Student Satisfaction and Preferences Related to Virtual Streaming Facilities During the COVID-19 Lockdown

Article *in* International Journal of Virtual and Personal Learning Environments · January 2022

DOI: 10.4018/IJVPLE.285595

CITATIONS
2

READS
368

2 authors:

Micheal M Van Wyk
University of South Africa
131 PUBLICATIONS **1,017** CITATIONS

SEE PROFILE

Samuel Amponsah
University of Ghana
49 PUBLICATIONS **235** CITATIONS

SEE PROFILE

International Journal of Virtual and Personal Learning Environments
Volume 12 • Issue 1

Student Satisfaction and Preferences Related to Virtual Streaming Facilities During the COVID-19 Lockdown

Micheal M. van Wyk, University of South Africa, South Africa
https://orcid.org/0000-0001-5536-1362

Samuel Amponsah, University of Ghana, Ghana
https://orcid.org/0000-0002-4303-4863

ABSTRACT

This paper reported how students used the virtual streaming technology and considered their satisfaction and preferences related to video conferencing during COVID-19 lockdown. A case study was selected for an exploratory mixed methods design to explore students' (n=89) lived experiences of the video conferencing facility during the COVID-19 lockdown. This study has found that students preferred both Teams and Zoom as virtual streaming facilities during the COVID-19 lockdown. Students were satisfied with virtual streaming platforms as a teaching and learning supportive tool that facilitated their shift to online learning. Moreover, this study reported that using a web-based videoconferencing platform as a virtual streaming tool supports students in learning from home in critical times such as this pandemic. Further research is needed to determine students and lecturers' digital literacy competencies using video conferencing for successful online learning post COVID-19 lockdown.

KEYWORDS

Case Study, COVID-19 Lockdown, Exploratory Mixed Methods Design, Student Learning Videoconferencing, Virtual Streaming Tool

INTRODUCTION

In recent times, two major "turning points" have changed the world of work dramatically, Education 4.0 and the COVID-19 pandemic. Education 4.0 has created exponential possibilities and opportunities for the knowledge economy, while the COVID-19 pandemic has had a significant impact on global events, from governance to socialisation. These two "turning points" have changed and challenged global events radically, while also bringing about an exponential shift in the boundaries of the knowledge economy. As historical events, the pandemic and Education 4.0 have changed how we live and work in our environment, with COVID-19 having a profound impact on the knowledge economy. Governments, corporates, households and higher education institutions (HEIs) have been and are being confronted with major challenges in overcoming the pandemic, while the search for a possible cure for the virus continues.

Currently, the higher education sector, worldwide, is dealing with the huge impact that COVID-19 has had on teaching and learning, with universities having been forced to shift their teaching towards

DOI: 10.4018/IJVPLE.285595

e-learning and/or blended learning modes. Globally, institutions of higher learning have ventured into online videoconferencing as part of teaching and learning. Many hours of conventional teaching and learning at contact or residential and distance education universities have been lost and this has taken a serious toll on academic performance and also, possibly, on throughput rates. To make up for lost time, universities have started to employ online videoconferencing platforms, such as Microsoft Teams or Zoom, and lecturers have been persuaded to adopt the use of videoconferencing to support their students in different learning spaces.

Laurillard (1993) coined the term "videoconferencing" to describe an online streaming facility intended to create access for students and lecturers in otherwise inaccessible spaces. Moreover, Wiesemes and Wang (2010) define video conferencing as a synchronous model of interactive transfer between groups and people, which could be by voice, video or data. Video-conferences can also be recorded for later use by either lecturers or students. Adding to this discourse, Cochrane (1996) concurs with Laurillard (1993) that this streaming medium provides access to many learning sites. In the context of this study, the researchers associate videoconferencing with using an online internet connection to stream a conference between lecturers and students and, by using the technology, they are also able to transmit audio and visual presentations. In this scenario, the video-conferences can also be recorded for later use by either the lecturers or students.

Therefore, this paper explores how students used virtual streaming technology and consider their views related to video conferencing during COVID-19 lockdown. Based on the aim of this paper, we came up with the following specific objectives:

- To determine students' experience in relation to the switch to the videoconferencing facility, as an online teaching and learning tool, during the COVID-19 lockdown.
- To investigate students' preferences and views of the virtual streaming tools used during the COVID-19 lockdown.
- To determine the effect of Teams and Zoom as virtual streaming tools (VSTs) on students' gender, satisfaction, preferences and benefits in this course during the COVID-19 lockdown.
- To explore the challenges experienced by students in using videoconferencing virtual streaming during the COVID-19 lockdown.

LITERATURE REVIEW

A Web-Based Digitalised Framework

In the context of this study, an integrative theoretical framework is employed. We argue that the videoconferencing facility is situated in a contextual sociocultural space (Vygotsky, 1980) that enhances students' cognition and active multiple modes of knowing (Gardner, 1983). The theories, namely the sociocultural theory of cognitive development (Vygotsky, 1980) and the web-collaborative learning (Drinkwater et al., 2004) will be the lens through which the use of a videoconferencing facility to support student learning will be examined. The originator of the sociocultural theory of cognitive development, Lev Vygotsky, posits that the community interacts, supports and develops the social, cultural and cognition abilities of the individual in the community. In this study, students and lecturers connect through a virtual streaming facility, where they interact, and where students receive support and develop their competencies. To execute these competencies, the universities, where this case study was conducted, used similar Sakai Learning Management Systems (LMSs) for teaching and learning purposes. The web-based digitalised platform, Sakai (LMS), was used to support lecturers as part of their strategy to change student views of videoconferencing during the COVID-19 pandemic. These LMS platforms provided access, as web-collaborative learning (Drinkwater et al. 2004) spaces for students and lecturers to share, participate and collaborate in an online space. Similarly, Janssen et al. (2013) and Langford and Damsa (2020) posit that digital literacy skills are vital for the successful

implementation of an online teaching and learning space. As a result, the two theories were deemed instrumental in understanding the connections, collaborations and general activities in the online space necessitated by the COVID-19 pandemic.

The Impact of COVID-19 on Teaching and Learning

The COVID-19 pandemic has affected almost all human activity and interrupted the educational sector with such a significant impact that radical shifts were warranted in all institutions that anticipated that change is required to survive and continue with its mandate. Given the World Health Organisation's (WHO) warning that the pandemic was highly contagious (WHO, 2020), the only possible solution left for institutions to continue their work was to move to a fully online learning or distance mode. Moving teaching and learning online was judged the surest way to avoid exacerbating the pandemic in the education sector, as this meant that social distancing protocols could be properly enforced. In light of these developments, it has been reported that, globally, more than 1.5 billion students of all ages – constituting nearly 90% of the global studentship population – have had their studies interrupted (UNESCO, 2020; UNICEF, 2020). Due to the closure of schools, the Commonwealth of Learning (COL) (2020) encouraged schools to do away with all forms of human interface and to deploy technology to ensure that teaching and learning were continued and sustained.

Due to the sudden nature and astronomical spread of the pandemic, which took everyone by surprise, both learners and teachers had to morph into digital migrants to be part of the teaching and learning engagements. Bozkurt et al. (2020) note that the sudden shift of teaching and learning to fully online learning has exerted a great deal of psychological pressure on teachers, students and other stakeholders. They reported that the overnight switch forced people out of their comfort zones [their established ways of teaching and learning], irrespective of their lack of familiarity with the new teaching and learning environment and its associated tools, and the lack of digital training in digital pedagogies, which have had ramifications for the new forms of teaching and learning under COVID-19. In this regard, Liyanagunawardena et al. (2013) have indicated that students, who are unfamiliar with or inexperienced in online learning, may feel demotivated and discouraged due to the precipitous learning curve brought about by the shift as well as by the overload of information and the amount of work they might be engulfed in. We believe that this also applies to teachers, who may be new to online teaching and learning environments and who may have been taken by surprise.

Though a large majority of educational institutions have managed to move online and continue with teaching and learning in the face of the COVID-19 pandemic, the rate of success in this transition may vary immensely among institutions and across boundaries. One of the foremost factors that have been noted as impinging on online teaching and learning engagements, is teachers' lack of online pedagogical knowledge. Bozkurt et al. (2020) assert that universities were impelled to move straight to online learning to replace face-to-face engagements. They further cite an instance where a University of Pretoria lecturer was directed to present her lectures to be recorded and streamed to students. This approach meant that all the facilities that could have been leveraged from digital technology were neglected and that the students would be the biggest losers, because the online teaching and learning environment thus created would simply be a replication of the face-to-face environment, without the conventional features and environments they had grown up in. To avert such a loss, Adam (2020) makes the assumption that, beyond digital and internet literacy, students require self-directed learning skills to be able to make the best of online learning. What we infer from Adam's assumption is that, with such skills, even where institutions or teachers have flaws in their engagements, students would be in a position to make the best out of the situation with the skills they possess.

Furthermore, teaching and learning online implies the use of certain digital tools, ranging from smartphones to laptops. Incidentally, Haßler et al. (2020) have highlighted the differences between high, middle and low-income countries in accessing such gadgets. They state that, while high-income populations can access online learning due to their ability to access digital devices, lower-income populations may rely only on television and radio. Borzekowski (2018) and Watson (2020) support

the claim concerning the latter group but note that the situation may even be more compelling than established by the authors so far. For instance, the World Bank (2018) reported that South Africa remains the world's most economically unequal country. In light of this, Hammond (2020) reports that 730 000 out of the one million higher education students have not yet received the laptops that the SA government committed to making available to students, in April 2020, to enable them to engage in online learning. Bozkurt et al. (2020) add that the majority of these students have Android phones, but they rely on the limited Wi-Fi services that are provided by their schools. These students were not able to afford the internet data needed to engage in online learning - once they had been sent home from school due to social distancing protocols. Mohammed (2020) documents how, in Ghana, some students do not have electricity or radios in their homes to be able to access even the most basic forms of distance learning in the COVID-19 era. In summing up, Rohs and Ganz (2015) draw a correlation between people's ability to utilise resources and opportunities provided through online learning and their socioeconomic status. As a result, the COVID-19 pandemic has further exposed the digital divide within countries and across boundaries – a divide that is a make-or-break factor in online teaching and learning.

As already illustrated, the pandemic has caused teaching and learning to pivot online, which has, in turn, restricted students and teachers' choices to the platforms that have been deployed for their engagements. Though teachers, especially, may be at liberty to use social media platforms in teaching, they still have to resort to their institutions' LMSs as their primary platforms [Sakai LMS]. What this means, according to Khalil et al. (2018), is that both the faculty and the students have to sign up for and accept certain user agreements for their data to be captured. Such agreements could be dangerous, as user data has become, what Kerres (2020) terms, the "new oil", with high marketing potential. Indeed, Prinsloo et al. (2019) argue that such data is sometimes sold to third parties. Based on such unethical practices, it is clear that not only has the COVID-19 pandemic exposed humans to health risks, but also to predators, whose activities inconvenience both teachers and students, preventing them from engaging in meaningful online teaching and learning during these trying times.

Video Conferencing as a Virtual Streaming Facility

A spike in the use of videoconferencing has been recorded this year, due to the imposed social distancing protocols motivated by the COVID-19 pandemic. According to Teräs et al. (2020), videoconferencing appeals to many people, due to its resemblance to conventional classroom delivery, wherein teachers and students may meet either synchronously or asynchronously. The authors, however, warn of the imminent dangers of replicating exact pedagogies of conventional classroom delivery in the online space. To avert such dangers, Koehler and Mishra (2009) note that redesigning curricula for technological knowledge, pedagogical and content knowledge and teacher professional development are imperatives for successful delivery in online spaces.

Coyle (2004, p. 6) indicates that "social constructivism provides a theoretical approach to learning in which students construct their own knowledge as a result of interaction with their environment and of mediating their understanding through meaningful cultural and social contexts contained within it". Essentially, when effective online pedagogical strategies are employed through videoconferencing, students can experience and analyse the socio-cultural interactions among themselves and with their teachers. These interactions, and subsequent online interactions, result in the construction of knowledge and also reflect transformational learning. Cranton and Taylor (2012) submit that social constructs have an impact on how we think and act.

Though Candarli and Yuksel (2012) hold the opinion that videoconferencing could increase student motivation, interaction, novelty and communication skills; however, they are sceptical that this will be generally achieved, based on the fact that students have different learning styles and adaptability to new technologies and some will remain uncomfortable adapting to it. Whether students adapt to changes or remain the same is based on their experience. Thus, their construction of knowledge could be impeded or expanded by old frames of reference (Mezirow, 1990) that students reflect on to act.

An interesting statistic from the work of Dogget (2008) shows that 80% of students were interested in the use of videoconferencing, while, within the same cohort of respondents, 80% indicated they still preferred the conventional classroom. What this means is that, in using videoconferencing, one needs to be intentional to sustain the interest of students. This can best be achieved when appropriate tools and technologies are leveraged to warrant constructivism in the online space. Besides, students should be provided with experiences that they can, at every point in time, reflect on in order to make appropriate decisions.

In a study by Candarli and Yuksel (2012), on Turkish students, 64%, 58% and 70%, respectively, agreed that videoconferencing gave them a worthwhile experience, that it should be used in future lectures and that they had enjoyed the interactions with speakers. These findings are akin to Mezirow's (1990) frames of reference as premises that students can rely on in making future decisions. Besides, the interaction that is created by the deployment of videoconferencing, the efficacy of this tool hinges on constructivism. According to Cronje and De Villiers (2005), constructivism entails the open nature of the environment set for students and also the collaborative nature of the platform for learning. Also, the use of videoconferencing connotes elements of the web-based theory, as Cronje and De Villiers opine that internet connections, web-authoring systems and World Wide Web (WWW) systems must be in place.

Furthermore, in a survey conducted by OWL Labs (2020), 96% of the respondents agreed that videoconferencing had effectively improved connectedness among remote teams; 50% lamented the delays in starting meetings, and it also emerged that respondents were twice more likely to use the Zoom videoconferencing tool than other available facilities. A presentation of TokBox's survey on the upsurge of web-based videoconferencing (WVC), by Hacker et al. (2020), also showed some interesting findings. The latter reported that upsurged in WVC usaged had led to virtual togetherness in peoples lives daily. However, by June 2018, there had been a universal adoption of videoconferencing by all age groups (88% for those between 18 and 34; 68% for the age group 35–54 years; and 35% for those above 55 years). Learners of all ages realised the ability of videoconferencing to offer them the freedom that conventional classrooms could not offer them over the years, so they jumped at the opportunity. This is reflected in the view of Tisdell (2012) that transformational learning is a tool for emancipatory education and not merely for individual transformation.

The power of videoconferencing in supporting learning cannot be overemphasised, especially as the world battles the effects of the COVID-19 pandemic. In this regard, MacLaughlin et al. (2004) shared that, through videoconferencing, the feedback obtained from students could be used to support the elaboration of subject content as well as for lesson development. Basiliko and Gupta (2015) further detailed that videoconferencing brings about collaboration by way of exchange of ideas among team members, despite the geographical distance separating them. Apart from the constructivist nature of video conferencing, Deejring (2014) touts its ability to bridge geographical distances as a key tenet of web-based theory. Also, a principal métier of videoconferencing remains students' ability to recall information learned previously and the availability of resources in the online space (Al-Samarraie, 2019; MacLaughlin et al., 2004). Finally, Jayaraman and Jothiswaran (2020) conducted a study on using video conferencing for teaching during the COVID-19 lockdown and they reported that the web-based platform, as a virtual streaming tool, supports students learning from home in critical times.

Contrary to the above, early apprehensions against distance learning included the geographical distance that would be created between students, their peers and their teachers. This assertion might not have changed much with the shift to online learning, but Al-Samarraie (2019, p.30) aptly notes the following:

The perspective of the constructivist approach to knowledge construction and learning, we believe, can be well supported with the use of video conferencing through a variety of collaborative learning tasks, interaction and reflection, and problem-solving conditions, which can offer the field of distance education alternative student-centred approaches to teaching and learning in hybrid courses.

Al-Samarraie further noted that videoconferencing can be leveraged for students' interpretation of learning problems when they are offered the opportunity to engage in different learning activities. Deejring (2014) established that web-based learning piggybacks on constructivism. This has been brought to light in the findings from Al-Samarraie's statement, as students work together in the online space, made possible by technology and the internet.

Lastly, it is worth noting that the shift to online learning, and thus the use of videoconferencing, calls for a significant number of shifts in pedagogical thinking. Consequently, the mode of assessment also needs to be altered. Likewise, Giesbers et al. (2013) call for the use of assessment tools that would increase students' sense of autonomy, competency and relatedness. Their viewpoint is that, ensuring these ideals will build resilience in students as they engage in online learning. Besides the use of alternative assessments, Lawson et al. (2010) assert that, through the use of different modes of communication, with different learning environments, the learning experiences of individuals can be altered significantly. Thus, the power of videoconferencing to offer students learning experiences that they might have been denied in conventional classroom settings, especially due to the COVID-19-inspired lockdowns and social distancing protocols, is illustrated.

METHODOLOGY

The context of the case study was a largely residential African contact university, the University of Ghana. This study was conducted during the COVID-19 pandemic, among a student population, to investigate their views of the virtual streaming facilities they were exposed to. The University of Ghana (UG) was established in 1948 and is the premier university in Ghana, with the largest student population in the country. UG has a student population made up of 51.3% males and 48.7% females. There are 82.9% undergraduate students, 13.7% graduate students and 0.5% visiting students. Ghanaians dominate the enrolment, as 98.83% of the student population are nationals, while the remaining 1.17% are international students. In total, UG has a student population of 53643 (UG, 2021). It is quite interesting to note that UG piloted the Sakai LMS for about two years, and finally rolled it out in 2014, but only the Department of Distance Education made full use of it, while the mainstream continued to rely heavily on the traditional forms of delivery (Amponsah et al., 2019). However, the lockdown, which was inspired by COVID-19 and the related social distancing protocols, despite its challenges, brought in its wake an advantage in the form of the adoption of educational technology for delivery and other engagements. Just as happened on a global scale, the management of UG was somewhat compelled to roll out training programmes (UG, 2020), which was aimed at equipping its faculty to engage students virtually, mainly through Zoom and Teams and supported by other social media tools available.

An exploratory mixed methods approach, which is captured within the pragmatic research philosophy, guided this study. Giddings and Grant (2007) postulate that the mixed methods approach emerged to breach the divide between the qualitative and quantitative research approaches. Johnson and Onwuegbuzie (2004, p.17), thus, define the approach as "the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study". Creswell (2012, p.5) also posits that the mixed methods approach's "central premise is that the use of qualitative and quantitative approaches in combination provides a better understanding of research problem than either approach alone". Though the use of this approach can be time-consuming, compared to using either of the single approaches, there is the benefit of complementary strengths when it is effectively used. Thus, in this case study we collected, analysed and combined the qualitative (QUAL) approach followed by the quantitative (QUAN) processes for the fieldwork (Creswell, 2012). Hence, we deemed the chosen design helpful in exploring students' lived experiences of the videoconferencing facilities during the COVID-19 pandemic and how the switch to online videoconferencing had changed their learning experiences.

The first phase of this study explored students' lived experiences of videoconferencing during the COVID-19 pandemic and how the switch to online videoconferencing had changed their learning from home experiences. A qualitative interpretivist research paradigm was selected to capture students' lived experiences of the videoconferencing that took place during the COVID-19 lockdown. The sample consisted of 10 undergraduate students and 12 postgraduate students, from different departments in the College of Humanities, which has the highest population of UG students. The researchers designed an open-ended online interview schedule for students to respond to. These interviews were done over time, with specific dates and times arranged with the students (identified interviewees) on Microsoft Teams and at a suitable place (online platform). According to Denzin (2012), the data triangulation process is conducted with students at an arranged place (on Microsoft Teams) and time to be interviewed. The interviews were aided by an audio recorder which helped to avoid loss of information during the interview process. The multiple data analysis process was compared and depicted data triangulation. This means that semi-structured interviews were recorded, transcribed and analysed, and compared to identify themes (Denzin, 2009; Nowell et al., 2017). The researchers used the posted comments on the videoconferencing facility as the qualitative research tool for the data collection process. The rationale for using videoconferencing as an online facility was to help explore students' views of how they used and expressed their views related to videoconferencing. The comments of students were downloaded, transcribed and analysed. The following steps of the thematic analysis process were used to identify specific extracts and themes (Creswell, 2012; Nowell et al., 2017), namely:

1. **Concepts:** Reading and re-reading each posting on the facility.
2. **Coding:** Identifying, underlining and coding each text of the postings.
3. **Listed patterns or categories:** Making a list of all repeated words in each posting.
4. **Identified themes:** Underlining all extracted words or ideas in each text.
5. **Revising themes:** Studying the themes again and revising the identified themes.

The second phase of this study was to investigate students' satisfaction and preference for the virtual streaming tools used during the COVID-19 lockdown quantitatively. The sample (n=89) completed the online close-ended questionnaire. This virtual streaming tool (VST), the online questionnaire, was computed and the reliability tested ($\alpha < 0.79$). Descriptive and inferential data (tables and figures) were presented. The videoconference, as a VST, was designed to be completed online by students to respond to items related to their satisfaction and preference for the streaming tools in this course. Though the academic staff and students at the university had always been expected to access the LMS for academic and some non-academic activities, only a fraction used the LMS. The COVID-19 lockdown, however, changed how this university conducts meetings.

Before conducting the research, ethical clearance was applied for and granted by the university ethics committee (Reference 2020/05/13/90178912/18/AM). The university policy stipulated that confidentiality and adherence to COVID-19 protocols be observed and adhered to before, during and after the COVID-19 lockdown.

The scientific acid test of trustworthiness and reliability were applied to both data sets for data triangulation purposes. After the data analysis process, trustworthiness was established, confirming that the themes that emerged were credible and valid. (Nowell et al. 2017). For the quantitative data, the statistical data, computed and presented descriptively, was reliable ($\alpha < 0.79$). As proposed by Creswell (2012) and Nowell et al. (2017), the researchers followed scientific protocols in cross-member checking of both data sets for data trustworthiness.

RESULTS

Qualitative Results

Based on the analysis of the results, several themes were identified based on specific extracts from the students' views.

The Videoconferencing Facility Supports and Enhances Student Learning During the COVID-19 Pandemic

During the videoconferencing sessions, many students supported this type of online facilitation. In their view, the facility supported them in completing their studies successfully. According to them, videoconferencing is an effective online platform that supports group discussions and the sharing of ideas and is an engaging tool for optimal learning. One very interesting comment posted by a student showed that the use of videoconferencing decreased or avoided delays in setting up meetings. Furthermore, it also minimised the risk of infection by the COVID-19 virus, because of social distancing. This student wrote*:*

The video conferencing facility has helped me in completing the semester successfully through online studies. It also gave me the opportunity to have group study discussions with my colleagues [peers], which has been very helpful.

These sentiments were echoed by another student, who opined that videoconferencing is a supportive facility that assisted students to achieve their learning goals during the COVID-19 lockdown. A similar point of agreement is made by another student, who stated that it "helped to complete the semester's work without having to postpone or defer till later, thereby avoiding delays in academic pursuits" and another student wrote that "it minimised the risk of infection of the virus by not meeting in-person for lectures".

Exposure and Switch to Videoconferencing as a Virtual Streaming Teaching and Learning Tool From Home

From the many comments by students, the exposure and the switch to videoconferencing, as an online teaching and learning tool, was an enormous learning experience. Students felt that they were being exposed to videoconferencing as a new type of learning experience and that it was an excellent online teaching and learning tool that assisted them in meeting their learning objectives in the course. This student's comment is on meeting the course outcomes: "Although it was difficult trying to understand the whole concept, I was able to cope and meet my academic requirements. It was a challenging experience, specifically, network and communication problems." The exposure to videoconferencing, as an online virtual space, enhanced the students' online skills. Students' comments on this include the following:

[It] was a nice experience, having been given the exposure to using the classroom virtually. It was something I kind of thought was impossible for Ghanaians.
It has been a very useful tool during this period. It allowed our instructors and colleagues [peers] to have a feel of studying together in one place. We are able to share our presentation slides and other documents, for others to also view, just like being in the classroom.

Highest Point or Most Joyous Moment in Using the Videoconferencing Facility

Participants were asked what their highest point or most joyous moment had been in using the videoconferencing facility. Most commonly, students wrote that it was the ability to share ideas remotely. Students echoed each other's sentiments that, during the lockdown, they sometimes felt

lonely and needed to feel that they belonged and are part of a community because they were used to contact sessions. Videoconferencing made it possible, as it virtually linked them to "[the] moments of being able to see your colleagues [peers] and share ideas, though remotely, and also being able to have successful presentations through the videoconferencing platform". Many wrote that they experienced successful virtual presentations, lively discussions, and several interactive engagements using the virtual facility. They expressed how they appreciated being able to interact with others, for example, with "tutors, myself and fellow course mates in discussions during lectures" and their satisfaction with their ability to navigate the platform and learn new skills, for instance, the ability to manage and manoeuvre the interface of the platform, make presentations and share my screen with participants at greater success (sic)".

Preference for Other Videoconferencing Facilities That Were Used by the Lecturers

Students preferred several other related videoconferencing tools such as Zoom, Microsoft Teams, the Free Conference Call app, Skype, Cisco Webex, Google Meet and WhatsApp. The students gave reasons for their preferences, such that they found it to be "excellent", "supportive", "engaging" and "effective tools for online learning". The following sentiments were echoed:

I preferred the Microsoft Teams and Free Conference app, because I used it for my studies.
There is also Skype for teaching and learning.
I was exposed to use Microsoft Teams and Webex. These are excellent platforms for learning.

Among other reasons given by students for preferring these platforms, were that "Zoom has been effective, all things being equal", as well as "with Teams, you can easily focus your attention on work-related topics and prioritise your time well". Students also viewed other videoconferencing products, such as Google Meet and WhatsApp, as "cheap and easy to navigate when the internet connection is good". Others felt that "the Zoom app was a perfect platform for learning via video". A further comment made by a student was that "it was able to offer all the necessary platforms required to get me through my studies successfully".

Online Skills Learned and How the Use of the Videoconferencing Tool Impacted the Learning Journey Under the COVID-19 Lockdown

Students alluded to the fact that they had learned specific online learning skills during the COVID-19 lockdown. They posted positive comments and indicated that they had mostly benefitted from the online facility in advancing their self-directed learning skills. They felt empowered by using the videoconferencing skills learnt. Specific online digital literacy skills emerged from their use of the videoconferencing facilities, such as creating or scheduling Zoom meetings, time management, presentation skills and facilitation. In this regard, one student comments:

Prominent among the skills learnt include how to create a Zoom meeting and add or invite participants. Engaging in a chat with friends, in the midst of a meeting, raise your [virtual] hand in the process of the meeting. Mute and unmute yourself in a meeting and, above all, how to share your document during a presentation. All these online skills have now made me a better and more confident person when it comes to using the Zoom video conferencing facility for my studies. Aside from that, I have become more diligent and time conscious on Zoom in order to avoid the misuse of my data bundle.

According to participants, effective communication is at the heart of successful online videoconferencing and vital for online learning. One student wrote: "Communication skills, it has enhanced my knowledge and sharpened my communicative skills as well." Another posted this comment: "I have been able to conduct live video presentations and easily screen-share during

meetings. This has given me a broader outlook and experience of having presentations (sic)." In experiencing online videoconferencing, planning, hosting and recording are important issues to be mindful of for successful learning. In this regard, the following comments were captured: "Learning how to log onto a videoconferencing platform. I deem it a skill for life (digital literacy skill). Hosting, coordinating and facilitating an online discussion and learning." Ultimately, several students concluded that videoconferencing offered them, as summed up in the following comment:

The opportunity to host and facilitate online meetings and discussions. This will enable me to engage my colleagues for further discussions and assignments. It has also exposed me to other videoconferencing facilities, which would help me adapt to convenient ones when the one I'm planning to use fails.

Key Challenges in Using the Videoconferencing Facility

Videoconferencing facility is an excellent tool, but several comments were made about the challenges experienced by students. The key challenges experienced by students ranged from poor connectivity, low sound quality of the video recordings to many other disruptions on the platform. Some highlighted challenges such as a "[poor] and unstable network", while others echoed frustrations over the "lack of airtime … so I couldn't join classes, as well as poor network". Moreover, it was also commented that "for large classes, there were a lot of distractions, such as noise and network jam". Two major challenges that most students lamented about were high data usage and several disruptions on the platform, which were barriers to successful learning. They expressed the following sentiments:

It consumes a lot of data and the duration for meetings, when not done on a paid platform, is very limited and disrupts the flow of ideas. Unfortunately, poor internet access adversely affects the class, because you can hardly hear what others may be saying.

Suggestions to Mitigate the Challenges Experienced When Using the Videoconferencing Facility

Students made several suggestions to mitigate the challenges experienced when using the videoconferencing facility. They were also positive and made practical suggestions to improve it as an online teaching and learning tool. Among the practical suggestions made were making enough data available by subsidising underprivileged students with data bundles. The sentiment was that the "university must provide enough data for students" and subsidise the charges associated with students assessing videoconferencing facilities". Furthermore, it was proposed that several revisions be made to the ICT policies for academic purposes. It was suggested that timeous and well-planned upgrades be made to the videoconferencing software and to the institutional online LMSs, to promote efficient connections. One student wrote:

I suggest there should be policy directives that will ensure the reduction of data charges on videoconferencing platforms that will be used for academic purposes. Also, there should be work done to ensure internet stability in all areas. Some lecturers were not abreast with some of the apps. Hence, operating it and using certain buttons such as muting the students was quite difficult. Therefore, I suggest seminars and conferences should be organised to enlighten lecturers on the apps.

The issue of access to an effective, reliable and stable LMS network is a major priority, as expresses by this student: "Getting access to reliable internet connectivity as well as making use of institutional paid platforms to help course representatives to schedule meetings to assist instructors." Some felt that lecturers should plan and give students sufficient time to prepare for active online engagement in videoconferencing, reiterating that students "should be given enough time notice, so that they can prepare … lecturers should be responsible for their network and management should make provision for Wi-Fi devices". Students proposed that university management should support

them with learning tools such as subsidised laptops and data bundles. One student wrote, "Also, the provision of electronic devices like tablets can make it easier for the less privileged students to join the online class." Finally, it was highlighted by a student that the "video lectures should be recorded so students, who had problems with their networks, or those who were not able to join the class, can download the recorded lecture and watch".

QUANTITATIVE RESULTS

As indicated, the VST was used to map student views regarding their satisfaction with and preferences for various platforms, in particular Zoom and Teams, in an online environment.

To determine the effect of the virtual streaming tools (VSTs) on students' gender, satisfaction, preferences and benefits in the course during the COVID-19 lockdown.

Table 1 summarises the statistics on male and female students' views on virtual streaming tools. The data shows that 11 of the virtual streaming tools were statistically significant, with p-values ranging from 0.976 to 0.744 and the t-test for the 11 items that ranged from $p < 0.000$ to $p < 0.002$. It is observed that students were satisfied with the virtual streaming tools, which were statistically significant. There were significant positive views from the two groups related to the virtual streaming platforms. As shown in Table 2, both groups reported significant satisfaction with the virtual streaming facilities for the course.

Consequently, the following null hypothesis is formulated to compute the significance levels: *There are no statistically significant differences in students' satisfaction and preferences in the virtual streaming tools (VSTs) used by students in this course during the COVID-19 lockdown*. Directive hypotheses were formulated to measure the effect of satisfaction and preferences for virtual streaming tools:

H1: Zoom, as a VST, positively influences students' satisfaction in the course.
H2: Zoom, as a VST, positively influences students' preference in the course.
H3: Teams, as a VST, positively influences students' satisfaction in the course.
H4: Teams, as a VST, positively influences students' preference in the course.

The results in Table 2 show that there is a positive relationship between the Zoom and satisfaction (0.763***), the Zoom and preference (0.704***), Teams and satisfaction (0.716***); and Teams and preference (0.761***). The directional hypotheses are accepted, which reflects statistically significant positive results. This concludes that students perceived satisfaction with and preferences for virtual streaming tools used in the course during the COVID-19 lockdown positively.

As shown in Figure 1, Microsoft Teams (47%) was the most preferred virtual streaming platform during the COVID-19 lockdown as compared to the other streaming tools. From the data in Figure 1, it is apparent that Teams (47%) was preferred to Zoom (34%).

What are your views relating to the benefits of Zoom and Teams as a virtual streaming platform during the COVID-19 lockdown?

The information in Table 3 reveals that students could identify several educational benefits that emerged from the virtual streaming tools (Zoom and Teams). These benefits were the quality of the virtual streaming videos, more students were accommodated on the platforms, thereby creating a live augmented reality to stream, chat, calling, collaborating and enhancing self-paced learning during the COVID-19 lockdown.

Table 1. Students' views on using videoconferencing as a virtual streaming facility (N=89)

Students' views on using video conferencing as a virtual streaming facility	Male (n=37) Descriptive analysis		Female (n = 52) Descriptive analysis		Statistical significance	
	M	SD	M	SD	t-test	Sign.
It is an effective virtual streaming facility that helped me to connect and communicate with fellow students during the COVID-19 lockdown.	3.89	1.455	3.76	1.805	0.001**	0.912*
It is a facility that supports productivity among lecturers and students to meet either synchronously or asynchronously during the COVID-19 lockdown.	2.86	1.828	2.65	1.720	0.140	0.853*
It enhanced online interactions that resulted in the construction of knowledge and reflects transformational learning during the COVID-19 lockdown.	3.06	1.083	3.31	1.031	0.000**	0.696
It increased student motivation, interaction and communication skills during the COVID-19 lockdown.	3.81	1.406	3.83	1.506	0.001**	0.862*
It gave students a worthwhile virtual learning experience with our lecturers during the COVID-19 lockdown.	2.89	1.836	3.07	1.344	0.310	0.613
It had effectively improved connectedness among remote teams, lecturers and students during the COVID-19 lockdown.	3.61	1.367	3.71	1.311	0.002**	0.797*
It brought about collaboration by way of exchange of ideas among lecturers and students, despite the geographical distance during the COVID-19 lockdown.	3.37	1.301	3.00	1.001	0.001**	0.619
It is an effective virtual facility that supported and enhanced student learning during the COVID-19 pandemic.	3.29	1.355	3.88	1.105	0.000**	0.803*
It is an effective online platform that supported us as a group in meaningful discussions, sharing of ideas and engaging us in optimal learning during the COVID-19 lockdown.	3.26	1.242	3.676	1.898	0.000**	0.744*
It is an excellent online teaching and learning tool that assisted me in meeting my learning objectives during the COVID-19 lockdown.	3.39	1.400	3.51	1.671	0.000**	0.889*
It is an effective facility that created successful virtual presentations, lively discussions and enhanced interactive engagements during the COVID-19 lockdown.	3.11	1.388	3.58	1.598	0.000**	0.843*
It saved time and made out-class-time much more convenient during the COVID-19 lockdown.	3.89	1.914	3.72	1.994	0.000**	0.976*
It enabled students to catch up with recorded lecture sessions for revision or later review, or "catch-up" during the COVID-19 lockdown.	3.49	1.303	3.11	1.103	0.001**	0.832*

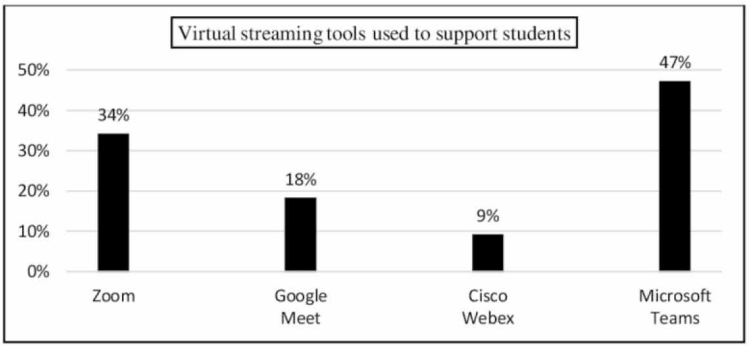
*p < 0.05; ** p < 0.001 Sign at 95% confidence level (2-tailed)

Table 2. Effect size of satisfaction and preferences of virtual streaming tools

Independent variables	< Or >	Dependent variables	Regression estimates	Total effects	Direct effect	Indirect effect
H1: Zoom, as a VST, positively influences students' satisfaction in the course	→	Satisfaction of virtual streaming tool	**0.763*****	0.863	0.763	0.100
H2: Zoom, as a VST, positively influences students' preference in the course.	→	Preference of virtual streaming tool	**0.704*****	0.784	0.704	0.080
H3: Teams, as a VST, positively influences students' satisfaction in the course	→	Satisfaction of Teams as virtual streaming	**0.716*****	0.966	0.716	0.201
H4: Teams, as a VST, positively influences students' preference in the course	→	Preference of Teams as virtual streaming	**0.761*****	0.891	0.661	0.077

*** $p < 0.001$ statistically significant at a 95% confidence level

Figure 1. Preferred virtual streaming tools to support students



DISCUSSION OF FINDINGS

In the research for this case study, we sought to focus on four research objectives regarding students' views on videoconferencing as a virtual streaming tool under the COVID-19 lockdown. Inherent in their responses were their lived experiences in terms of how videoconferencing, in particular Teams and Zoom as teaching and learning tools, facilitated their shift to online learning, their joyous moments, the challenges they had experienced, suggestions to sidestep their challenges and critical online skills they had garnered.

Firstly, we reported on how the students use and express their views relating to the videoconferencing facility. The students were elated that the videoconferencing tools had aided the successful completion of their course work, based on the directive of COL (2020) that all forms of human engagements should be replaced with technology amidst the COVID-19 pandemic. To this end, a participant shared, "The Teams videoconferencing facility has helped me in completing the semester successfully." This experience supports the assertion that both the Teams and Zoom videoconferencing tools appeal to many by virtue of their ability to replicate conventional classroom engagements (Morgan, 2019; Teras et al., 2020; Gray et al. 2020). It also came to light that the deployment of the videoconferencing facility has curtailed the spread of infections during the COVID-19 pandemic, which expresses the very essence of Drinkwater et al.'s (2004) web-collaborative learning theory for

Table 3. Educational benefits of virtual streaming tools

Educational benefits	Extracts of students' views of the benefits of virtual streaming tools	
	Zoom	**Microsoft Teams**
Virtual streaming quality	Students indicated that Zoom automatically lowers picture resolution and increases the quality of picture streaming. Thapelo echoed this sentiment: "*Zoom is more appealing to me. I enjoyed the clearer and sharper pictures displayed during streaming video quality.*"	Some students responded that Teams virtual streaming is lower than Zoom, which impacts the quality of pictures. Deborah posted this comment: *"As compared to Zoom, the streaming quality of videos is less clear. Maybe it is the resolution that influences the quality of how it was developed."*
Accommodating participants on the platform (limitations)	Students viewed the Zoom platform, which accommodates up to 300 participants at a time as welcoming. Most students indicated the purpose of using Zoom as a platform. Sally posted her comment: *"I was surprised how many of us have participated in this platform. At one session, we were more than 239 students. If it was not under lockdown, we were supposed to be sitting in separate classes, at different times, for our sessions."*	Students viewed Teams as a limited streaming tool that accommodates fewer participants. Trevor wrote the following comment: *"Yeah, this platform was not geared up to accommodate 300 plus students to actively participate. I noticed some students were excluded because one of my classmates phoned during the session, which (sic) he could not participate in our discussions. But, I think, 90% of the class was accommodated to participate (sic) in the online discussions."*
Live streaming for chatting, calling, and collaborating (augmented reality)	Zoom is a tool for live streaming, chatting and collaboration. Deborah opines: "*Zoom, as a virtual streaming option, is better quality (sic) for chatting, calling as compared to other multimedia. One advantage is to use the chat side (sic) to ask or to post questions during the sessions."*	Teams provide live streaming, creates augmented reality, and makes chatting more enjoyable. Thapelo remarks: "*On Teams, I like to use the chat space to write questions or post comments. I often made calls to my lecturers or students. Teams is the best live streaming reality experience."*
Enhancing self-paced learning	Students posted comments that the recorded videos can be watched later and they could pace their learning. Sarah wrote that she watched the recorded version of the video later to catch up or do revisions: "*I used this platform for the past year, so I preferred it. It helps me to pace my learning after our sessions. Most times, I access the recordings and do my revision."*	Students wrote that they could view the recordings on Teams at any time and at their own pace, and they could regulate their learning. Beryl posted this comment: "*I preferred this streaming tool. Teams recording supports my self-paced learning and helped me to catch up on lost sessions."*

successful online engagements. It is a known fact that the best way to stop the effects of the pandemic from being exacerbated is through the observation of strict social/physical distancing protocols. Hence, it is not at all surprising that videoconferencing has gained so much prominence in these unusual and challenging times. Hacker et al. (2020) points to how there was a universal adoption of the use of web-video conferencing between 2012 and 2018. Jayaraman and Jothiswaran (2020) conducted a study using the videoconferencing web-based platform as a virtual streaming tool that supports students learning from home in critical times (such as during the COVID-19 pandemic). Moreover, Oeppen et al. (2020) concur and add that, when normalcy is restored, post-COVID-19, many will continue with videoconferencing because of its convenience in planning meetings, flexibility in time management and cost savings in respect of travelling to the workplace. Participants indicated that, through the virtual connection, videoconferencing had helped them to address their loneliness. In this light, one participant reflected that videoconferencing "allowed our instructors and colleagues to have a feel of (sic) studying together in one place". Another important item that participants highlighted as a positive development, was the opportunity given them to do virtual presentations and, for the

first time, not only see others presenting, but also to be able to see themselves, while they presented. On this matter, a student expressed joyfully, "seeing my tutors, myself and fellow course mates in discussions …" as gratifying. In all this, it stands to reason that, through the transition, students have been able to transform their experiences and expectations of learning and teaching, from the conventional classrooms to the benefits that could be gained from a web-based facility (Basiliko & Gupta, 2015; Drinkwater et al., 2004; Gray, et al. 2020; Tisdell, 2012). Besides this, there is the advantage of the satisfaction that students can experience in seeing how they are co-constructing knowledge among themselves and, with their instructors. This outcome reflects a key element of the sociocultural theory of cognitive development (Vygotsky, 1980).

The second question, on the challenges experienced by students in using videoconferencing during the lockdown, elicited some profound responses from the participants, but they also made suggestions to mitigate the challenges. Participants first touched on their initial difficulties, network and communication problems, poor sound quality of videos, data depletion and disruption on the platform. Such difficulties, identified by the students, are not the preserve of the Ghanaian higher education students referred to earlier, because Haßler et al. (2020) have already highlighted that there are differences in accessing technological gadgets among different classes of people. In corroborating this, Hammond (2020) shares the view that there is a deficit in the distribution of or access to technological gadgets among higher education students. Other students lamented the lack of data to sustain their engagements on the videoconferencing platforms. On this challenge, a student bemoaned the hurdles that had to be confronted thus, "lack of airtime sometimes, so I couldn't join classes, as well as poor network". This challenge is also identified among the challenges documented by the OWL Lab (2020), wherein 50% of respondents in their survey expressed similar issues. Under the weight of such difficulties, the kind of open environments (constructivism) made possible by web-based technologies (Deejring, 2014; Cronje & Villiers, 2005; Drinkwater et al., 2004) is denied. The difficulties the students face may even be more compelling, with remarks such as, "[some] lecturers were not abreast with some of the apps". Such a situation might have resulted from the abrupt shift to online learning, without adequate time to plan and prepare, due to the sudden outbreak of the COVID-19 pandemic.

Some students expressed negative sentiments about the videoconferencing experience; however, Cochrane (1996) maintains that it cannot be assumed that connecting groups or individuals to a web-based virtual streaming facility will create an effective learning space. Therefore, though the difficulties outlined by the participants in this study might have affected their online engagements, it should be noted that Mezirow (1990) asserts that our experiences are frames of reference from which we reflect and act. Thus, it is appropriate that the participants were quick to suggest solutions to the difficulties they faced. First of all, they called for data availability by proposing that underprivileged students' data should be subsidised. This finds its roots in a report by Tlou (2020) that private university students were unable to join online learning communities due to a lack of data. Notably, the arrangements to zero-rate engagements on the universities' LMSs (University of Ghana, 2020) did not cover videoconferencing facilities, so students had to bear that cost. It is in response to this that a student stated that institutions should, "subsidise the charges associated with students accessing videoconferencing facilities". The students also suggested that ICT policies be put in place for academic purposes; that the institutional online management system should be upgraded to ensure effective connections; and that forward planning is undertaken and sufficient time is allowed to prepare for online active engagements. On the latter issue, Teras et al. (2020) cautioned against replicating exactly what is done in conventional classrooms, online, and noted teachers' unfamiliarity with online pedagogies as a key drawback to the deployment of videoconferencing. It is in this light that one participant suggested that "seminars and conferences should be organised to enlighten lecturers on the apps". It needs to be emphasised that without the requisite training, especially for instructors, it would be practically impossible for them to create the kind of environment to develop students' cognition and also a collaborative web-based

experience (Jayaraman & Jothiswaran, 2020; Drinkwater et al., 2004; Vygotsky, 1980) to optimise students' online learning experiences.

Furthermore, students were questioned on how they had experienced the switch to videoconferencing, as an online teaching and learning tool. Varying and interesting responses were recorded. Typical in their reaction to online teaching and learning tools, the students stated that videoconferencing supported cooperative engagements and optimised their learning. The issue of constructivism is strongly evident here (Basiliko & Gupta, 2015; Jayaraman & Jothiswaran, 2020), as these students worked together in a virtual space. It is in this light that a participant reflected that the videoconferencing tool "enables me to engage my colleagues [peers] for further discussions and assignments". The experience of being able to do new things after switching to videoconferencing also featured strongly in the responses by the students. They could not hide their joy as they indicated that they had been able to create or reschedule Zoom meetings, manage their time well in order not to miss a virtual meeting, and had acquired presentation and facilitation skills. On this note, it is apparent that the students have engaged in a constructivist journey to be able to learn new skills while using videoconferencing to facilitate their studies, which is in line with constructs contained in the sociocultural theory of cognitive development (Deejring, 2014; Vygotsky, 1980). Also, the participants have been able to use these skills on their own, to reflect how they have transformed through their engagements online (Mezirow, 1990; Tisdell, 2012). Summing up the skills that participants have garnered by the use of the videoconferencing tool, a participant aptly stated, "I deem it a skill for life (digital literacy skill)". Similarly, research reported that digital literacy skills (digital competence) of teachers and students is paramount for the success of planning, designing and implementing online teaching and learning space (Candarli & Yuksel, 2012; Drinkwater et al., 2004; Janssen, et al., 2013; Langford & Damsa, 2020). Given that participants could not have otherwise continued with their academic work and the fact that they have acquired many different skills, their experience as students can best be described as having been empowering through a collaboration of an online community made up of themselves and instructors (Drinkwater et al., 2004; Vygotsky, 1980). This is evidenced in the variety of skills they mentioned, such as communication, presentation, digital, coordinating, facilitating and planning skills. In one typical instance, a participant shared, "communication skills … It has enhanced my knowledge and sharpened my communicative skills as well". This view is supported by Trisdell's (2012) assertion that transformational learning is a tool for emancipatory education. Also, Adam's (2020) assumption that students need self-directed skills to be able to make the best out of online learning has come into play. These students have benefitted with skills other than just being students in the online space. The switch to videoconferencing could not have happened without hitches, but, based on the benefits thereof, students' views could be summed up in one participant's note, "it has been a new type of learning all together". This resonates with the assertion by Candarli and Yuksel (2012) that videoconferencing could increase students' interaction, motivation, novelty and communication skills.

Finally, the results reported that the effect size of the virtual streaming tools (VSTs) on students' satisfaction and preferences in the course during the COVID-19 lockdown was statistically significant (ranging from 0.976 to 0.744). The null hypotheses were accepted for Zoom (satisfaction = 0.763; preference = 0.704) and Teams (satisfaction = 0.716; preference = 0.761) as virtual streaming platforms positively.

CONCLUSION

This paper was framed in the web-based collaborative learning theory and the sociocultural theory of cognitive development by Drinkwater et al. (2004) and Vygotsky (1980), respectively. The paper has argued that videoconferencing is a web-based virtual facility using an online internet connection to stream a conference between the lecturer and students, as well as transmitting audio and visual presentations, to support student learning during the COVID-19 lockdown. This study has found that

students preferred both Teams and Zoom as virtual streaming facilities during COVID-19 lockdown. Students were satisfied that virtual streaming platforms, as teaching and learning supportive tools, facilitated their shift to online learning. These facilities supported students in learning from home, at a critical time, namely the pandemic. Furthermore, this facility aided the successful completion of the students' course work. It also enhanced the online digital skills of students and impacted the student learning journey. On the one hand, the evidence from this study suggests that videoconferencing is an effective online platform that supports group discussions, sharing of ideas, and is an engaging tool for optimal learning. On the other hand, students raised several concerns about their use of the facility during the lockdown. The concerns raised are valid and are supported by Cochrane's assertion that one cannot assume that connecting students to a virtual streaming facility will create an effective learning space. The present study confirms previous findings and contributes additional evidence that suggests students must be empowered with digital literacy and self-directed learning skills as imperatives for successful online learning. Moreover, lecturers must be empowered with technological and pedagogical content knowledge competencies to plan, design and effectively support students using video conferencing and other multimodal tools for optimal learning. The current study sampled only a small cohort of four departments at an African university. Further research is needed to determine students and lecturers' digital literacy competencies using videoconferencing for successful online learning post the COVID-19 pandemic.

REFERENCES

Adam, T. (2020, April 22). The privilege of pivot online: A South African perspective. *Open Development & Education.*

Al-Samarraie, H. (2019). A scoping review of videoconferencing systems in higher education: Learning paradigms, opportunities, and challenges. *International Review of Research in Open and Distributed Learning*, *20*(3). Advance online publication. doi:10.19173/irrodl.v20i4.4037

Amponsah, S., Badu-Nyarko, S. K., Obodai, G. A., & Anane, P. (2019). Learning Environment for Supporting Undergraduate Online Distance Education Students. In Student Support Toward Self-Directed Learning in Open and Distributed Environments (pp. 78-102). IGI Global. doi:10.4018/978-1-5225-9316-4.ch004

Basiliko, N., & Gupta, V. (2015). Bringing guest scientists to the university biology classroom via the Web. *FEMS Microbiology Letters*, *362*(16), 1–3. doi:10.1093/femsle/fnv124 PMID:26223586

Borzekowski, D. L. G. (2018). A quasi-experiment examining the impact of educational cartoons on Tanzanian children. *Journal of Applied Developmental Psychology*, *54*, 53–59. doi:10.1016/j.appdev.2017.11.007

Bozkurt, A., Jung, I., Xiao, J., Vladimirschi, V., Schuwer, R., Egorov, G., & Paskevicius, M. (2020). A global outlook to the interruption of education due to COVID-19 pandemic: Navigating in a time of uncertainty and crisis. *Asian Journal of Distance Education*, *15*(1), 1–126.

Candarli, D., & Yuksel, H. G. (2012). Students' perceptions of video conferencing in the classrooms in higher education. *Procedia: Social and Behavioral Sciences*, *47*, 357–361. doi:10.1016/j.sbspro.2012.06.663

Cochrane, C. (1996). The use of videoconferencing to support learning: An overview of issues relevant to the library and information profession. *Education for Information, 14*(4), 317–330.

Commonwealth of Learning (2020). *Guidelines on distance education during COVID-19*. Burnaby, British Columbia, Canada: Commonwealth of Learning.

Coyle, D. (2004). Redefining classroom boundaries: Learning to teach using new technologies. *Canadian Journal of Educational Administration and Policy*, *32*(July), 1–24.

Cranton, P., & Taylor, E. W. (2012). Transformative learning theory: Seeking a more unified theory. In E. W. Taylor & P. Cranton (Eds.), *The handbook of transformative learning* (pp. 3–20). John Wiley & Sons.

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Pearson.

Cronje, J. C., & De Villiers, M. R. (2005). Six learning theory perspectives on a Web-based learning environment. *South African Journal of Higher Education*, *19*(3), 35–57.

Deejring, K. (2014). The design of web-based learning model using collaborative learning techniques and a scaffolding system to enhance learners' competency in higher education. *Procedia: Social and Behavioral Sciences*, *116*, 436–441. doi:10.1016/j.sbspro.2014.01.236

Denzin, N. K. (2009). *The research act: A theoretical introduction to sociological methods* (3rd ed.). Prentice Hall.

Denzin, N. K. (2012). Triangulation 2.0. *Journal of Mixed Methods Research*, *6*(2), 80–88. doi:10.1177/1558689812437186

Doggett, A. M. (2008). The Videoconferencing Classroom: What Do Students Think? *Journal of Industrial Teacher Education*, *44*(4), 29–41.

Drinkwater, P.M., Adeline, C. M, French, S., Papamichail, S.K., & Rickards, T, (2004). Adopting a web-based collaborative tool to support the Manchester method approach to learning. *The Electronic Journal of e-Learning, 2*(1), 62-69.

Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences*. Basic.

Giddings, L. S., & Grant, B. M. (2007). A Trojan horse for positivism?: A critique of mixed methods research. *Advances in Nursing Science*, *30*(1), 52–60. doi:10.1097/00012272-200701000-00006 PMID:17299284

Giesbers, B., Rienties, B., Tempelaar, D., & Gijselaers, W. (2013). Investigating the relations between motivation, tool use, participation, and performance in an e-learning course using Web videoconferencing. *Computers in Human Behavior*, *29*(1), 285–292. doi:10.1016/j.chb.2012.09.005

Gray, L. M., Wong-Wylie, G., Rempel, G. R., & Cook, K. (2020). Expanding qualitative research interviewing strategies: Zoom video communications. *Qualitative Report*, *25*(5), 1292–1301.

Hacker, J., vom Brocke, J., Handali, J., Otto, M., & Schneider, J. (2020). Virtually in this together – how web-conferencing systems enabled a new virtual togetherness during the COVID-19 crisis. *European Journal of Information Systems*, *29*(5), 563–584. doi:10.1080/0960085X.2020.1814680

Hammond, A. (2020). *Laptops for all NSFAS students.* Skills Portal.

Haßler, B., Khalayleh, A., McBurnie, C., Adam, T., & Allier-Gagneur, Z. (2020, May 11). Who has what? Assessing who has access to what devices in the education response to the COVID-19 pandemic. *Open Development & Education.*

Janssen, J., Stoyanov, S., Ferrari, A., Punie, Y., Pannekeet, K., & Sloep, P. (2013). Experts' views on digital competence: Commonalities and differences. *Computers & Education*, *68*, 473–481. doi:10.1016/j.compedu.2013.06.008

Jayaraman, R., & Jothiswaran, V. V. (2020). Web-based platforms for virtual learning. *Biotica Research Today*, *2*(5), 184–186.

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, *33*(7), 14–26. doi:10.3102/0013189X033007014

Kerres, M. (2020). Against all odds: Education in Germany coping with Covid-19. *Post digital*. *Science and Education*, 1–5.

Khalil, M., Prinsloo, P., & Slade, S. (2018). User consent in MOOCs – Micro, Meso, and Macro Perspectives. *International Review of Research in Open and Distributed Learning*, *19*(5). Advance online publication. doi:10.19173/irrodl.v19i5.3908

Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)? *Contemporary Issues in Technology & Teacher Education*, *9*(1), 60–70.

OWL Labs. (2020). *19 key videoconferencing statistics for 2020.* Author.

Langford, M., & Damsa, C. (2020). *Online teaching in the time of COVID-19: Academics' experiences in Norway. Centre for Experiential Legal Learning (CELL)*. University of Oslo.

Laurillard, D. (1993). *Rethinking university teaching: A framework for the effective use of educational technology*. Routledge.

Lawson, T., Comber, C., Gage, J., & Cullum-Hanshaw, A. (2010). Images of the future for education? Videoconferencing: A literature review. *Technology, Pedagogy and Education*, *19*(3), 295–314. doi:10.1080/1475939X.2010.513761

Liyanagunawardena, T., Williams, S., & Adams, A. (2013). The Impact and reach of MOOCs: A developing countries' perspective. *E-Learning Papers, 33*.

MacLaughlin, E. J., Supernaw, R. B., & Howard, K. A. (2004). Impact of distance learning using videoconferencing technology on student performance. *American Journal of Pharmaceutical Education*, *68*(3), 1–6. doi:10.5688/aj680358

Mezirow, J. (1990). How critical reflection triggers transformative learning. In J. Mezirow (Ed.), *Fostering critical reflection in adulthood* (pp. 1–20). Jossey-Bass.

Mohammed, W. F. (2020). *What COVID-19 reveals about educational inequality in Ghana*. Academic Press.

Morgan, H. (2019). Connecting with educators from abroad via zoom: A powerful teaching method. *Multicultural Education*, *26*(2), 36–39.

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis: Striving to meet the trustworthiness criteria. *International Journal of Qualitative Methods*, *16*(1). Advance online publication. doi:10.1177/1609406917733847

Oeppen, R. S., Shaw, G., & Brennan, P. A. (2020). Human factors recognition at virtual meetings and videoconferencing: How to get the best performance from yourself and others. *British Journal of Oral & Maxillofacial Surgery*, *58*(6), 643–648. doi:10.1016/j.bjoms.2020.04.046 PMID:32417017

Prinsloo, P., Slade, S., & Khalil, M. (2019). Student data privacy in MOOCs: A sentiment analysis. *Distance Education*, *40*(3), 1–19. doi:10.1080/01587919.2019.1632171

Rohs, M., & Ganz, M. (2015). MOOCs and the claim of education for all: A disillusion by empirical data. *International Review of Research in Open and Distance Learning*, *16*(6). Advance online publication. doi:10.19173/irrodl.v16i6.2033

Teräs, M., Teräs, H., Arinto, P., Brunton, J., Daryono, D., & Subramaniam, T. (2020). *Digital Culture & Education*. Academic Press.

The World Bank. (2018). *Overcoming poverty and inequality in South Africa: An assessment of drivers, constraints and opportunities*. World Bank.

Tisdell, E. (2012). Themes and variations of transformational learning: Interdisciplinary perspectives on forms that transform. In E. W. Taylor & P. Cranton (Eds.), *The handbook of transformative learning: Theory, research and practice* (pp. 21–35). Jossey-Bass.

Tlou, G. (2020). *Covid-19: Private university students in SA unable to study online due to high data costs.* Academic Press.

UNESCO. (2020). *Adverse consequences of school closures*. UNESCO.

UNICEF. (2020). *UNICEF and Microsoft launch global learning platform to help address COVID-19 education crisis*. UNICEF.

University of Ghana. (2020). *No: 4: Roll out of online teaching and learning at UG.* Author.

University of Ghana. (2021). *Enrolment and graduation statistics.* Author.

Vygotsky, L. S. (1980). *Mind in society: The development of higher psychological processes*. Harvard University Press. doi:10.2307/j.ctvjf9vz4

Watson, J. (2020, March 31). Learning through television in low-income contexts: Mitigating the impact of coronavirus (COVID-19). *The EdTech Hub*.

WHO. (2020). *Coronavirus disease (COVID-19) Pandemic*. World Health Organization.

Wiesemes, R., & Wang, R. (2010). Videoconferencing for opening classroom doors in initial teacher education: Sociocultural processes of mimicking and improvisation. *International Journal of Media. Technology and Lifelong Learning*, *6*(1), 1–15.

Micheal M. van Wyk is a Professor in the Department of Curriculum and Instructional Studies, College of Education, University of South Africa. Currently a National Research Foundation researcher in Economics education. Published more than 57 research articles in accredited international and South African journals. Supervised 14 doctoral and 24 masters' degree students. Awarded the Chancellors' 2013 Award for Excellence in Research at the University of South Africa. Received an award for Outstanding Education Research Paper (International conference, Dublin-Ireland, 2010). Prof van Wyk is an international reviewer for several international journals as well for South African journals. Serves on various International Academic Boards of journals. Co-published in academic textbooks entitled: Schooling, Society and Inclusive Education (2014), Educational Research: an African approach (2015) and Teaching Economic and Management Science in the Senior Phase (2016) with Oxford University Press. Founder and Editor-in-chief for African Journal of Pedagogy and Curriculum. Research interests are technology-integrated teaching strategies, social entrepreneurship and economics education.

Samuel Amponsah is a Senior Lecturer with a demonstrated history of working at all levels of education. He is the Acting Head of University of Ghana's Distance Education Department. He holds a Doctor of Education degree from the University of South Africa. Before joining the University of Ghana, Amponsah lectured at Esayidi TVET in South Africa and headed the Farming Management Department. Samuel's areas of research interest are distance and online learning and adult learning. He is a fellow of the Global Challenges Research Fund and currently on a departmental project investigating the adult learning needs of Ghanaian adult learners.