in Light of COVID-19 Pandemic," *Higher Education Studies* (2020).

⁹ Olasile Babatunde Adedoyin and Emrah Soykan, "Covid-19 Pandemic and Online Learning: The Challenges and Opportunities," *Interactive Learning Environments*, 2020.

¹⁰ Catherine A. Adams and Patti Pente, "Teachers Teaching in the New Mediascape: Digital Immigrants or 'Natural Born Cyborgs'?", *E-Learning and Digital Media* (2011).

¹¹ Bokolo Anthony Jnr, "Use of Telemedicine and Virtual Care for Remote Treatment in Response to COVID-19 Pandemic," *Journal of Medical Systems* (2020).

¹² Eddie M Mulenga and José M Marbán, "Is COVID-19 the Gateway for Digital Learning in Mathematics Education?", *Contemporary Educational Technology* 12, no. 2 (2020): ep269; Zayabalaradjane and Chacko, "Interaction Analysis of FAIMER Mentor-Learner Web Online Collaborative Learning Session"; "Award for Distinguished Scientific Contributions: John O'Keefe," *American Psychologist* (2020).

According to Powell and McGuigan ¹³, although the virtual learning environment offers ascendancies of accessibility and Critical reflection flexibility, it cannot fully replace the human connection and informal spontaneity found in face-to-face teaching within the physical classroom. In times of adversity like the spread of covid-19, education centers worldwide have implemented Synchronous live streaming and asynchronous online activities via online learning platforms to keep students on track ¹⁴. Some believe it cannot be a well-suited substitute for customary classes; blended learning and a mix of synchronous and asynchronous teaching method is more preferred ¹⁵. Based on Cambridge English Dictionary ¹⁶, Recorded aspects are referred to as asynchronous, meaning that they were “not happening or being done simultaneously,” and the live aspects are referred to as synchronous, meaning that they were “simultaneous happening or activity.”

Osborne and Hogarth ¹⁷ proposed some strategies in their study to heighten student participation in online classes, which are creating a sense of ease, maintaining alertness, and using student interactions by breaking material to foster micro-learning and balancing asynchronous and synchronous instruction. Furthermore, student engagement in online learning can be boosted via asynchronous and synchronous tools such as email, forums, chats, and videoconferences¹⁸.

Osborne and Hogarth ¹⁹ also mentioned that there should be a balance between recorded aspects(asynchronous) and live aspects of the content and activity delivery(synchronous). Breaking up activities is often called microlearning, where information and activities are delivered in short segments that are paired with relevant learning objectives ²⁰.

Baxter and Hainey ²¹ researched reviewing if synchronous online delivery is effective. Of 900 participants, some considered that learning remotely online was beneficial for instant feedback, supported motivation, and fostered communities of practice. However, it was not acknowledged as a beneficial pedagogical approach for enhancing the student learning experience. The research also identified the aspect of engagement as the area of conflict that can influence students' online learning experience positively or negatively.

¹³ Lisa Powell and Nicholas McGuigan, “Teaching, Virtually: A Critical Reflection,” *Accounting Research Journal* (2020).

¹⁴ Mahmoud Al-Balas et al., “Correction to: Distance Learning in Clinical Medical Education amid COVID-19 Pandemic in Jordan: Current Situation, Challenges, and Perspectives (BMC Medical Education, (2020), 20, 1, (341), 10.1186/S12909-020-02257-4),” *BMC Medical Education*, 2020.

¹⁵ Zakaryia Almahasees, Khaled Mohsen, and Mohammad Omar Amin, “Faculty’s and Students’ Perceptions of Online Learning During COVID-19,” *Frontiers in Education* (2021).

¹⁶ Bryan S Turner, *The Cambridge Dictionary of Sociology*, 2006.

¹⁷ Sarah Osborne and Kate Hogarth, “Mind the Gap: The Reality of Remote Learning during COVID-19,” *Accounting Research Journal* (2020).

¹⁸ Imanol Ordorika, “Pandemia y Educación Superior. Revista de La Educación Superior,” *Revista de la Educación Superior* (2020).

¹⁹ Osborne and Hogarth, “Mind the Gap: The Reality of Remote Learning during COVID-19.”

²⁰ Beau Shine and Sarah E. Heath, “Techniques for Fostering Self-Regulated Learning Via Learning Management Systems in On-Campus and Online Courses,” *Journal of Teaching and Learning with Technology* (2020).

²¹ Thomas Connolly et al., “Learning 2.0,” in *Higher Education Institutions and Learning Management Systems*, 2011.

To name some of the advantages of online learning when synchronous learning is utilized collaboratively and interactively via of online communication apps, it might follow the learning theory of social constructivism, which explains that learning arises when it is used socially through interaction and collaboration ²². Through synchronous communication and feedback, teachers can assist students in learning and problem solving to develop “self-regulated students” ²³. Moreover, whether online learning is delivered synchronously or asynchronously, it allows students in remote and distant places with educational accessibility, providing a more “inclusive and equitable learning experience” ²⁴. Through online learning, especially asynchronously, students can become members of a virtual community through engagement and constructively influencing other students and feeling immersed in the experience ²⁵. As Fredricks et al.²⁶ said, student engagement is a multidimensional construct covering three aspects of learning: behavioral, emotional, and cognitive.

Behavioral engagement refers to class attendance, participation, and persistence in the learning process ²⁷. Emotional engagement means affective reasons, personal feelings, and attitudes toward learning ²⁸. It reflects intrinsic motivation, self-belief, bonding with teachers and classmates, a sense of belonging, and attachment to the schools ²⁹. And lastly, Cognitive engagement is about the willingness to exert mental effort in learning ³⁰.

Cognitive engagement aspect rates were different among the students. The results represent that Students learning in face-face settings adopt self-regulated learning, deep cognitive learning, and information processing strategies. Socializing activities enhance self-regulated learning. While online learning, students got fewer ideas of what they were trying to accomplish; even if the learning outcomes were communicated, they were also less active in regulating their learning from planning, organizing, and evaluation

²² Carina Ginty, “Building Digital Teaching and Learning Capabilities with DigitalEd.Ie in Response to a Global Pandemic,” *AISHE-J: The All Ireland Journal of Teaching & Learning in Higher Education* (2021).

²³ Diana Rancourt et al., “Response to Tomalski et Al. (2019): Recommendations for Adapting a Comprehensive Athlete Mental Health Screening Program for Broad Dissemination,” *Journal of Sport Psychology in Action* (2020).

²⁴ Frederick Grinnell, Simon Dalley, and Joan Reisch, “High School Science Fair: Positive and Negative Outcomes,” *PLoS ONE* (2020).

²⁵ Shi Zhao et al., “Estimating the Unreported Number of Novel Coronavirus (2019-Ncov) Cases in China in the First Half of January 2020: A Data-Driven Modelling Analysis of the Early Outbreak,” *Journal of Clinical Medicine* (2020).

²⁶ Jennifer A Fredricks and Wendy McColskey, “The Measurement of Student Engagement: A Comparative Analysis of Various Methods and Student Self-Report Instruments,” *Handbook of Research on Student Engagement* (Springer US, 2012), http://dx.doi.org/10.1007/978-1-4614-2018-7_37.

²⁷ Paul R Trowler, “Introduction: Higher Education Policy, Institutional Change,” in *Higher Education Policy and Institutional Change: Intentions and Outcomes in Turbulent Environments*, 2002; Fredricks and McColskey, “The Measurement of Student Engagement: A Comparative Analysis of Various Methods and Student Self-Report Instruments.”

²⁸ Fredricks and McColskey, “The Measurement of Student Engagement: A Comparative Analysis of Various Methods and Student Self-Report Instruments.”

²⁹ Shui-fong Lam et al., “Understanding and Measuring Student Engagement in School: The Results of an International Study from 12 Countries,” *School Psychology Quarterly* 29, no. 2 (2014): 213–232, <http://dx.doi.org/10.1037/spq0000057>.

³⁰ Ming Hung Lin, Huang Cheng Chen, and Kuang Sheng Liu, “A Study of the Effects of Digital Learning on Learning Motivation and Learning Outcome,” *Eurasia Journal of Mathematics, Science and Technology Education* (2017).

Section 2

Reviewing online learning obstacles in different countries

Changes from face-face to remote learning created challenges for the educators and the educational boards governing the assessments at higher education levels as to the administration of the assessments due to logistical issues such as poor Internet, lack of devices, proctoring, and power outage ³¹.

In a study, students identified the technological problems of e-learning, which were related to Russia and Kazakhstan ³².

- The quality of the Internet connection
- Personal electronic device
- Lack of proper digital devices
- The quality of Internet connection
- E-learning problems, underdevelopment of interaction skills in a virtual learning environment, self-organization, and self-motivation difficulties.

A study in Pakistan by Adnan and Anwar ³³ has shown that online learning cannot satisfy the educational needs of students due to financial and technological barriers.

Haider and Al-Salman³⁴ conducted a survey on 775 students in Jordan universities, and they found some issues students face in their education procedure.

- Sleep compliance dropped by more than 50% during online learning
- Using digital tools for learning has an impact on sleeping habits
- Continuous exposure to electronic screens in online learning is tiring
- Extended usage of e-learning tools creates boredom, nervousness, and tension
- Online learning socially and psychologically is unhealthy

Two surveys were carried out at private and public universities in Bangladesh. The first survey discovered that more than half of the students could not join online classes because of poor Internet connections or about 44% due to the unavailability of devices. The other study identified the same problems and barriers to online learning, poor learning environment, and technophobia ³⁵.

³¹ Natela Doghonadze et al., "The Degree of Readiness to Total Distance Learning in the Face of COVID-19 - Teachers' View (Case of Azerbaijan, Georgia, Iraq, Nigeria, UK and Ukraine)," *Journal of Education in Black Sea Region* 5, no. 2 (2020): 2–41, <http://dx.doi.org/10.31578/jeb.v5i2.197>; Khadijah Mukhtar et al., "Advantages, Limitations and Recommendations for Online Learning during COVID-19 Pandemic Era," *Pakistan journal of medical sciences* 36, no. COVID19-S4 (May 2020): S27–S31, <https://pubmed.ncbi.nlm.nih.gov/32582310/>; Divya Singh and Mashamaite Peterlia Ramutsheli, "Student Data Protection in a South African ODL University Context: Risks, Challenges and Lessons from Comparative Jurisdictions," *Distance Education* 37, no. 2 (2016): 164–179, <http://dx.doi.org/10.1080/01587919.2016.1184397>.

³² Aida Kamysbayeva et al., "E-Learning Challenge Studying the COVID-19 Pandemic," *International Journal of Educational Management* 35, no. 7 (2021): 1492–1503, <http://dx.doi.org/10.1108/ijem-06-2021-0257>.

³³ S. M. Abu Adnan Abir et al., "Building Resilience against COVID-19 Pandemic Using Artificial Intelligence, Machine Learning, and IoT: A Survey of Recent Progress," *IoT* (2020).

³⁴ Ahmad S Haider and Saleh Al-Salman, "Dataset of Jordanian University Students' Psychological Health Impacted by Using e-Learning Tools during COVID-19," *Data in brief* 32 (July 31, 2020): 106104, <https://pubmed.ncbi.nlm.nih.gov/32789158>.

³⁵ Md. Abdur Rouf et al., "Online Classes for Higher Education in Bangladesh during the COVID-19 Pandemic: A Perception-Based Study," *PSU Research Review* (2022), <http://dx.doi.org/10.1108/prr-05-2021-0026>.

Ebrahimi and Jiar ³⁶ and Badiozaman et al. ³⁷ have pointed out that despite the need for going all educational centers to online mode in Malaysia, some failed to adopt the necessary procure for going online. Lack of resources or internet connectivity is mentioned as some of the probable factors. In addition, teachers lacked digital skills and have low digital literacy mostly for teachers, students, and teachers.

A study of Gautam, D.K. & Gautam, P.K in Nepal revealed much more problems than in the other Asian countries³⁸.

- Poor Internet connectivity
- Unstable power supply
- Internet package is expensive
- Some students need basic knowledge of technology
- Most of the students seem to have low commitment
- Difficulties with assignment, evaluation (grading), and control; few students try to cheat
- Late joining and early leaving
- Less interest in face-face interaction and discussion
- Reading stress of student and unable to pay attention
- Problems with devices/equipment and their knowledge of online class
- Problems with reading students' psychology, attitude, behavior, and expectations

As it seems Asian countries share similar obstacles in their online learning, two research in India that has already been mentioned by Bordoloi et al.³⁹ and Patra et al.⁴⁰ identified their students' most occurring problems, which are as follows:

- Poor internet quality and accessibility is the main problem
- It was also observed that a lack of ICT skills
- Lack of proper digital services
- Poor electricity in the localities
- Accessing the students in remote places has been a major issue
- A gap between the poor and the rich in education
- Information and communication technologies literacy
- Skills and technical support

³⁶ Mukhamad Shokheh, Mansoureh Ebrahimi, and Kamaruzaman Yusoff, "From Islamic Teaching to Social Charity: The Muhammadiyah Movement in Semarang, Central Java, Indonesia; 1926-1940," *Asian Culture and History* (2018).

³⁷ Ida Fatimawati Adi Badiozaman, Hugh John Leong, and Wallace Wong, "Embracing Educational Disruption: A Case Study in Making the Shift to a Remote Learning Environment," *Journal of Applied Research in Higher Education* 14, no. 1 (2020): 1–15, <http://dx.doi.org/10.1108/jarhe-08-2020-0256>.

³⁸ Dhruva Kumar Gautam and Prakash Kumar Gautam, "Transition to Online Higher Education during COVID-19 Pandemic: Turmoil and Way Forward to Developing Country of South Asia-Nepal," *Journal of Research in Innovative Teaching & Learning* 14, no. 1 (2021): 93–111, <http://dx.doi.org/10.1108/jrit-10-2020-0051>.

³⁹ Ritimoni Bordoloi, Prasenjit Das, and Kandarpa Das, "Perception towards Online/Blended Learning at the Time of Covid-19 Pandemic: An Academic Analytics in the Indian Context," *Asian Association of Open Universities Journal* 16, no. 1 (2021): 41–60, <http://dx.doi.org/10.1108/aaouj-09-2020-0079>.

⁴⁰ Soumendra Kumar Patra, Bijaya Kumar Sundaray, and Durga Madhab Mahapatra, "Are University Teachers Ready to Use and Adopt E-Learning System? An Empirical Substantiation during COVID-19 Pandemic," *Quality Assurance in Education* 29, no. 4 (2021): 509–522, <http://dx.doi.org/10.1108/qae-12-2020-0146>.

Some other studies in Europe also share the same problems and also some new ones. Previously an article by Baxter and Hainey ⁴¹ in Scotland discussed about online synchronous learning. It also found some drawbacks towards online learning as below:

- Ineffectiveness of remote synchronous online learning due to poor or no access to the internet

- Some students preferred asynchronous delivery
- Learning from home creates a distraction
- Balancing home-life commitments
- Isolation feeling because being away from the rest of the class

Another example, Nenko et al. ⁴² conducted research in Ukraine, and identified these obstacles to online learning:

- Lack of digital literacy of several pedagogical staff (mostly teachers)
- Inadequate funding for the development of distance learning technologies
- Lack of the technical equipment
- Access to the Internet in rural areas

A study in Romania of Coman et al. ⁴³ revealed that the hierarchy of problems arising from online learning is changing in the context of the pandemic crisis. Technical issues are the most important, a lack of technical skills among teachers, and teachers' teaching style needs to be matched with the online environment.

Azorín ⁴⁴ wrote an article if there is another kind of education coming to the world after Covid. And she identified some critical issues of online learning, specifically in Spain. Economic difficulties, school drop-out, and teacher collaboration. Moreover, Spanish teachers recorded the least collaboration, and prefer working in isolation in their classrooms ⁴⁵.

Some experts wonder if it's necessary to train teachers for online learning, such as Whalen ⁴⁶. This study also provides some recommendations for teachers, for instance, providing teachers with the opportunity to develop online and blended teaching competencies to be prepared to teach in different formats, settings, and situations. Pedagogical professionals or experts should be invited to train teachers on using specific emergency remote teaching regarding online course delivery platforms, class size management, scheduling, etc. ⁴⁷.

⁴¹ Gavin Baxter and Thomas Hainey, "Remote Learning in the Context of COVID-19: Reviewing the Effectiveness of Synchronous Online Delivery," *Journal of Research in Innovative Teaching & Learning* (2022), <http://dx.doi.org/10.1108/jrit-12-2021-0086>.

⁴² Yuliia Nenko, Nelia Kybalna, and Yana Snisarenko, "The COVID-19 Distance Learning: Insight from Ukrainian Students," *Revista Brasileira de Educação do Campo* (2020): 1–19, <http://dx.doi.org/10.20873/uft.rbec.e8925>.

⁴³ Claudiu Coman et al., "Online Teaching and Learning in Higher Education during the Coronavirus Pandemic: Students' Perspective," *Sustainability* 12, no. 24 (2020): 10367, <http://dx.doi.org/10.3390/su122410367>.

⁴⁴ Cecilia Azorín, "Beyond COVID-19 Supernova. Is Another Education Coming?," *Journal of Professional Capital and Community* 5, no. 3/4 (2020): 381–390, <http://dx.doi.org/10.1108/jpcc-05-2020-0019>.

⁴⁵ Susan Printy and Yan Liu, "Distributed Leadership Globally: The Interactive Nature of Principal and Teacher Leadership in 32 Countries," *Educational Administration Quarterly* (2021).

⁴⁶ Laurel Whalen et al., "#Healthykidsquarantined: Supporting Schools and Families with Virtual Physical Activity, Physical Education, and Nutrition Education during the Coronavirus Pandemic," *Journal of Teaching in Physical Education* (2020).

⁴⁷ Xudong Zhu and Jing Liu, "Education in and After Covid-19: Immediate Responses and Long-Term Visions," *Postdigital Science and Education* 2, no. 3 (2020): 695–699, <http://dx.doi.org/10.1007/s42438-020-00126-3>.

Selected countries in Africa share many common issues with Asian countries. For instance, a study conducted in Kenya by Tarus et al. ⁴⁸, identified three major e-learning challenges: Inadequate ICT infrastructure, Lack of technical skills, and financial constraints.

Almost similarly Olayemi et al. ⁴⁹ have pointed to some problems found in their study in Nigeria:

- High cost of data, poor internet services
- Lack of power supply
- Inaccessibility to online library resources
- Limited access to computer
- Attitudes of users to change
- Lack of time and convenience and distraction from the environment or social media

In Ghana Aboagye et al. ⁵⁰ revealed a low level of students' readiness for online learning during the covid-19 outbreak. Issues students faced for online learning students face in the online learning process are:

- Students were not ready for online learning and a new education method
- accessibility and connectivity to the internet
- lack of appropriate technological devices, such as laptop
- socio-psychological problems due to limited communication and interaction with teachers and peers

In another survey established in Africa, Zimbabwe universities mentioned: Internet connectivity, ICT infrastructure that was not reliable, and a lack of ICT training opportunities as the problems students have confronted ⁵¹.

The last country to investigate in our review in Africa is South Africa, where Mukuna and Peter Aloka ⁵² conducted research in a rural school. The research identified some similar problems in other African countries as well as new ones.

- Parents rarely involve themselves in children's homework,
- Submission of poor-quality work and incomplete tasks,
- Insufficient personal caring equipment
- Poor network access, and
- Lack of Information Communication Technology (ICT) devices to access the Internet
- Lack of ICT knowledge

⁴⁸ John K Tarus, David Gichoya, and Alex Muumbo, "Challenges of Implementing E-Learning in Kenya: A Case of Kenyan Public Universities," *The International Review of Research in Open and Distributed Learning* 16, no. 1 (2015), <http://dx.doi.org/10.19173/irrodl.v16i1.1816>.

⁴⁹ Lawal Olatunde Olayemi, Ramona Boodoosingh, and Filipina Amosa Lei Sam, "Is Samoa Prepared for an Outbreak of COVID-19?," *Asia-Pacific Journal of Public Health*, 2021.

⁵⁰ Emmanuel Aboagye, Joseph Anthony Yawson, and Kofi Nyantakyi Appiah, "COVID-19 and E-Learning: The Challenges of Students in Tertiary Institutions," *Social Education Research* (2020): 1–8, <http://dx.doi.org/10.37256/ser.212021422>.

⁵¹ Norman Rudhumbu et al., "Insight into Online Teaching Behaviour of Lecturers in Zimbabwean Universities during the COVID-19 Era and beyond: Issues and Challenges," *The International Journal of Information and Learning Technology* 38, no. 5 (2021): 518–539, <http://dx.doi.org/10.1108/ijilt-07-2021-0104>.

⁵² Kananga Robert Mukuna and Peter J O Aloka, "Exploring Educators' Challenges of Online Learning in Covid-19 at a Rural School, South Africa," *International Journal of Learning, Teaching and Educational Research* 19, no. 10 (2020): 134–149, <http://dx.doi.org/10.26803/ijlter.19.10.8>.

Insufficient personal equipment and poor network access can be due to the cost of purchasing mobile phones that are compatible with Internet connectivity, lack of electricity, low network coverage, and expensive maintenance requirements for data, and Wi-Fi.

Setting aside country-specific studies, Deshmukh ⁵³ did a qualitative research study on comparing online and face-face classrooms in terms of visual differences in global campuses over 12 different countries, among students and education facilities and administrations. The research identified some challenges towards online learning as below:

- Most students miss the old scheduled classes and their structured
- Students could not hold the same level of concentration
- Technical issues and equity limitations of digital platforms
- Junior and last year students were affected the most. First years due to lack of friendship and disparity with school atmosphere, and the latter group because of the sudden break up in rituals and community bonds.

- The backbone of education is thinking and doing or learning by doing. Online classes omitted physical capabilities.

- Educators felt uncomfortable facing a blank screen with a forced structure and one-way communication.

- Classrooms should reflect multiple Intelligences and learning styles.
- Students in distant areas lack access to the internet and technology.
- Exams and metrics were the other areas of weakness.
- Virtual environment was meant to replicate classrooms, not the campus.

The last continent to review in America. A report from the Education department of The USA 2021 in about Covid 19 impacts on America's education identified some problems.

- Technology barriers for black students more than for white. Lack of digital devices and Internet connection access

- School or university dropout due to financial and less engagement
- Students of color report outsized difficulties
- Stress and anxiety, feelings of disappointment, sadness, loneliness, and isolation. These symptoms are higher in students of color.

Islam et al. (2021) conducted a survey in over 30 higher education institutions in The USA and found that:

- Overload and inconsistency information are two major challenges
- Lack of documentation and reflection.
- Administrative structure and hierarchy
- High level of uncertainty because of covid-19 situation
- The lack of clear centralized guidance.

An already mentioned study by Wu et al. ⁵⁴ identified online learning concerns and obstacles in North America, Canada, and the USA, namely:

⁵³ Jay Deshmukh, "Speculations on the Post-Pandemic University Campus – a Global Inquiry," *Archnet-IJAR: International Journal of Architectural Research* 15, no. 1 (2021): 131–147, <http://dx.doi.org/10.1108/arch-10-2020-0245>.

⁵⁴ David T Wu et al., "The Impact of COVID-19 on Dental Education in North America-Where Do We Go Next?," *European journal of dental education : official journal of the Association for Dental Education in Europe* 24, no. 4 (November

- Students experienced a higher level of anxiety and depression
- Dental schools' payment problems for staff and teachers
- Abuse or segregation against patients and dental group individuals of Asian, Asian American, or Asian Canadian descent
- Concerning about employment market, as well as high student debt
- Course attendance and examinations are sensitive to students' time zones.

A study in Mexico by Rodríguez et al.⁵⁵ revealed that living conditions in rural places are filled with poverty, and students in schools receive lower support and resources in their education than in urban areas. As a consequence of inaccessibility to the internet and its cost, Mexicans created television programs to provide needed education for students. Some other problems merged alongside others, such as lack of an adequate Internet connection, electronic devices, the required skills to learn online, or for teachers to teach online.

Sdenka et al.⁵⁶ provided a systematic review of Latin American countries (such as Brazil, Peru, Chile, Colombia, etc.) education during covid-19 identified that:

- Internet access
- Mental health issues, stress, and anxiety
- Need to improve the quality of online learning
- Lack of skills for online learning for students
- Dropouts due to the unsuitability of online teaching methods

RESULT AND DISCUSSION

Part I. Students' engagement, technology, major and overall sentiment over online learning during covid-19 are identified as effective factors in experiencing successful online learning.

The first factor, to sum up, is the engagement of students. Virtual learning cannot be a suitable replacement for traditional classes, Even though its benefits have been mentioned by both students and teachers.

2020): 825–827, <https://pubmed.ncbi.nlm.nih.gov/32654328>; Jiayi Bao and Andy Wu, "Equality and Equity in Compensation," *Harvard Business School working paper series# 17-093* (2017).

⁵⁵ Kingsley Okoye et al., "Technology-Mediated Teaching and Learning Process: A Conceptual Study of Educators' Response amidst the Covid-19 Pandemic," *Education and Information Technologies*, 2021.

⁵⁶ Sdenka Zobeida Salas-Pilco, Yuqin Yang, and Zhe Zhang, "Student Engagement in Online Learning in Latin American Higher Education during the COVID-19 Pandemic: A Systematic Review," *British journal of educational technology : journal of the Council for Educational Technology* 53, no. 3 (May 2022): 593–619, <https://pubmed.ncbi.nlm.nih.gov/35600418>.

However, it is also reported that blended learning can be a good way of teaching, a mixture of synchronous and asynchronous online classes with face-to-face classes if the infrastructure is satisfactory to conduct online classes. Moreover, student engagement in emotional and cognitive areas altered drastically during Covid time; a decrease in motivation and lack of social interaction and activities are responsible for that.

The second factor, technology refers to devices that are usually needed for participating in online classes as well as digital applications. Which is one of the areas that has been a game-changer in adapting online learning in different countries and education centers was the availability of needed technology gadgets for both students and teachers. The most used gadgets were smartphones and laptops. ICT knowledge for teachers is fundamental. Zoom, Microsoft teams, and WhatsApp are the most used ways of communication and teaching at this time.

Third different majors require different education processes as they differ on what goals students want to achieve. It is reported that students with related majors to medical sciences have had more anxiety with distant learning causing their education and later careers to deal with people's lives. Hence, the quality of their lessons is vital, and some classes require physical attendance, which cannot be done in online classes. The environment of education is another key to success alongside other factors, and this feature plays at different levels of significance for different majors.

Lastly, Sentiment toward online learning was not positive since most countries, universities or students, and teachers were not mentally ready to shift their casual way of education to entirely online-driven courses, to conduct an effective online learning experience, preparedness beforehand is vital.

Part II what can be concluded from all articles which mentioned drawbacks and identified issues towards online learning? Well, this review tries to get an overall view of different continents.

Studied countries in Asia reported some problems that are mostly identical; they share almost the same problems. Internet connection is identified as the main issue toward online learning, followed by the non-existence of needed digital devices to participate in online classes due to financial barriers and with a minor reported issue with lack of ICT knowledge.

From selected articles inside Europe, it is evident that students are predominantly worried about ICT knowledge of their instruction; they believe teachers' skills are not sufficient to satisfy their needs. Relatively, teachers' methods of teaching are not appreciated. According to their significance, Internet-related issues and lack of digital devices are other problems.

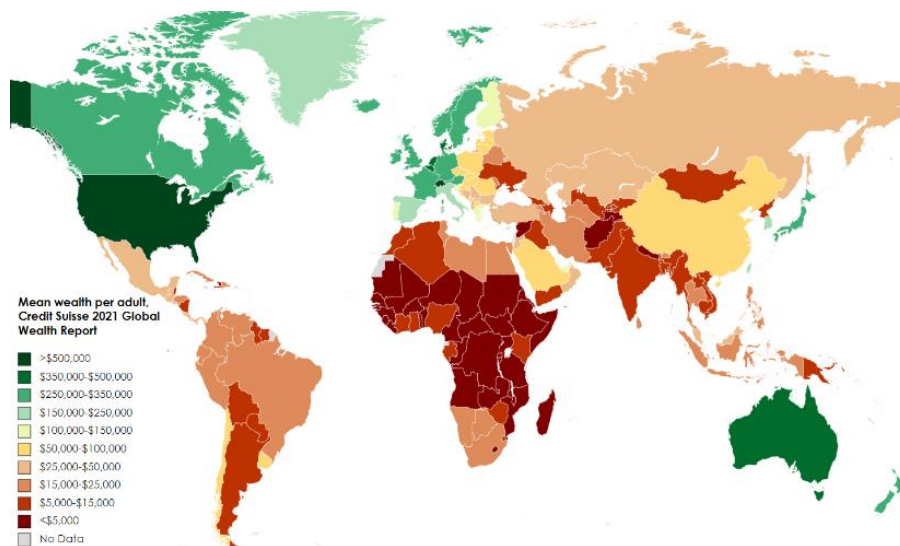
Studied articles in the USA revealed that most people have access to the internet and digital devices. However, it is reported that there is a gap between white students and students of color both in accessing technology and their mental health reported by the U.S. Department of education, and also some discrimination between students has been found. Moreover, two studies mentioned students felt anxiety about their chances in their future jobs.

In South America, contrary in north America, symptoms of online learning problems are much alike in Africa and some of the mentioned Asian countries. Internet connection accessibility, lack of digital devices, and lack of ICT knowledge and power supply are recognized as the main issues in the studied articles.

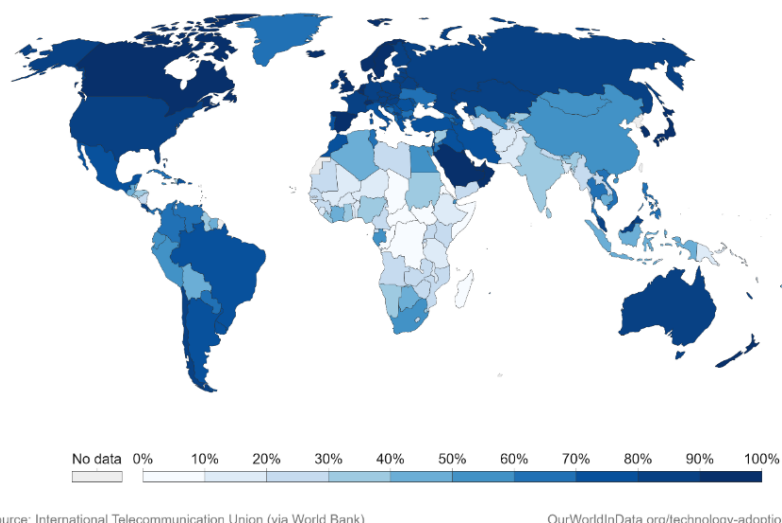
A successful online learning rate in developed countries or continents is more likely. In the selected countries, those who could not have access to the internet or purchase proper digital devices are due to financial barriers. This paper provides some figures to demonstrate the issues better.

Figure 1 shows the average salary per adult based on us dollars across the globe, this figures clearly show that African countries have the lowest income, followed by some Asian and South American countries. In contrast, North America and European countries have the best avenues.

The goal of this information is to show why some students in Africa, Asia, or South America cannot afford digital devices or the internet. This might be an indication of why the reviewed articles



in Europe and North America rarely talked about issues of not having digital devices.



The last figure, figure 2, shows much internet usage each country in the world had in 2019. This figure clarifies which countries probably suffered from internet connectivity in online learning in the covid-19 era and which countries did not. As is shown in the picture, African countries were the most harmed nation in terms of internet usage, and without a proper internet connection, there will be no quality learning.

CONCLUSION

Four factors are acknowledged in this paper as influential factors in online learning classes. This review found out that in undeveloped countries success of online education is highly correlated with the financial status of countries, whereas, in developed countries, its success has other areas of concern among people.

REFERENCES

- Abir, S. M. Abu Adnan, Shama Naz Islam, Adnan Anwar, Abdun Naser Mahmood, and Aman Maung Than Oo. "Building Resilience against COVID-19 Pandemic Using Artificial Intelligence, Machine Learning, and IoT: A Survey of Recent Progress." *IoT* (2020).
- Aboagye, Emmanuel, Joseph Anthony Yawson, and Kofi Nyantakyi Appiah. "COVID-19 and E-Learning: The Challenges of Students in Tertiary Institutions." *Social Education Research* (2020): 1–8. <http://dx.doi.org/10.37256/ser.212021422>.
- Adams, Catherine A., and Patti Pente. "Teachers Teaching in the New Mediascape: Digital Immigrants or 'Natural Born Cyborgs'?" *E-Learning and Digital Media* (2011).
- Adedoyin, Olasile Babatunde, and Emrah Soykan. "Covid-19 Pandemic and Online Learning: The Challenges and Opportunities." *Interactive Learning Environments*, 2020.
- Adi Badiozaman, Ida Fatimawati, Hugh John Leong, and Wallace Wong. "Embracing Educational Disruption: A Case Study in Making the Shift to a Remote Learning Environment." *Journal of Applied Research in Higher Education* 14, no. 1 (2020): 1–15. <http://dx.doi.org/10.1108/jarhe-08-2020-0256>.

- Al-Balas, Mahmoud, Hasan Ibrahim Al-Balas, Hatim M. Jaber, Khaled Obeidat, Hamzeh Al-Balas, Emad A. Aborajoo, Raed Al-Taher, and Bayan Al-Balas. "Correction to: Distance Learning in Clinical Medical Education amid COVID-19 Pandemic in Jordan: Current Situation, Challenges, and Perspectives (BMC Medical Education, (2020), 20, 1, (341), 10.1186/S12909-020-02257-4)." *BMC Medical Education*, 2020.
- Ali, Wahab. "Online and Remote Learning in Higher Education Institutes: A Necessity in Light of COVID-19 Pandemic." *Higher Education Studies* (2020).
- Almahasees, Zakaryia, Khaled Mohsen, and Mohammad Omar Amin. "Faculty's and Students' Perceptions of Online Learning During COVID-19." *Frontiers in Education* (2021).
- Azorín, Cecilia. "Beyond COVID-19 Supernova. Is Another Education Coming?" *Journal of Professional Capital and Community* 5, no. 3/4 (2020): 381–390. <http://dx.doi.org/10.1108/jpcc-05-2020-0019>.
- Bao, Jiayi, and Andy Wu. "Equality and Equity in Compensation." *Harvard Business School working paper series# 17-093* (2017).
- Baxter, Gavin, and Thomas Hainey. "Remote Learning in the Context of COVID-19: Reviewing the Effectiveness of Synchronous Online Delivery." *Journal of Research in Innovative Teaching & Learning* (2022). <http://dx.doi.org/10.1108/jrit-12-2021-0086>.
- Bokolo Anthony Jnr. "Use of Telemedicine and Virtual Care for Remote Treatment in Response to COVID-19 Pandemic." *Journal of Medical Systems* (2020).
- Bordoloi, Ritimoni, Prasenjit Das, and Kandarpa Das. "Perception towards Online/Blended Learning at the Time of Covid-19 Pandemic: An Academic Analytics in the Indian Context." *Asian Association of Open Universities Journal* 16, no. 1 (2021): 41–60. <http://dx.doi.org/10.1108/aaouj-09-2020-0079>.
- Bozkurt, Aras, and Ramesh C Sharma. "Digital Transformation and the Way We (Mis)Interpret Technology." *Asian Journal of Distance Education* (2022).
- Carr, Wilfred, and Stephen Kemmis. *Becoming Critical: Education Knowledge and Action Research*. Routledge, 2003.
- Coman, Claudiu, Laurențiu Gabriel Țiru, Luiza Meseșan-Schmitz, Carmen Stanciu, and Maria Cristina Bularca. "Online Teaching and Learning in Higher Education during the Coronavirus Pandemic: Students' Perspective." *Sustainability* 12, no. 24 (2020): 10367. <http://dx.doi.org/10.3390/su122410367>.
- Connolly, Thomas, Carole Gould, Gavin J. Baxter, and Tom Hainey. "Learning 2.0." In *Higher Education Institutions and Learning Management Systems*, 2011.
- d'Orville, Hans. "COVID-19 Causes Unprecedented Educational Disruption: Is There a Road towards a New Normal?" *Prospects* (2020).
- Deshmukh, Jay. "Speculations on the Post-Pandemic University Campus – a Global Inquiry." *Archnet-IJAR: International Journal of Architectural Research* 15, no. 1 (2021): 131–147. <http://dx.doi.org/10.1108/arch-10-2020-0245>.
- Dewi, Maya Puspita, and Muh Barid Nizarudin Wajdi. "Distance Learning Policy during Pandemic COVID-19." *EDUTECH: Journal of Education and Technology* 4, no. 3 (2021): 325–333.
- Doghonadze, Natela, Aydin Aliyev, Huda Halawachy, Ludmila Knodel, and Adebayo Samuel Adedoyin. "The Degree of Readiness to Total Distance Learning in the Face of COVID-19 - Teachers' View (Case of Azerbaijan, Georgia, Iraq, Nigeria, UK and Ukraine)." *Journal of Education in Black Sea Region* 5, no. 2 (2020): 2–41. <http://dx.doi.org/10.31578/jeb.v5i2.197>.
- Eickelmann, Birgit, and Julia Gerick. "Lernen Mit Digitalen Medien." In *„Langsam Vermisse Ich Die*

Schule ...“, 2020.

- Fredricks, Jennifer A, and Wendy McColskey. “The Measurement of Student Engagement: A Comparative Analysis of Various Methods and Student Self-Report Instruments.” *Handbook of Research on Student Engagement*. Springer US, 2012. http://dx.doi.org/10.1007/978-1-4614-2018-7_37.
- Gautam, Dhruva Kumar, and Prakash Kumar Gautam. “Transition to Online Higher Education during COVID-19 Pandemic: Turmoil and Way Forward to Developing Country of South Asia-Nepal.” *Journal of Research in Innovative Teaching & Learning* 14, no. 1 (2021): 93–111. <http://dx.doi.org/10.1108/jrit-10-2020-0051>.
- Ginty, Carina. “Building Digital Teaching and Learning Capabilities with DigitalEd.Ie in Response to a Global Pandemic.” *AISHE-J: The All Ireland Journal of Teaching & Learning in Higher Education* (2021).
- Grinnell, Frederick, Simon Dalley, and Joan Reisch. “High School Science Fair: Positive and Negative Outcomes.” *PLoS ONE* (2020).
- Haider, Ahmad S, and Saleh Al-Salman. “Dataset of Jordanian University Students’ Psychological Health Impacted by Using e-Learning Tools during COVID-19.” *Data in brief* 32 (July 31, 2020): 106104. <https://pubmed.ncbi.nlm.nih.gov/32789158>.
- Ibrahim, Olayinka Rasheed, Bello Muhammed Suleiman, Suleiman Bello Abdullahi, Taofeek Oloyede, Abdallah Sanda, Maruf Sanusi Gbadamosi, Bashir Olajide Yusuf, et al. “Epidemiology of COVID-19 and Predictors of Outcome in Nigeria: A Single-Center Study.” *American Journal of Tropical Medicine and Hygiene* (2020).
- Jupri, Jupri, and Haerazi Haerazi. “Teaching English Using Two Stay Two Stray in Improving Students’ English Speaking Skills Integrated with Foreign Language Anxiety.” *Journal of Language and Literature Studies* 2, no. 1 (2022): 33–42.
- Kamysbayeva, Aida, Alexey Koryakov, Natalya Garnova, Sergey Glushkov, and Svetlana Klimenkova. “E-Learning Challenge Studying the COVID-19 Pandemic.” *International Journal of Educational Management* 35, no. 7 (2021): 1492–1503. <http://dx.doi.org/10.1108/ijem-06-2021-0257>.
- Khan, S., and A. Mian. “Medical Education: COVID-19 and Surgery.” *British Journal of Surgery*, 2020.
- Lam, Shui-fong, Shane Jimerson, Bernard P H Wong, Eve Kikas, Hyeonsook Shin, Feliciano H Veiga, Chryse Hatzichristou, et al. “Understanding and Measuring Student Engagement in School: The Results of an International Study from 12 Countries.” *School Psychology Quarterly* 29, no. 2 (2014): 213–232. <http://dx.doi.org/10.1037/spq0000057>.
- Van Lancker, Wim, and Zachary Parolin. “COVID-19, School Closures, and Child Poverty: A Social Crisis in the Making.” *The Lancet Public Health*, 2020.
- Lin, Ming Hung, Huang Cheng Chen, and Kuang Sheng Liu. “A Study of the Effects of Digital Learning on Learning Motivation and Learning Outcome.” *Eurasia Journal of Mathematics, Science and Technology Education* (2017).
- Mukhtar, Khadijah, Kainat Javed, Mahwish Arooj, and Ahsan Sethi. “Advantages, Limitations and Recommendations for Online Learning during COVID-19 Pandemic Era.” *Pakistan journal of medical sciences* 36, no. COVID19-S4 (May 2020): S27–S31. <https://pubmed.ncbi.nlm.nih.gov/32582310>.
- Mukuna, Kananga Robert, and Peter J O Aloka. “Exploring Educators’ Challenges of Online Learning in Covid-19 at a Rural School, South Africa.” *International Journal of Learning, Teaching and Educational Research* 19, no. 10 (2020): 134–149. <http://dx.doi.org/10.26803/ijlter.19.10.8>.
- Mulenga, Eddie M, and José M Marbán. “Is COVID-19 the Gateway for Digital Learning in

- Mathematics Education?" *Contemporary Educational Technology* 12, no. 2 (2020): ep269.
- Nenko, Yuliia, Nelia Kybalna, and Yana Snisarenko. "The COVID-19 Distance Learning: Insight from Ukrainian Students." *Revista Brasileira de Educação do Campo* (2020): 1–19. <http://dx.doi.org/10.20873/uft.rbec.e8925>.
- Okoye, Kingsley, Jorge Alfonso Rodriguez-Tort, Jose Escamilla, and Samira Hosseini. "Technology-Mediated Teaching and Learning Process: A Conceptual Study of Educators' Response amidst the Covid-19 Pandemic." *Education and Information Technologies*, 2021.
- Olayemi, Lawal Olatunde, Ramona Bodoosingh, and Filipina Amosa Lei Sam. "Is Samoa Prepared for an Outbreak of COVID-19?" *Asia-Pacific Journal of Public Health*, 2021.
- Ordorika, Imanol. "Pandemia y Educación Superior. Revista de La Educación Superior." *Revista de la Educación Superior* (2020).
- Osborne, Sarah, and Kate Hogarth. "Mind the Gap: The Reality of Remote Learning during COVID-19." *Accounting Research Journal* (2020).
- Patra, Soumendra Kumar, Bijaya Kumar Sundaray, and Durga Madhab Mahapatra. "Are University Teachers Ready to Use and Adopt E-Learning System? An Empirical Substantiation during COVID-19 Pandemic." *Quality Assurance in Education* 29, no. 4 (2021): 509–522. <http://dx.doi.org/10.1108/qac-12-2020-0146>.
- Powell, Lisa, and Nicholas McGuigan. "Teaching, Virtually: A Critical Reflection." *Accounting Research Journal* (2020).
- Printy, Susan, and Yan Liu. "Distributed Leadership Globally: The Interactive Nature of Principal and Teacher Leadership in 32 Countries." *Educational Administration Quarterly* (2021).
- Rancourt, Diana, Ashley Brauer, Madeline Palermo, Emily M. Choquette, and Christopher Stanley. "Response to Tomalski et Al. (2019): Recommendations for Adapting a Comprehensive Athlete Mental Health Screening Program for Broad Dissemination." *Journal of Sport Psychology in Action* (2020).
- Rouf, Md. Abdur, Mohammad Sharif Hossain, Md. Habibullah, and Tanvir Ahmed. "Online Classes for Higher Education in Bangladesh during the COVID-19 Pandemic: A Perception-Based Study." *PSU Research Review* (2022). <http://dx.doi.org/10.1108/prr-05-2021-0026>.
- Rudhumbu, Norman, Wilson Parawira, Crispin Bhukuvhani, Jacob Nezandoyi, Cuthbert Majoni, Felix Chikosha, Kwashirai Zvokumba, and Bernard Chingwanangwana. "Insight into Online Teaching Behaviour of Lecturers in Zimbabwean Universities during the COVID-19 Era and beyond: Issues and Challenges." *The International Journal of Information and Learning Technology* 38, no. 5 (2021): 518–539. <http://dx.doi.org/10.1108/ijilt-07-2021-0104>.
- Salas-Pilco, Sdenka Zobeida, Yuqin Yang, and Zhe Zhang. "Student Engagement in Online Learning in Latin American Higher Education during the COVID-19 Pandemic: A Systematic Review." *British journal of educational technology : journal of the Council for Educational Technology* 53, no. 3 (May 2022): 593–619. <https://pubmed.ncbi.nlm.nih.gov/35600418>.
- Shine, Beau, and Sarah E. Heath. "Techniques for Fostering Self-Regulated Learning Via Learning Management Systems in On-Campus and Online Courses." *Journal of Teaching and Learning with Technology* (2020).
- Shokheh, Mukhamad, Mansourah Ebrahimi, and Kamaruzaman Yusoff. "From Islamic Teaching to Social Charity: The Muhammadiyah Movement in Semarang, Central Java, Indonesia; 1926-1940." *Asian Culture and History* (2018).
- Singh, Divya, and Mashamaite Peterlia Ramutsheli. "Student Data Protection in a South African ODL

- University Context: Risks, Challenges and Lessons from Comparative Jurisdictions.” *Distance Education* 37, no. 2 (2016): 164–179. <http://dx.doi.org/10.1080/01587919.2016.1184397>.
- Tarus, John K, David Gichoya, and Alex Muumbo. “Challenges of Implementing E-Learning in Kenya: A Case of Kenyan Public Universities.” *The International Review of Research in Open and Distributed Learning* 16, no. 1 (2015). <http://dx.doi.org/10.19173/irrodl.v16i1.1816>.
- Trowler, Paul R. “Introduction: Higher Education Policy, Institutional Change.” In *Higher Education Policy and Institutional Change: Intentions and Outcomes in Turbulent Environments*, 2002.
- Turner, Bryan S. *The Cambridge Dictionary of Sociology*, 2006.
- UNESCO. “Events Canceled/Postponed - Coronavirus Outbreak.” 2020. Last modified 2020. Accessed April 5, 2020. <https://en.unesco.org/events/events-canceledpostponed-coronavirus-outbreak>.
- Whalen, Laurel, Jeanne Barcelona, Erin Centeio, and Nathan McCaughtry. “#Healthykidsquarantined: Supporting Schools and Families with Virtual Physical Activity, Physical Education, and Nutrition Education during the Coronavirus Pandemic.” *Journal of Teaching in Physical Education* (2020).
- Wu, David T, Kevin Y Wu, Thomas T Nguyen, and Simon D Tran. “The Impact of COVID-19 on Dental Education in North America-Where Do We Go Next?” *European journal of dental education : official journal of the Association for Dental Education in Europe* 24, no. 4 (November 2020): 825–827. <https://pubmed.ncbi.nlm.nih.gov/32654328>.
- Zayabalaradjane, Zayapragassarazan, and Thomas V Chacko. “Interaction Analysis of FAIMER Mentor-Learner Web Online Collaborative Learning Session.” *Malaysian Online Journal of Educational Technology* (2020).
- Zhao, Shi, Salihu S. Musa, Qianying Lin, Jinjun Ran, Guangpu Yang, Weiming Wang, Yijun Lou, et al. “Estimating the Unreported Number of Novel Coronavirus (2019-Ncov) Cases in China in the First Half of January 2020: A Data-Driven Modelling Analysis of the Early Outbreak.” *Journal of Clinical Medicine* (2020).
- Zhu, Xudong, and Jing Liu. “Education in and After Covid-19: Immediate Responses and Long-Term Visions.” *Postdigital Science and Education* 2, no. 3 (2020): 695–699. <http://dx.doi.org/10.1007/s42438-020-00126-3>.
- “Award for Distinguished Scientific Contributions: John O’Keefe.” *American Psychologist* (2020).