



THE IMPACT OF COVID 19 PANDEMIC ON RADIOGRAPHY EDUCATION AND TRAINING: A SYSTEMATIC REVIEW

Dlana. Z Joseph¹, Fatima Zahra Ibrahim¹, Adamu Yakubu¹, Musa Gloria Lalai¹

^{1,2} Department of Radiography, Federal University of Lafia, Nasarawa State, Nigeria

Corresponding Author

Ibrahim, Fatima Zahra
fz.ibrahim@yahoo.com

ARTICLE INFO

Keywords: Covid-19, virus, Radiography education, Radiography training, Nigeria, online learning.

ABSTRACT

Introduction: Covid-19 pandemic has affected Radiography education globally. Social distancing, being one of the effective ways of preventing the spread of the virus, has resulted in the need to lessen traditional face-to-face classes in schools and clinical learning environment.

Aim: This study aims at highlighting education styles that would be most beneficial to radiography education while considering its distinctive nature of the high need to involve practical knowledge acquisition, and also compliant to the covid-19 social distancing guideline.

Methodology: This study utilised an intensive literature search 20 of related and relevant articles. Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) in the following databases: Scopus, EMBASE, PubMed, CINAHL, Web of Science, the Cochrane Library, Research gates and Google scholar were used to source relevant articles. According to the preset inclusion and exclusion criteria. A Systematic review of published articles on Impact of Covid-19 on Radiography education were sought for. Other possible training methods that would be sustainable, resilient, and in conformity with the covid 19 guidelines were sourced. Search terms were “radiography”, “education”, “online learning”, and “Covid 19”. Only education articles that were radiography education-based or medical health-related were included.

Result: To reduce the frequency of traditional face-to-face classes, there is a high need for radiography educators and trainees to adapt to the growing technology of online learning. Online learning should be complimented with small group, tutorial group, simulations games, proper utilisation of skills, virtual learning and demonstration laboratories, to supplement the clinical practical skills needed. However, online learning adaptation, is hindered by several factors, for example, expert skills in handling the computer, insufficient and unstable power supply in developing countries, cost of computer gadgets and data, and the struggle to balance school-work life when studying from home.

Conclusion: This study recognises that there are technological opportunities worth adapting in Radiography education to ensure continuing education and production of competent radiographers that would be able to manage and handle the emerging global health challenges in the new normal.

Implication of the study: The Radiography curriculum needs to be resilient at all times to ensure constant continuing of radiography education. All stakeholders involved in Radiography education need to work together to ensure online learning and other alternative learning methods can be efficiently adopted and implemented in the Covid 19 era.

Introduction

Covid-19 is a type of coronavirus infections which are known to cause respiratory ailments to humans and animals. The current novel Coronavirus Disease of 2019 (COVID-19) pandemic has significantly impacted all training programs globally. According to the Centre for Disease Control and Prevention (CDC) (2020), It was first discovered in Wuhan; China, in December 2019, and its discovery was first associated with contact to a large seafood and animal market. Later, human to human transmission was noted, and the transmission was emphasised to be through air droplets. This discovery had led to the social distancing as one of the recommendations by the World Health Organisation (WHO) to curtail the virus, which discourages the large gathering of people, and it also recommends at least a metre distance between people. Other Covid 19 prevention recommendations by the WHO are the use of face masks and thorough washing of hands with soap and water for at least forty seconds or the use of Alcohol hand sanitisers in the absence of water.

Covid -19 pandemic has led to worldwide schools' closure. Lockdown has been implemented in over 131 countries globally to adhere to the social distancing guideline, thus affecting about 1.5 billion learners in the world⁴. In Nigeria, about 80 million learners were affected by school closure⁵. Taking advantage of innovative screen-sharing platforms including Zoom and Microsoft Teams, to deliver digital or e-learning lectures became a new normal. Several innovative strategies have been developed to compensate for these limitations and enhance the educational experience of radiography students during the pandemic.

Online learning possesses several advantages, especially at a time when physical distancing is essential. It allows for wide-reaching dissemination of teaching; valuable for Trusts and training programmes spanning multiple sites, and offers greater flexibility through its recording facilities for the learner to access teaching at a time convenient to them. In light of changes to trainee rotas, redeployment and delays to examinations with associated anxieties caused, this has provided a means to maintain regular teaching and encourage cohesion within radiology departments despite the unprecedented circumstances. Similarly, several national and international organisations have harnessed the potential of online learning as a means to preserve education during this period. Free-to-view webinars produced

by a variety of organisations have proven popular, and social media platforms, such as Instagram and Twitter, have also provided opportunity for educators to share content. With new technologies come limitations. As online learning and screen-sharing applications become more seamless, one must remain mindful of requirements to prevent the inadvertent sharing of sensitive information when teaching. Compared to face-to-face teaching, the response-lag and loss of non-verbal cues mean that a teacher has to work harder to be inclusive and personalised in a live session.

The first Coronavirus case in Nigeria was recorded on 27th February 2020, in Lagos by the Federal Ministry of Health. In less than two months after the first incidence, Nigeria recorded more than 50 cases³, and thus the Federal Ministry of Education approved the school closure from 23rd March 2020. Subsequently, schools remained closed for about seven months until they began gradual reopening, as the daily number of cases declines nationally. Schools were open whilst adhering strictly to the Ministry of Health guidelines and protocols set to ensure learning facilities are safe. The second phase of school lockdown started after the end of year school break; schools were advised to remain closed till 18th January following the second wave of the virus.

Globally, several researchers have worked on the effect of Covid-19 on clinical practising radiographers. In Spain, a study conducted to evaluate Radiographers' concern about working during the Covid19 pandemic showed that they expressed a high level of threat of being exposed to the virus, as well as exposing family members, patients and other colleagues⁶. In Ghana, being a low resource setting, a study conducted revealed that Radiographers experienced a high level of workplace-related stress due to the pandemic with very limited psychosocial support to help elevate the mental state and wellbeing of these Radiographers⁷. Related mental work stress was also noted amongst Radiographers in Cyprus, although there seems to be adequate and satisfactory personnel protective equipment (PPE)⁸, and thus these stresses the need for complementing the use of PPE with proper support protocol to guarantee Radiography staff and patients of their safety in the clinics. Students in clinical placement also express similar worry of being infected with the Virus⁹.

A limited number of researches has been geared towards radiography learning and education

amidst the covid-19 pandemic¹⁰. However, this article searched beyond radiography to other health professions like medicine^{11,12}, surgery¹³ and orthopaedic¹⁴ learning amid the pandemic, and major findings were the adaptation of online education to supplement the limitation physical classroom in curbing the spread of the covid-19 virus. However, as much as online education brings opportunity for continuing education in a student-centred learning approach, it still comes with its challenges¹⁵. These challenges include difficulty in balancing home and school life/activities, cost of computer hardware, software licencing, and data, unstable power supply, and threats of cybersecurity.

Radiography education in Nigeria is a five-year program that is usually all based on physical face-to-face classes. The first year is mainly core-science courses which are usually classroom-based and lab-based. The second year is mainly medical science course which includes anatomy, physiology and biochemistry, and it also includes core radiography courses as wells as learning basic nursing care. Subsequently, the third- and fifth-year concentrates on learning core medical radiography course, in addition to some medical college course, such as Anatomy, Histology, Physiology, Biochemistry, Pharmacology, and Pathology.

All through the five-year study period, students participate in clinical posting. However, the later classes of the third to the fifth year spend more time in clinical posting acquiring knowledge of the practical aspects of the profession. It is empirical to mention that the hospital environment where these clinical postings take place is a high-risk area for getting different infections as well as the coronavirus^{16,13,16}. Thus, in as much as clinical posting is very vital to the curriculum it has to be planned in such a way that all risks are curtailed to the barest minimum to protect the students and staff in the hospitals.

Skill training is an essential part M. Zemlin¹ of medical education and cannot be fully digitalized nor should it be omitted. The pandemic demonstrates that skills like ultrasound are H. Abdul-Khaliq⁴ essential when treating critical ill patients. Medical faculties use peer E. Tutdibi^{1,2} assisted learning (PAL) concepts to teach skills, like ultrasound through specially trained student tutors. It is important to make the necessary adjustment to the teaching and/or learning pattern as students resume back after a long Covid19

break. Presently the globe is facing the second wave of the virus and it therefore paramount that all necessary safety precautions are adhered to to protect students, teachers and the public from the deadly virus.

The pandemic has created challenges in education which have led to several authors highlighting solutions worth adapting to cushion the effect of the pandemic on education. However, there is not enough literature that focuses on Radiography education amidst the Covid 19 pandemic, so this study aims at highlighting education styles that would be most beneficial to the radiography education while considering its distinctive nature of the high need to involve practical knowledge acquisition, that would conform to the covid-19 social distancing guideline.

Objectives of the study

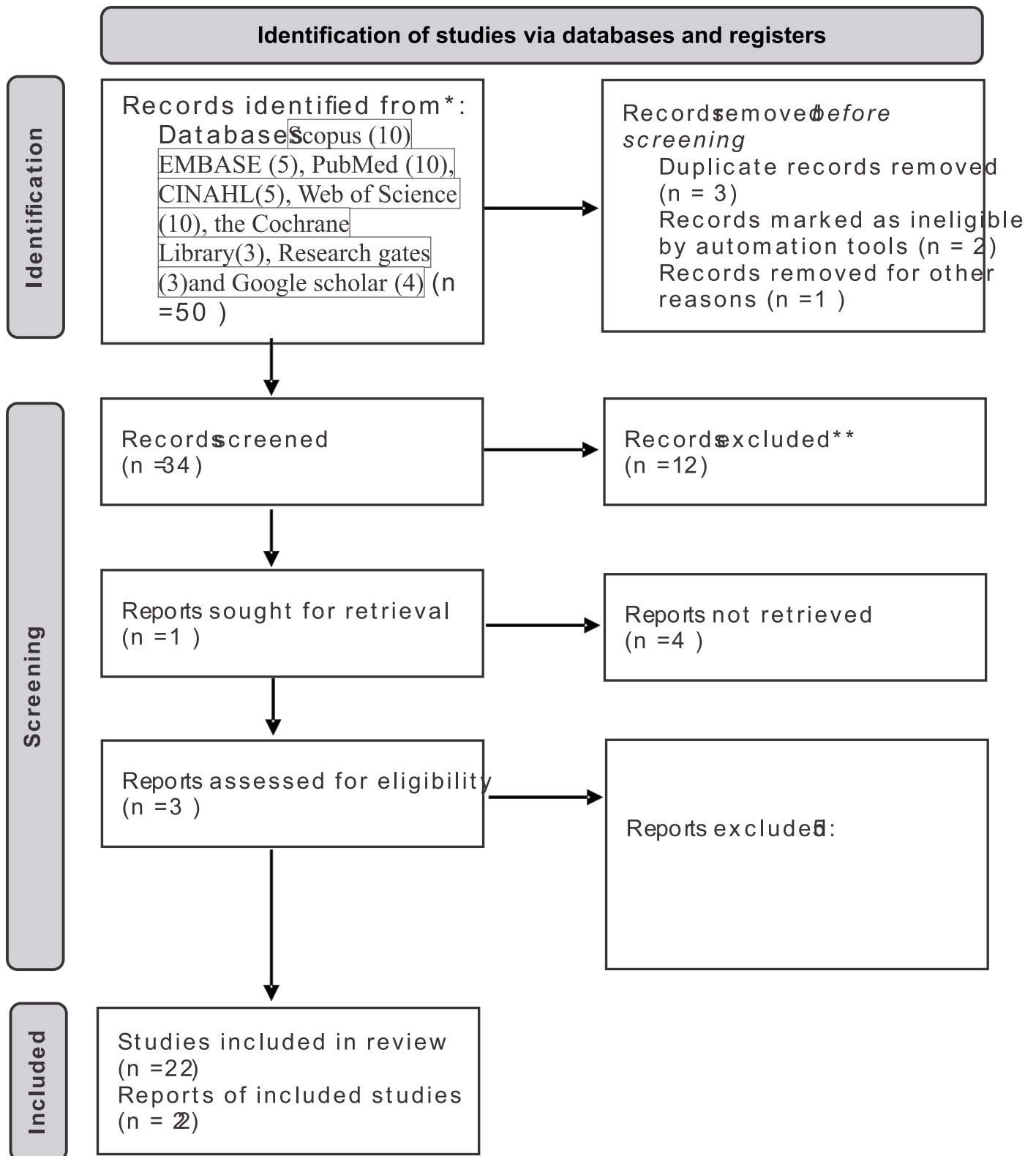
- To highlight the impact of the pandemic on Radiography education and training
- To highlight opportunities set by other alternative learning methods to complement physical classes
- To highlight the possible limitation that could hinder the implementation of possible alternative learning methods in Nigeria, and provide solutions that could mitigate it.

Methodology

This study utilised an intensive literature search for recommended covid-19 guidelines. Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) in the following databases: Scopus, EMBASE, PubMed, CINAHL, Web of Science, the Cochrane Library, Research gates and Google scholar were used to source relevant articles. According to the pre-set inclusion and exclusion criteria. A Systematic review of 22 published articles on Covid-19 were sought for. Other possible training methods that would be sustainable, resilient, and in conformity with the covid 19 guidelines were sourced. Keywords used for sought articles were “radiography”, “education”, “online learning”, and “Covid 19”, and only education articles that were radiography education-based or medical health-related were chosen.

Data and information are collected from the CDC, WHO and Nigerian Centre for Disease Control on Covid 19. Information on the impact of Covid 19 on education was obtained for UNESCO.

The study also reported personal observation noted in online lecturers, seminars, and meetings.



PRISMA Flow diagram for the search strategy

RESULTS

Synthesis of evidence

Opportunities worth adopting for radiography education during the pandemic

It is necessary to exploit sustainable strategies in teaching and learning methods in radiography education that can be in line with the Covid19

schools' guideline and the face of any adversity 10. Several authors also noted the need for a new curriculum for medical education to include online teaching methods 10,17. Satisfaction with online learning was reported to be exponential to years of experience with the tool, thereby encouraging that online learning continues post-pandemic to allow teachers and learners to continue to develop their

skills on online learning technology 18,19. This is also supported by findings of Cherry and Flora (2017) which reveals that perception of the effectiveness of online tools in Radiography improves with online technology experience and competency 18.

Providing pre-recorded videos or audios of classes is a great way for students to learn on their own. Students can be provided with these video and audios in good time to study before meeting up in class to discuss with their teacher and classmates. This will make the class more interactive and save more time, thus time spent in class could be reduced as a way of avoiding contacts during the pandemic. Also, this can be implemented for online classes to be more efficient and interactive as well. The pre-recorded videos and audios can be given together with online reading materials like textbooks, journals, articles, and notes. Aruna (2019) highlights that providing pre-recorded videos makes the students more engaged in the learning process, allows equal visibility in a supposedly crowded classroom and enhances mastery learning 20.

Clinical posting and laboratory postings can be minimised with the use of simulations and 3D models 12,13,20. Human simulations can be used in skills lab for learners to learn radiographic technique while avoiding physical contact with patients. Simulations games can be developed to help students identify radiographs and structures in them and depict pathology from radiographs. In general, studies reveal helps improve professional practice, roles, and skills in radiography 21. Simulation can also help in the aspect of radiation protection, as students can learn clinical skills with non-human objects, thereby not having to subject humans to radiation error or mistakes as they learn.

Flipped classroom, a learning style where students are fragmented into smaller groups to learn or study or discuss a certain topic with their peers. This allows individuals views and contribution to be heard and tutors get to give direct feedback to students 20. Students can have flipped online classes for ease of meeting and communication, for flipped classes also promotes teamwork.

It is highly recommended that radiography education moves with the new trend of technology to ensure adequate training of a new generation of Radiographers to be able to adapt and conquer the fast-growing challenges in public health. When teachers and learners of Radiographer adapt to

these opportunities it would only not be beneficial to the advancement of medicine but also enable a better work environment and decrease occupational work hazard of being infected by nosocomial infections that are being acquired in a clinical environment.

Online learning allows the opportunity for highly disciplined individuals to learn at their pace and convenient 19,22. Students can take short breaks to assimilate a lesson before they proceed to take more lessons. Learners also have access to a bulk of quality information to enhance their understanding and knowledge of a given topic. Students can also communicate with each other and learn from each other at ease on virtual platforms. Students can achieve quite much over a short time.

Online learning can be very cost saving 22. Transportation fares and fares involved with being away from home can be avoided. The school can also do away with having to build massing halls, classes, offices, and hostels to accommodate students at all times. Shortages of expert personnel can be compensated for with virtual learning.

Lastly, virtual learning can be made in a way that would make learning fun for students, to keep the students motivated and zestful at all times. Learning games, interactive forums, and instant feedbacks enable students smooth and effective learning and understanding 19,23.

Challenges faced by e-learning in general

The major challenge that arises from digital learning is the loss of physical contact with colleagues, classmates and teachers thus less collaborative experience with people which will inevitably psychologically stress and affects the mental health of the students 24,25. Learners also find it challenging to separate school task and home task, thus also making it challenging to manage time/work efficiently 24. Generally, students prefer face to face classes compared to virtual learning in situations where they are allowed to chose one 22,26.

Carlson (2020), noted that education engagement is difficult to assess while using online learning tools as compared to face to face classes. A learner's interest is usually evaluated by professional teachers who believe in having an interactive class where both teachers and students are emotionally ready to learn 27. A learner's interest is what encourages the lifelong application of what was taught; however, this is difficult to access with online teaching.

Converting traditional lessons to online classes is not a transcriptional process but a translational one requiring more intensive use of varieties of educational tools, thereby requiring the need to combine multiple devices for a lecture²⁸.

Clinically, although the use of simulation and 3D models can be used to supplement clinical posting, it is however inevitable to note that the students would miss out on the development of nonverbal communications skills which they get from the interaction with patients^{13,22}.

The major challenge of being online in Nigeria is that it is expensive and not easily affordable for most students. The cost of gadgets needed like phone, laptops, and modems or router to be online is not affordable to some students. Also, mobile data and wireless subscriptions are not equally affordable. Also, the frustrations from network fluctuations, thereby making students/teachers miss out on important parts of the classes or meetings and losing focus and interest completely. Poor power supply to power up the devices needed to stay connected to these online classes is another challenge that most users in Nigerian's face.

Recommendation for Radiography Education to Adopt

So, due to the challenges identified above, the writers make some suggestions on how to scale through them.

The radiography curriculum needs to allow for educational strategies that can withstand any pandemic, security uncertainties, and any form of crises. Thus, the curriculum and mode of teaching need to be resilient to any form of external problems. Teaching methods to be set that both learners and educators would be used to avoid issues of transitioning at the time of emergencies. The educational practices need to be going in line with global development and technology.

Majorly, clinical learning is mainly at risk, even with the so-called available Personnel Protective Equipment (PPE). Therefore, the need to minimise patient contact is encouraged; accordingly, there is a need to provide proper learning simulation^{24,29}. Contacts can be minimized by maximising the use of skills labs, use of simulation games, and online learning tools. Also, some classes can be replaced with a smaller number of students' tutorial groups. Primarily, several authors in different fields; medical education^{12,30}, pathology education³¹, and radiography education^{10,18} etc., have

recommended the use of online platforms to help decongest the traditional classrooms and adhere to the social distance guideline of government and internal organisations. When online platforms are being utilised, teachers should ensure it is very interactive, ensuring learners are actively involved. Schools should provide free and quality wireless services in the school premises and hostels to enable students to be online for any supplementary online learning.

Generally, the power supply of Nigeria needs to be improved to ensure smooth online learning for students, for there is a great unstable supply of electricity in most part of Nigeria. Data quality and costs need to be reviewed to ensure every student can afford to be online to learn.

In summary, it is highly recommended that the traditional teaching style of face to face learning is harmonised with online learning, flipped classrooms, simulations and other technology-driven learning methods. This should be continued even post covid19 period to enable both teachers and learners to familiarised and build up competency.

Conclusion

It very important that radiography education constantly continues, despite any natural and man-made adversities. Covid19 virus has imposed challenges in radiography education and all education in general. Majorly, the most effective prevention of the virus of social distancing has caused the classroom and clinics devoid of students, and thus to ensure continuing education online learning platforms have widely been utilised and recommended. Other strategies of ensuring continuing education are incorporating small tutorial groups, high utilization of skills and demonstration lab, and the use of simulation games. Online learning comes with various challenges, ranging from computer expertise, costs, internet and power supply, and home-school life imbalance etc.

The writers recommend using sustainable alternative strategies that would supplement face-to-face traditional learning methods. Adopting these strategies and ensuring its challenges have been mitigated to the minimum possible way would ensure the continued education of radiographers and production of Radiographers in the workforce who would be resilient to global health challenges. The radiography curriculum in Nigeria should be able to cater to these alternative

teaching methods.

The Nigerian government needs to provide amenities that would ensure the smooth running of online learning and thus ensuring power and data are accessible, efficient, and affordable to everyone.

References

1. Centers for Disease Control and Prevention. Things to know about the Covid-19 Pandemic.(2020).doi:10.1109/icorr.2007.4428362
2. World Health Organization. Advice for the public. (2020). Available at: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public>. (Accessed: 23rd January 2021)
3. Nigeria Centre for Disease Control. NCDC Coronavirus COVID-19 Microsite. Frequently Asked Questions (2020). Available at: <https://covid19.ncdc.gov.ng/faq/>.(Accessed: 23rd January 2021)
4. United Nations Educational, S. and C. O. School closures caused by Coronavirus (Covid-19). Unesco (2020). Available at: <https://en.unesco.org/covid19/education-response>. (Accessed: 23rd January 2021)
5. Education, F. M. of. Executive Summary. 13 (2020).
6. Ruiz, C., Llopis, D., Roman, A., Alfayate, E. & Herrera-Peco, I. Spanish radiographers concerns about the COVID-19 pandemic. *Radiography* (2020).doi:10.1016/j.radi.2020.10.001
7. Akudjedu, T. N., Botwe, B. O., Wuni, A. R. & Mishio, N. A. Impact of the COVID-19 pandemic on clinical radiography practice in low resource settings: The Ghanaian radiographers perspective. *Radiography* (2020). doi:10.1016/j.radi.2020.10.013
8. Zervides, C., Sassi, M., Kefala-Karli, P. & Sassis, L. Impact of COVID-19 pandemic on radiographers in the Republic of Cyprus. A questionnaire survey. *Radiography* (2020). doi:10.1016/j.radi.2020.10.004
9. Rainford, L. A. et al. The impact of COVID-19 upon student radiographers and clinical training. *Radiography* (2020). doi:10.1016/j.radi.2020.10.015
10. Tay, Y. X., Cai, S., Chow, H. C. & Lai, C. The needs and concerns of clinical educators in radiography education in the face of COVID-19 pandemic. *Journal of Medical Imaging and Radiation Sciences* 0, (2020).
11. Ahmed, H., Allaf, M. & Elghazaly, H. COVID-19 and medical education. *The Lancet Infectious Diseases* 20, 777778 (2020).
12. Almarzooq, Z. I., Lopes, M. & Kochar, A. Virtual Learning During the. *Jornal of the American Cardiology* 75,263538 (2020).
13. Dedeilia, A. et al. Medical and surgical education challenges and innovations in the COVID-19 era: A systematic review. *In Vivo* 34,16031611 (2020).
14. Kogan, M., Klein, S. E., Hannon, C. P. & Nolte, M. T. Orthopaedic Education During the COVID-19 Pandemic. *The Journal of the American Academy of Orthopaedic Surgeons* 28, e456e464 (2020).
15. Seymour-Walsh, A. E., Bell, A., Weber, A. & Smith, T. Adapting to a new reality: COVID-19 coronavirus and online education in the health profession. *Rural and Remote Health* 20, (2020).
16. Mahajan, V., Singh, T. & Azad, C. Using Telemedicine During the COVID-19 Pandemic. *Indian pediatrics* 57, 652657 (2020).
17. Sandhu, P. & de Wolf, M. The impact of COVID-19 on the undergraduate medical curriculum. *Medical Education Online* 25, (2020).
18. Cherry, S. J. & Flora, B. H. Radiography faculty engaged in online education: Perceptions of effectiveness, satisfaction, and technological self-efficacy. *Radiologic Technology* 88,249262 (2017).
19. Sandeep, M. Increasing use of digital platforms for online teaching-learning in COVID Era: Pros and cons. ~ 41 ~ *Asian Journal of Management and Commerce* 1, 6973 (2020).
20. Aruna, V. Teaching-Learning Methods in Medical Education Merits and Demerits. *International Journal of Research & Review* (www.ijrrjournal.com) Vol 6, (2019).
21. Shiner, N. Is there a role for simulation based education within conventional diagnostic radiography? A literature review. *Radiography* 24,262271 (2018).
22. Ullah, H., Muhammad, | & Bakhsh, H. P. Online Oriented Classes: Merits and Demerits of the Point of View of Ghazians at Ghazi University Dera Ghazi Khan. doi:10.31703/gesr.2020(V-III).18
23. Minocha, S. The State of Virtual Reality in Education-Shape of Things to Come. (2015).

24. Luyben, A., Fleming, V. & Vermeulen, J. Midwifery education in COVID-19- time: Challenges and opportunities. *Midwifery* 89, 102776 (2020).
25. Virarkar, M., Jensen, C., Javadi, S., Saleh, M. & Bhosale, P. R. Radiology Education Amid COVID-19 Pandemic and Possible Solutions. *Journal of computer assisted tomography* 44, 472478 (2020).
26. Mehmood, Q. et al. View of ONLINE CLASSES IN DIFFERENT INSTITUTES OF PAKISTAN DURING CORONAVIRUS PANDEMIC; MERITS AND DEMERITS. *Pak Postgrad Med J* 7174 (2020). Available at: <http://www.ppmj.org.pk/index.php/ppmj/article/view/310/224>. (Accessed: 11th June 2021)
27. Carlson, E. R. COVID-19 and Educational Engagement. *Journal of Oral and Maxillofacial Surgery* 78, 10491051 (2020).
28. Ortiz, P. A. Teaching in the time of COVID-19. *Biochemistry and Molecular Biology Education* 48, 201 (2020).
29. Mishra, K., Boland, M. V. & Woreta, F. A. Incorporating a virtual curriculum into ophthalmology education in the coronavirus disease-2019 era. *Current opinion in ophthalmology* 31, 380385 (2020).
30. Chick, R. C. et al. Using Technology to Maintain the Education of Residents During the COVID-19 Pandemic. *Journal of Surgical Education* 77, 729732 (2020).
31. Mukhopadhyay, S. et al. Leveraging Technology for Remote Learning in the Era of COVID-19 and Social Distancing Tips and Resources for Pathology Educators and Trainees. *Archives of Pathology & Laboratory Medicine* 144, 10271036 (2020).