

The Impact of COVID-19 Pandemic on Medical Students' Learning at Copper Belt University School of Medicine and Students' Perspective on Online Education

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Abstract

Background: The COVID-19 pandemic has impacted all aspects of our lives and caused severe disruption to everyday life around the world. And as any other sector, education has been affected by the COVID-19 pandemic in many ways. The current study that focused on the impact of the COVID-19 on medical students' learning is essential in order to allow students and educators to evaluate the effects of the current changes the pandemic has brought to learn and apply new principles and practices to the future of the medical field by not only contributing towards the advancement of medical education in terms of curricular changes but also developing different disciplines of medicine in the country.

Objectives: The objective of this study was to assess the impact of the COVID-19 pandemic on medical students' learning at CBU-SOM and the students' perspective on online learning.

Methods: One hundred and twenty students (58.3% males and 41.7% females) responded to an online cross-section survey. A structural questionnaire link using 'Google form' was sent to students through WhatsApp in specific CBU-SOM students' WhatsApp groups. Data collected was downloaded from Google form and imported to IBM SPSS where it was statistically analysed. Descriptive, independent sample T-test, one-way ANOVA, and logistic regression analyses were conducted.

Results: Majority of the responses indicated that students did not experience effective and constant access to online teaching and learning during the COVID-19 pandemic and they were not satisfied with the way it was conducted hence more disadvantages than advantages of online education were highlighted. In rating their overall online learning experience, more than 70% of respondents gave a rating of between 1 and 5 out of 10 (terrible-okay) and 54.17% indicated that they preferred face-to-face mode of teaching. Pandemic on different aspects of students' learning at the CBU-SOM. Besides, almost 70% of the respondents indicated that the COVID-19 pandemic affected students' learning in medical school. Independent sample t-test and One-way ANOVA analyses demonstrated P-value for age (0.0230), year of study (0.003) and place residing during school closures (0.002) to be less than 0.05 (Significance value) hence concluding that the respondents' age, year of study and the place they were residing (at own home, boarding house, relatives place etc.) had a significant impact on their responses. Inferential statistical analysis (Regression) showed that P value was 0.752, thereby concluding that there was no statistically significant relationship between teaching and learning towards the impact of COVID-19 pandemic on students' learning at CBU-SOM.

Conclusion: The study showed that COVID-19 pandemic had a negative impact on the learning of students at CBU-SOM and that students had an unfavourable perspective on online education. However, there was no statistically significant relationship between the students' perspective on online education and the impact of COVID-19 on medical students' learning.

Keywords: COVID-19 pandemic • Medical student's learning • Online learning • Copperbelt University School of Medicine • Impact of COVID-19 on medical student education.

Introduction

Coronavirus disease 2019 (COVID 19), caused by the novel coronavirus SARS-CoV-2 has spread rapidly worldwide since its first discovery in December 2019 in Wuhan, China. It was declared a Public Health Emergency of International Concern (PHEIC) on 30th January 2020 and later a pandemic

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on 11th March 2020 by the World Health Organisation (WHO). Globally as of 20th January 2022, there had been 336, 780, 193 confirmed cases of COVID-19, including 5, 560, 718 deaths, reported to WHO with Zambia reporting 299, 172 confirmed cases of COVID-19 with 3, 887 deaths from 3rd January 2020 to 20th January 2022 (WHO, 2022) The COVID-19 pandemic has impacted all aspects of our lives and caused severe disruption to everyday life around the world. Many governments continue to caution the public to take responsive care by observing the "golden rules" which include masking up in public [1], maintaining physical distance, washing hands frequently or using hand sanitiser, avoiding crowded places and staying at home, and seeking medical attention early if one suspects symptoms in order to prevent the spread of the virus [2-6].

"No epidemic is ever just a health issue in isolation, and COVID-19 has emphasised this on the global stage. We need to be looking at it in terms of an economic issue, a livelihood issue, a social issue and a political issue too." (Juliet Bedford, 2021 as cited in welcome, 2021). And as any other sector, education has been affected by the COVID-19 pandemic in many ways [7]. Since July 2020, 98.6% of learners worldwide were affected by the

pandemic, representing 1.725 billion children and youth, from pre-primary to higher education, in 200 countries. The measure of limiting social contact as one of many governments' action following a common goal of reducing spread of the coronavirus led to the closure of schools for several weeks and months [7,8]. On 18th January 2020, the Government of the Republic of Zambia (GRZ) through the Minister of Health issued the premature closure notice of all schools, colleges and universities in Zambia as one of the various containment measures adopted to curb the spread of COVID-19 [9-23]. This closure lasted six months (which was longer than in most countries in the region) after the president announced the reopening of schools on 11th September 2020 [11]. This announcement came a month after the WHO and United Nations Children's Emergency Fund had warned of the harmfulness of prolonged school closures on learners. And effects of the disruption of the school calendar on learners such as increased rates of teenage pregnancies and early marriages among school going girls started becoming evident as physical schooling resumed [14]. This six-month closure, however was not the only closure to be announced and there have been other indefinite closures of leaning institutions with subsequent waves of the COVID-19 pandemic that have disrupted their calendars of these institutions.

The learning process becomes challenging too many students in schools and colleges during natural disasters like floods, hurricanes, and earthquakes in which schools are forced to close in order to protect human lives. Traditional face-to-face learning has been replaced by distance education since March 2020 [6] and many institutions of learning around the world including those in Zambia have resorted to the use of online learning in order to avoid disruptions in their academic calendars [15] stated that "online learning was the best solution for continuing education during the pandemic, especially in tertiary education [18]." Online learning, usually said as "e-learning" among other terms is simply one form of distance learning that takes place over the net [21,23]. "E-learning is covered under a larger term of technology-based learning through websites, learning portals, video conferencing, YouTube, mobile apps, and thousand types of free available websites for blended learning tools". However, the use of suitable and relevant teaching methods for online education is dependent on the expertise and exposure to information and communications technology (ICT) for both learners and educators [24-28] and therefore, great flexibility from university students and teachers was required in the use of technology which resulted from the necessity for social distancing due to the COVID-19 pandemic [6]. Furthermore, time management, usage of digital tools, students' assessment, communication, affordability, teaching methods, flexibility and the loss of in-person connection are among the challenges to online education that have been highlighted thus far and online education may not be equal in terms of access or instructional quality as some students do not have access to laptop computers or high-speed internet at home [29,30]. In addition, many teachers who are elderly internet users may not benefit from online education as they are technophobic, which means they are concerned about or unsure how to cope with computer hardware and software in their classrooms.

While acknowledging the fact that the entire education system has been affected by the COVID-19, the current study will be conducted to analyse the impact of the pandemic on medical students' learning at the Copperbelt University School of Medicine and the students' perspective on online learning.

Statement of the problem

During the first 12 to 18 months of medical school, most medical schools require students to meet in physical settings for interactive problem-solving or small-group discussions; their physical presence in both inpatient and outpatient settings has been an unquestioned tenet of early clinical immersion experiences and the clerkship curriculum. Students may participate in advanced clinical rotations, sub internships prior to residency, or research projects during the last 18 months of medical school which are more individualized. Therefore, COVID-19 has the potential to have an impact on students throughout their academic careers (Rose, 2020).

Online education allowed for the continuation of education in many institutions including medical institutions. However, a study by on the impact of COVID-19 pandemic on the academic performance of veterinary medical students showed that the fundamental problem that online education faces in

veterinary medical science is how to deliver practical courses as most of the subjects are practical and learning them online is difficult and students believe that completing veterinary competencies only through an online education system is challenging.

Most of the previous studies were conducted in countries where the resources and facilities are much better than the Zambia and no study was found to investigate the impact of the COVID-19 pandemic on medical students' learning in Zambia. The current study that will therefore focus on the impact of the COVID-19 medical students' learning as these are the doctors of tomorrow and their training will eventually have an impact on their performance in their careers.

Literature Review

A review on the literature will be focused on studies done to show the effects of the COVID-19 pandemic on the academic performance of students in tertiary institutions especially those in the medical field and their perspective on online education [28].

Impact of COVID-19 on education

Several studies have found both positive and negative impacts of the pandemic on education. Globally, the negative impacts of school closure due to summer vacation or natural disasters, as well as absenteeism, on student achievement have been well established while the impact of COVID-19-related school closures on student achievement, on the other hand, is not well understood. A systematic review by Hammerstein and colleagues on the effects of COVID-19 related school closures on student achievement showed that there is clear evidence for a negative effect of these closures on student achievement. It was noted that despite the fact that remote learning was implemented during COVID-19-related school closures, the results achieved by remote learning were similar to those obtained when no teaching was done at all over the summer holiday. It was also noted that children from families with a low socio-economic status (SES) were more negatively affected by COVID-19-related school closures with reasons being that children from families with a low SES are less likely to have access to remote learning as stated by UNESCO (2021), are rarely provided with active learning help from their schools and spend less time learning as compared to children from families with a high SES whose parents are also more likely to provide greater psychological support which seems to be specifically important in the COVID-19 pandemic situation. And so, this may also be the case for students in tertiary institutions (Figure 1).

For new and returning students alike, adjusting to university life can be both thrilling and difficult. Pressure to succeed academically in an increasingly competitive environment, along with a wide range of lifestyle changes, can lead to sub-optimal well-being [3]. However, Flores, Maria Assunção, et al. Noted that home confinement hampers the ability to fully experience university life, influencing academic study (e.g., uncertainty about cancellation, delays in activities, and use of digital platforms) and limiting access to social support, which can be critical in overcoming the challenges of the university

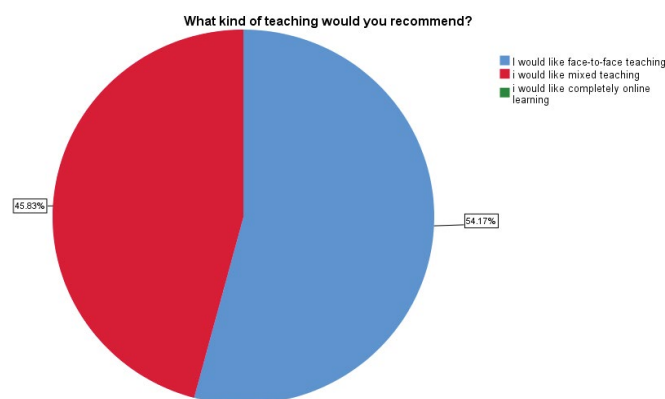


Figure 1. Recommended mode of teaching.

environment. Owing to the discovery of a new coronavirus, Sars-Cov-2, students in higher education now face a significantly different learning environment. Universities all across the world cancelled on-campus classes and transferred their educational methods to online platforms which was not new to some universities, but it was new to others, who were meeting such modes of instruction for the first time [1]. Tertiary students around the world are dealing with a great deal of uncertainty about their studies, ranging from the dread of getting the virus to the unknown quantity surrounding the completion of their studies [3,1] also added on to say that students were (on the global level) most or all of the time while studying at home (many not only being under a lockdown but also in isolation or even in quarantine) worrying about their professional career in the future and study issues, e.g., lectures, seminars, practical work. Also found that the pandemic had a negative effect because students had difficulties in accessing online learning due to inadequate network and on top of this, they had to pay for higher data quota than before the pandemic. Chandra (2020) as cited in [31-35] found several negative consequences of the pandemic: students experienced academic stress, fear of failure, feelings of boredom and depressive thoughts that distracted students from academic and creative activities. A study by Jena (2020) found that the negative impacts of the pandemic on education in India included: hampered educational activity, impact on employment due to postponed recruitment and delay of student placements which would later also affect education as decrease in employment gradually decreases education because people struggle for food rather than education, lack of student/teacher preparation for online education, reduced global employment and education opportunity, limited access to the digital world due to limited internet access and lack of affordability of computers, laptops or supporting mobile phones which created a digital divide among students and would eventually enhance the gap between the rich and the poor, and delayed payment of school and college fees as most parents were facing unemployment during the pandemic. Students in studies done by [32] clearly indicated the negative consequences of the pandemic:

- They felt the lack of motivation and focus;
- Experienced anxiety, academic stress, fear of failure, feelings of boredom and depressive thoughts that distracted students from academic and creative activities.
- Missing out on socialization and socio-emotional aspect of learning students highlight the lack of interaction and live communication as one of the biggest shortcomings of distance learning during a pandemic and
- Indicated the perception of increased academic workload during distance learning (virtual studies). A study by Flores, Maria Assunção, et al. showed a negative impact of DE on the mental health of students presenting depressive symptoms and impairment in concentration and learning, the latter identified as the strongest predictors of poor academic performances [34] also stated that online education might weaken the supervision of students and that it is more common for students to skip classes and follow the lessons less carefully [36].

In Africa, a study by Noori, Abdul Qawi. on the impact of the COVID-19 pandemic on students' learning in higher education in Afghanistan revealed that the majority of students did not experience constant and effective online learning and they faced different challenges in teaching and learning activities during the pandemic because of lack of enough resources that hindered their learning and therefore almost all students were unsatisfied with online learning and teaching. Most of the students had problems with the Internet and technological facilities including the fact that most of the Internet bundles were very expensive and they had financial problems buying Internet bundles and the mobile companies' Internet connectivity was not stable and they could not experience effective online teaching and learning during the COVID-19 pandemic. In their article identified the following impacts of COVID -19 on higher education in Nigeria: decreased international education, disruption of higher education's academic calendar, cancellation of local and international conferences, creation of a teaching and learning gap, loss of manpower in educational institutions, and a reduction in higher education's budget (Figure 2).

Student's evaluation of their overall online learning experience

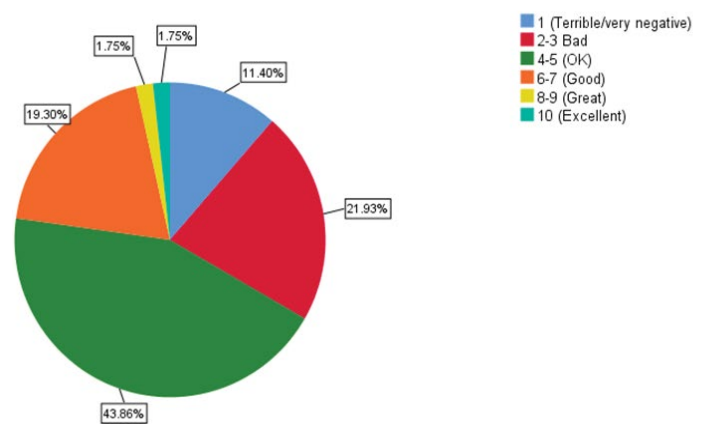


Figure 2. Student's evaluation of their overall online learning experience.

In Zambia, a research by Hapompwe, Chrine C, et al. highlighted the eminently bad academic performance that was expected from general examination classes as a result of the disruption of the learning cycle caused by public health efforts to stop COVID-19 from spreading further.

One of the key findings in a study by is that, while peri-urban students had more difficulty accessing remote learning during the COVID-19 school closure, urban students also faced challenges such as a lack of access to ICT services, irregular electricity supply, and a lack of motivation to learn without physical interaction with the teacher and fellow students, as well as a lack of self-confidence [12,32,9]. Found that the COVID-19 negatively impacted the mental health and physical activity of undergraduate pharmacy students at the University of Zambia and established that students experiencing anxiety associated with COVID-19 risk were more likely to have poor academic outcomes and progression.

Despite the negative impact of the COVID-19 pandemic on education several studies have shown that the pandemic also had a positive impact on education. Jena (2020) highlighted a number of positive impacts which include: a move towards blended learning by educational institutions, a rise in use of management systems, enhanced use of soft copy learning material, improved collaborative work, enhanced digital literacy, and improved use of electronic media for sharing information, worldwide exposure and better time management. Stated that the primary advantage of distance learning was that students could:

- Work according to their own schedule in a relaxed environment
- Look at the lecture again if necessary
- Feel free to ask questions and communicate with teachers and finally
- Save travel time. Found that online delivery of courses has the potential to encourage student engagement, geographical accessibility, and synchronous/asynchronous learning and examination and that the pandemic has provided opportunities for staff to acquire skills in online teaching methods and digital media production while developing alternative modes of assessments and transferring principles of learning.

Impact of COVID-19 pandemic on medical education

"The transition from the workplace or medical school setting to home results in isolation, an increased use of email, and struggles with establishing boundaries between work and home, which could affect faculty, students, and support staff" [31,34] In their study found that disadvantages of online teaching in medical school included: limited interaction between teachers and students, influenced teachers' personal style and students' attention in class, and made the students' learning more difficult to manage; and long-term use of electronic products could damage eyesight and health [27,15]. A study by Gaur, et al. (2020) showed that the lack of hands-on training in the preclinical years may

have serious implications on the training of the current cohort of students, and they may struggle later in the clinical years. Rose S [31] highlighted the effects of the COVID-19 pandemic lockdown on the clerkship environment of medical students and stated that students were not allowed to be part of the clinical team as they could transmit the highly contagious virus unknowingly or contract the disease and that lack of COVID-19 testing; diminished value of education, with cancelation of surgical procedures and routine appointments and the transition to telehealth formats; and lack of adequate personal protective equipment (PPE) also contributed to limitation of the role of students in this clinical environment. In states that "it is well established that clerking patients cannot be replaced by online learning as "clinical experience and human interaction are extremely important for the practice of medicine" and online learning cannot completely replace in-person live sessions [35]. Furthermore, unsupervised online exams may encourage students towards academic misconduct or dishonesty, which may "severely affect the knowledge and conduct of future doctors and therefore the quality of healthcare.

Stated that in Africa, the persistent COVID-19 pandemic is wreaking havoc on medical education and this effect will most likely intensify and, in some nations, become permanent as the pandemic progresses. While policymakers have focused their efforts on reducing COVID-19's impact on the more visible aspects of the health system (such as service delivery and health financing), little attention has been paid to the less visible but vital role of medical education found that the problems with online learning encountered by veterinary medical students included: lack of application in the clinical setting for the things they learned from books, lack of online information about certain subjects, such as veterinary anatomy, it is hard to teach the practical lessons of clinical subjects in online basis, spending long time in online learning makes the students lose their motivation to participate also they feel tired and less interactive due to no contact between students, professors and animals, which makes it very boring and easily lose concentration and some students have the sense of loneliness. However, the Veterinary medical students in the study by Mahdy, Mohamed A.A. stated that the advantages of online learning were that: it was more convenient and flexible than ordinary classes, students have more time to learn and do other activities and it saves time and provides an opportunity for self-study. Whatever the change and extent of transformation in medical education after the pandemic it is inevitable that there will be increased individual and collective awareness and acceptance of the innovative potential that technology, including emergent technology, can offer to enhance teaching and learning across the spectrum of medical education.

Having reviewed several literature on the impacts of the COVID-19 pandemic on education and particularly students in the medical field, it is essential that the impact of the pandemic on medical students' learning and their perspective on online learning is assessed so that interventions may be directed to learn and apply new principles and practices to the future of the medical field both in terms of medical student education and development of advanced technology in different disciplines of medicine in the country.

Objectives

General objective: To assess the impact of the COVID-19 pandemic on medical students' learning at The Copperbelt University School of Medicine and the students' perspective on online learning.

Specific objectives:

- To assess both negative and positive impacts of the COVID-19 pandemic on medical students' learning.
- To assess medical students' perspective on online teaching and learning.
- To identify factors associated with medical students' perspective on online teaching and learning.
- To establish the effects of the COVID-19 pandemic and online teaching and learning on medical students' academic achievement and performance.

Research questions

- What is the impact of COVID-19 pandemic on medical students' learning at The Copperbelt University School of Medicine?
- What is the medical students' perspective on online learning?
- Is there any relationship between medical students' perspective on online teaching and learning and the impact of COVID-19 pandemic on medical students' learning?
- Are there any effects of the COVID-19 pandemic and online teaching and learning on medical students' academic performance?
- Do medical students' demographic variables e.g. gender, age, place of residence, year of study, etc. have a significant impact on their responses

Justification

It is the desire of every county to achieve the United Nations Sustainable Development Goals (SDGs). SDG4 aims to "ensure inclusive and equitable quality education and promote lifelong learning for all". However, the shift to online model has raised many queries on the quality of education. States that "academic performance of learners is one of the most reliable indicators of quality education epitomizing quality productive inputs and optimal resources." It has been noted that medical students' academic performance predicts their professional competence in their medical career.

The United Nations has set Target 3.C (Increase health financing and support health workforce in developing countries) for SDG3 (Ensure healthy lives and promote well-being for all at all ages) and defined it as: to "substantially increase health financing and recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing states." And Zambia as a developing country with a doctor-to-patient ratio of one doctor for every 12,000 patients is well below the World Health Organization's recommended ratio of one doctor per 1,000 people. Therefore, recognizing the prospect of a health-care worker shortage as a result of the COVID-19 pandemic, students may need to be involved in the workforce and immersed in the clinical setting [31]. However, medical institutions have not been spared of closures during the pandemic as students were sent home and not allowed to be in the hospital setting.

The current study that will therefore focus on the impact of the COVID-19 on medical students' leaning is essential in order to allow students and educators to evaluate the effects of the current changes the pandemic has brought to learn and apply new principles and practices to the future of the medical field by not only contributing towards the advancement of medical education in terms of curricular changes but also developing different disciplines of medicine in the country [33]. The greater demand for quality education justifies the need for more effective interventions in preventing anything that hinders the delivery of quality education. The study will also help reveal critical areas in the education sector that have been underexplored. Thus, if policy makers will take into consideration the findings and apply the results it will be of benefit. Additionally, the findings of this study will be of benefit in providing data for the conduction of larger studies.

Measurements

Operational definitions

Medical student: In this study a medical student was defined as an undergraduate student enrolled for a regular schedule of courses in pursuit of a degree in Medicine and Surgery (MBChB) or Dental Surgery (BDS) who is not in the first year of study.

Learning: the activity or process of gaining knowledge or skill by studying, practicing, being taught, or experiencing something (Merriam-Webster, n.d.). In this study, learning will be defined based on the students' response to whether they are able to gain knowledge or skill when using online learning platforms. And the impact of the COVID-19 pandemic on learning will be assessed using a questionnaire by asking students to state whether they agree or disagree with the effects of the pandemic on their learning.

Students' perspective: Perspective is an internal process which has been recognized by an individual when selected and regulated stimuli come from outside which is captured by one's senses, then spontaneously individual feelings and thoughts will give meaning to the existing stimuli. It is a way of looking at a problem that occurs or a particular point of view used in seeing a phenomenon [36]. Students' perspective on online learning will be assessed using a questionnaire.

Online learning: Online learning, a form of distance learning is education that takes place over the net and it's usually said as "e-learning" among different terms [36]. It will be defined as usage of various online platforms for the purpose of learning.

Academic performance: according to academic performance involves meeting goals, achievements and objectives set in the program or course that a student attends which are expressed through grades which are the result of an assessment that involves passing or not certain tests, subjects or courses. The academic performance involves factors such as the intellectual level, personality, motivation, skills, interests, study habits, self-esteem or the teacher-student relationship. Sometimes it can be related to teaching methods [14]. Academic performance will be defined based on whether it has improved or not following the pandemic and will be stated as satisfactory or unsatisfactory.

Theoretical framework

This study is supported by different learning theories including the theory of transformative learning, theory of connectivism, Social Cognitive Career Theory (SCCT) and the Unified Theory of Acceptance and Use of Technology (UTAUT). The COVID-19 pandemic is a social and economic crisis just as much as it is a health one and its consequences, severe and far-reaching, are being felt across the world. From school closures to devastated industries and millions of jobs lost (Wellcome, 2021). The pandemic has created inharmoniousness in the education system around the world, and caused important changes and transformation in higher education. The theory of transformative learning explains that the learning begins when the learners experience an anticipated situation or a discomfort position and states that when students experience learning, they create meaning which causes transformation in their attitudes, behaviour and understanding. Mezirow points out that transformative learning happens when the learners interact with the environment and integrate with the learning process [24]. In order to enhance students' learning during a cognitive dissonance, educators should make use of useful techniques and change the learning process to new norms. This change will lead to sense of control and self-awareness among the learners and therefore lead to innovation and transformation in the learning process. Additionally, Connectivism emphasizes the importance of technology and socialization for building an educational framework and highlights that learning is a continuous process that requires nurturing connections between study areas. The compelling thing about this theory is that it supports both virtual learning and face-to-face learning [16]. The SCCT, developed based on Bandura's general social cognitive theory to predict the success and performance of individuals with regard to their cognitive, psychological, and behavioural aspects. The SCCT model demonstrates that learning is an active cognitive process in the mind which is influenced by factors such as age, personality traits such as compliance with environmental conditions, class attendance, positive interaction with others, intrinsic and extrinsic motivational goals, characteristics of the study approach, and individual self-regulating learning strategies and places emphasis on the role that these factors play in achieving academic or professional success [22]. Furthermore, the UTAUT was articulated by Venkatesh et al. (2003) and has four main constructs that directly influence user acceptance and behaviour, namely, performance expectancy, effort expectancy, social influence, and facility conditions which are identified as factors that can affect student performance [19].

Methodology

Study site

The present study was conducted at the Copperbelt University School of

Medicine in. The Copperbelt University School of Medicine is a government owned institution with students from different social classes and therefore helped in avoiding bias when it came to data collection.

Target population

The target population was undergraduate medical students enrolled for a regular schedule of courses in pursuit of a degree at any of the Copperbelt University School of Medicine in Medicine and Surgery (MBChB) and Dental Surgery (BDS) who are not in the first year of study and are older than 18 years.

Study design

The study design was a cross-sectional online survey.

Sample size

The sample size was calculated using the standard formula as shown below:

$$\text{Sample size} = \frac{n}{1 + \left(\frac{z^2 p(1-p)}{d^2}\right)}$$

Where,

$$n = Z^2 p(1-p) / d^2$$

Where,

$$Z = 1.96, d = 0.08, p = 0.5, \text{population} \sim 600$$

$$n = \frac{1.96^2 \times 0.5(1-0.5)}{0.08^2}$$

$$n = 150$$

Therefore,

$$\text{Sample size} = \frac{150}{1 - \frac{150}{600}}$$

$$\text{Sample size} = 120$$

Sampling procedure

The medical students were randomly selected using simple random sampling.

Inclusion and exclusion criteria

Inclusion criteria:

- Undergraduate Medical students aged 18 years and above who attend The Copperbelt University Michael Chilufya
- Sata School of Medicine enrolled for a regular schedule of courses in pursuit of a degree in MBChB or BDS.
- Undergraduate Medical students aged 18 years and above who are in their pre-clinical or clinical years of study.
- Undergraduate Medical students aged 18 years and above willing to participate in the study.

Exclusion criteria:

- Undergraduate Medical students not enrolled for a regular schedule in pursuit of a degree in MBChB or BDS at The Copperbelt University Michael Chilufya Sata School of Medicine or less than 18 years of age.
- Undergraduate Medical students not willing to participate in the study.
- Undergraduate Medical students who are in their first year of study
- Undergraduate Medical students with obvious congenital or physical impairment.

Data collection

An online survey was conducted using an online survey questionnaire to collect the information. A structural questionnaire link using 'Google form' was sent to students through WhatsApp in specific CBU-SOM students' WhatsApp groups. Participants were provided full consent before participation in the online survey.

Data analysis

Data collected was downloaded from Google form and then converted to Ms. Excel file which was then be imported to IBM SPSS where it was statistically analysed. Descriptive analysis was carried out to find frequency, percentage and mean. Independent Samples T-test and One-Way ANOVA test (using $p=0.05$) were conducted to find out the differences in participants' responses by their demographic variables. Regression analysis was also carried out to examine the relationship between students' perspective on online teaching and learning and the impact of COVID-19 pandemic on students' learning.

Ethical consideration

Approval to carry out the study was sought from the Tropical Diseases Research Centre (TDRC) research ethics committee and Ministry of Health Copperbelt Provincial Office. The study was administered IRB registration number: 00002911 and FWA number: 00003729. Information for participation in the current study was clearly given to the individual participants via a consent form so that they could give informed consent and were made known that participation was voluntary. The participants were also assured maintenance of privacy and confidentiality throughout the study.

Study limitations

Some limitations faced in conducting the research study include limited time in conducting the research which resulted in the study being conducted among a small sample from a single medical school, and a small sample size. Secondly, majority of respondents were students in the 5th academic year and as a result, the findings may be biased to some extent, therefore caution needs to be taken while generalizing the results. Another limitation was the differences in academic calendars of students at CBU-SOM which could have contributed to the perceived biasness in responses.

Results

Quantitative results

Participant characteristics: In this research study, 120 medical students in the programs Medicine and Surgery and Dental Surgery were studied. Based on the sample size calculation from a given population, 120 students were selected as the sample size for the study and this resulted in a 100% response rate. Of all the submitted responses, none were excluded.

Table 1 displays the participants' demographic information. Of the 120 respondents, 70 were male and 50 were female. Sixty-five of the respondents were aged between 18-24 years, 50 were age aged between 25-30 and 5 were aged 30 and above. Majority were affiliated to the Christian religion (95.8%), from families with a middle-income status (73.3%), were enrolled in the Medicine and Surgery program (92.5%) and in 5th year of study (65%). Participants had different education sponsorship with 62 on, 26 on self, and 32 on both government and self-sponsorship.

Table 2 shows the learning status and academic sphere of students during the COVID-19 related school closures. During the school closures, 81 (67.5%) students continued learning through textbook reading and digital e-learning, while 20 (16.7%) students were studying through reading textbooks by own effort and did not participate in online learning. Most of the students (81.7%) reported that they were spending less time than the normal situation for study. Eighty-seven (72.5%) out of the 120 participants had no separate room for study. In addition, 91.7% were residing at their own (family) home of and 81.7% of their place of residence was in the urban area.

Information about online classes: Table 3 reveals that 90% of

respondents used a mobile phone to attend online classes while 7.5% used a laptop/computer and 2.5% used a tablet/iPad. A larger number of students (101) stated that they had not attended online classes before the COVID-19 pandemic. Students were using various platforms for online lessons and material sharing. The results show that the most used platform for online classes was the Zoom application (82.5%), followed by Google meet (70%) and then Google classroom (56.7%). For material sharing, WhatsApp group was the most used platform (95%), followed by Telegram (44.2%) and Google classroom (38.3%). When asked about their attendance rate and attention during online classes, a greater number of students, 72.5% and 80.8% respectively, stated that they were both reduced.

Teaching and learning during COVID-19 related school closures:

Table 4 shows descriptive statistics of students' experiences of teaching and learning during the COVID-19 related school closures. It shows that majority of respondents disagreed and strongly disagreed with statements relating to either being engaged in online classes or satisfied with the way online teaching was conducted. When it comes to online learning during the closures, most students agreed or strongly agreed to having had internet access and electricity and also to the negative aspects of online learning. Overall, the responses indicate that students did not experience effective and constant access to online teaching and learning during the COVID-19 pandemic and they were not satisfied with the way it was conducted.

Advantages and disadvantages of online education

Table 5 displays advantages and disadvantages of online education that

Table 1. Variables, indicators and scale of measurement.

Variables	Indicators	Type of variable	Scale of measurement
Gender	Male	Extraneous	Nominal
	Female		
Age	18-22	Extraneous	Nominal
	23-27		
	28 and above		
Religion	Christian		Nominal
	Muslim		
	Hindu		
	other		
Programme of study	MBChB	Extraneous	Ordinal
	BDS		
Sponsorship	Government		
	Self		
	Both		
Place of residence during school closures.	Urban	Extraneous	Ordinal
	Rural		
Family socio-economic status	Low income	Extraneous	Ordinal
	Middle income		
	High income		
Mode of learning during school closure	Both textbook and online	Extraneous	Nominal
	Online only		
	Textbook only		
Time spent for studying during closures	Less than normal situation	Extraneous	Ordinal
	More than normal situation		
	Same as normal situation.		
Gadgets used for online classes	Mobile phone	Extraneous	Nominal
	ipad/tablet laptop or computer		
Attended online classes before lockdown	Yes	Extraneous	Nominal
	No		
Academic performance	Affected	Dependent	Ordinal
	Not affected		
Impact of pandemic on learning	Negatively impacted	Independent	Ordinal
	Positively impacted		
	Not affected		
Attitude towards online learning	Positive	Independent	Ordinal
	negative		

Table 2. Demographic information of participants (n=120).

Demographic Variables		Frequency (n)	Percentage (%)
Gender	Male	70	58.3
	Female	50	41.7
Age	18-24	65	54.2
	25-30	50	41.7
	30 and above	5	4.2
Religion	Christian	115	95.8
	Muslim	2	1.7
	Buddhist	1	0.8
	Other	2	1.7
Family SES	Low	25	20.8
	Middle	88	73.3
	High	7	5.8
Program of study	Medicine and Surgery	111	92.5
	Dental surgery	9	7.5
	3 rd	4	3.3
	4 th	29	24.2
Year of study	5 th	78	65
	6 th	9	7.5
	Government	62	51.7
Education sponsorship	Self	26	21.7
	Both government and self	32	26.7

Table 3. Learning status and academic sphere during COVID-19 related school closures.

Variables	Frequency (n)	Percentage (%)	
Mode of learning	Both online and textbook	81	67.5
	Online only	19	15.8
	Textbook only	20	16.7
Time spent studying during COVID-19 related school closures	Less than normal situation	98	81.7
	More than normal situation	19	15.8
	Same as normal situation	3	2.5
Separate study room	Yes	33	27.5
	No	87	72.5
Place residing during COVID-19 related school closures	At own home	110	91.7
	Other (boarding house, relative's home, etc.)	10	8.3
Area of place residing	Rural	22	18.3
	urban	98	81.7

respondents found. The two most selected advantages were opportunity to download recorded lessons (53.3%) and reduction in the travel time necessary to reach the university (56.7%) while 22.5% stated they didn't find any positive aspects with regards to online education. Most respondents selected all disadvantages related to online education with only 0.8% (1) of respondents stating they didn't find any negative aspects. Respondents were asked which mode of teaching they preferred (face-to-face, mixed or completely online).

Figure 1 shows findings of the study in this respect (recommended mode of teaching) which reveals that 54.17% of the respondents preferred to have face-to-face teaching, 45.83% preferred a mixture of both modes of teaching (i.e. online and face-to-face) while none (0%) of the respondents preferred to have online teaching only.

Overall online learning experience

Figure 2 shows the results of students' rating of their online learning experience. Majority of respondents (43.86%) rated their overall online learning as 4-5/10 meaning it was okay. Only 3.5% rated their experience 8-10/10 (great-excellent) while 11.4% rated it 1/10 (terrible/very negative).

The impact of COVID-19 pandemic on students' learning

Table 6 shows descriptive statistics of students' perception about the

The relationship between students' experiences of teaching and learning and the impact of COVID-19 on students' learning: Inferential statistical analysis (Regression) to examine the relationship between students' experience of teaching and learning and the impact of COVID-19 pandemic on students' learning. The results of the analysis showed that P value is 0.752,

Table 4. Information about online classes.

Variables	Frequency (n)	Percentage (%)	
Gadgets for attending online classes	Mobile phone	108	90
	Tablet/iPad	3	2.5
	Laptop/computer	9	7.5
Attended online class before COVID-19	Yes	19	15.8
	No	101	84.2
Platforms of online classes	Google classroom	68	56.7
	Zoom app	99	82.5
	Google meet	84	70.0
	Skype	1	0.8
	YouTube	35	29.2
	Team link	1	0.8
Platforms of material sharing	Other	0	0
	WhatsApp group	114	95
	Google classroom	46	38.3
	Telegram	53	44.2
	Institution/teacher's website	14	11.7
Attendance rate during online classes	YouTube video upload	20	16.7
	Reduced	87	72.5
	Remained unchanged	31	25.8
Attention during online classes	Increased	2	1.7
	Reduced	97	80.8
	Remained unchanged	19	15.8
	Increased	4	3.3

impact of the COVID-19 pandemic on different aspects of students' learning at the CBU-SOM. It indicates that almost 70% of the respondents strongly agreed or agreed with the statements indicating that The COVID-19 pandemic affected students' learning in medical school. About 15-30% indicated neutrality in their responses.

Student's emotions: Displays students' emotional wellbeing during COVID-19 related school closures. Responses show that majority of respondents experienced some level of sadness (58.8%), pessimism about the future (52.5%), loss of energy (63.4%), changes in their sleeping patterns (64.2%) and concentration difficulties (69.1%) while the majority did not experience loss of pleasure, irritability or changes in appetite.

Impact of participants' demographic variables on their responses: Independent sample t-test and One-way ANOVA tests were conducted to determine the impact of respondents' demographic variables, on their responses. The mean was used to compare the differences in the responses of the participants for each variable. The results indicate that P-value for gender (0.500), religion (0.222), family SES (0.896), program of study (0.287), educational sponsorship (0.799), separate study room (0.163), and area of place residing during school closures (0.739), were greater than 0.05 (Significance value). Therefore, it can be concluded that the students' gender, religion, family SES, program of study, educational sponsorship, having a separate study room or not, and area of place residing (rural or urban) do not have any significant impact on their responses. However, the results demonstrate P-value for age (0.0230), year of study (0.003) and place residing during school closures (0.002) were less than 0.05 (Significance value). Therefore, it is concluded that the respondents' age, year of study and the place they were residing (at own home, boarding house, relatives place etc.) had a significant impact on their responses.

Table 5. Descriptive statistics on teaching and learning during COVID-19 related school closures.

Teaching					
Statements	SD	D	A	SA	Mean
My lecturers were teaching normally during the COVID-19 related school closures	46.7%	44.2%	8.3%	0.8%	1.63
I had contact with my lecturers through online platforms	29.2%	33.3%	35.8%	1.7%	2.10
I was engaged in online classes	30.8%	20.8%	43.3%	5.0%	2.23
There was overall good communication during online classes	39.2%	47.5%	11.7%	1.7%	1.76
I adapted very well to online teaching	40.8%	42.5%	15.0%	1.7%	1.78
I'm in favour of online teaching	45.8%	39.2%	12.5%	2.5%	1.72
Online education should only be used as an emergency measure	12.5%	16.7%	43.3%	27.5%	2.86
Online teaching should be used as a supplement to offline teaching	10.8%	15.0%	52.5%	21.7%	2.85
Online teaching should be used as a replacement of offline teaching	67.5%	25.0%	5.8%	1.7%	1.42
Overall, online teaching was very effective for me	50.0%	36.7%	10.8%	2.5%	1.66
Learning					
I had internet access during the closures	16.7%	18.3%	51.7%	13.3%	2.62
I had electricity during the closures	10.0%	20.0%	56.7%	13.3%	2.73
I had better knowledge using technology	15.0%	34.2%	40.0%	10.8%	2.47
Online learning caused a delay in my studies	12.5%	15.8%	47.5%	24.2%	2.83
Online learning affected my daily schedule	10.8%	13.3%	50.0%	25.8%	2.91
Online learning caused me to spend more time on electronic devices	11.7%	11.7%	55.8%	20.8%	2.86
Too much learning tasks assigned than in offline learning	15.0%	23.3%	37.5%	24.2%	2.71
Online learning has better learning effect than offline learning	58.3%	33.3%	6.7%	1.7%	1.52
I was satisfied with online learning	51.7%	36.7%	8.3%	3.3%	1.63

SD= Strongly disagree, D= Disagree, A= Agree, SA= Strongly agree

Table 6. Advantages and disadvantages of online education.

Advantages	Frequency (n)	Percentage (%)
Greater care in adapting lessons to stimulate the students and involve them through active participation.	13	10.8
Opportunity to download recorded lessons	64	53.3
Greater respect for lesson times	16	13.3
Greater opportunity to contact teachers outside class hours for clarification via email, WhatsApp, etc.	19	15.8
Greater sense of team between students and teachers	12	10
Reduction in the travel time necessary to reach the university	68	56.7
I honestly didn't find any positive aspects	27	22.5
Other	5	4.2
Disadvantages/negative aspects		
Absence of direct face-to-face contact with lecturers	83	69.2
Reduced interaction with lecturers during lessons	87	72.5
Distracting effect due to the study environment	92	76.7
Lack of specific teaching methods	65	54.2
Absence of laboratory and other practical activities	87	72.5
I didn't find any negative aspects	1	0.8
Other	4	3.3

which is greater than the significance level (0.05). Thus, it can be concluded that there was no statistically significant relationship between teaching and learning towards the impact of COVID-19 pandemic on students' learning at CBU-SOM.

Qualitative results

The qualitative data were gathered from randomly selected responses of 20 out of the 120 participant responses in the questionnaire. The themes extracted from the questionnaire. The data showed that almost all the participants were not satisfied with online teaching and learning during the COVID-19 pandemic and they faced different challenges such as distraction due to environment, poor concentration, lack of a stable internet connection and electricity, lack of teacher-student interaction, financial challenges with buying data bundles and lack of knowledge on using technology by lecturers which negatively affected their learning experience during the COVID-19 pandemic.

Discussion

The COVID-19 pandemic has impacted all areas of human life and medical students' learning is not an exception. The impact of COVID-19 pandemic on students' learning in a country with limited resources differs from those with better resources. The present study aimed at investigating the impact of the COVID-19 pandemic on the learning of medical students at the Copperbelt University School of Medicine and their perspective on online education. Besides, it also attempted to explore whether students' demographic variables such as gender, age, year of study, etc., had any significant influence on their responses and whether there was any statistically significant relationship between students' perspective on online education and the impact of COVID-19 on medical students' learning.

The present study revealed that majority of respondents used a mobile phone to attend online classes and were using various platforms for online lessons and material sharing. The results show that the most used platform for online classes was the Zoom application followed by Google meet and then Google classroom. For material sharing, WhatsApp group was the most used platform, followed by Telegram and Google classroom. When asked about their attendance rate and attention during online classes, a greater number

Table 7. Impact of the COVID-19 pandemic on medical students' learning at the Copperbelt University School of Medicine.

Themes	COVID-19 impact on students' learning	Students reasons for observed worsening in following online lessons	Students' assessment of their academic performance during online education	Comments and suggestions
Participant 1	We could not be on the wards as clinical students learn mostly on the wards and interact with patients or learn from senior Doctors as they treat patients.	Poor concentration during classes as I would find myself sleeping or just doing other things on the phone during class.	There has been no change.	Online learning helps if well planned and executed can be a good supplement of face-to-face learning.
Participant 2	School closure, cancellation of physical classes and no/rarely held online classes, minimal encounters with lecturers and tutors.	Cancellation of physical class	Fair	Online learning should be incorporated into clinical teaching whenever necessary to ensure the continued flow of the learning process.
Participant 3	The impact was more on the negative than the positive side of things	Poor network, challenges with money for buying data bundles and the home environment wasn't conducive for my studies	It reduced	Online learning can never surpass physical learning
Participant 4	It wasn't so effective due to network interruptions and electricity interruptions at times	No internet access at times as data was not provided	It reduced	The online learning would be improved if everyone had the same access to internet connection (if it's provided for everyone, because at times others don't have and they miss out) and reduced power outage
Participant 5	I used to perform poorly on online tests due to limited test duration.	I used to get bored quickly	It was very poor	Face to face learning is always a better option.
Participant 6	I had to study topics with little guidance from lecturers as they would only send notes and not make effort to explain. This was challenging especially with chores at home.	Lack of interaction with lecturers	Surprisingly, my academic performance was good but I know I did not learn as much as I needed to.	Online learning is not suitable for training undergraduates, especially medical students because it falls way short of the quality of training required of them
Participant 7	It caused a delay in my graduation	My short attention span	It dropped drastically	Online learning is not all bad, I think it's the future but our school was not prepared for it.
Participant 8	Lack of physical interaction and being home with bad economic challenges lead me into repeating courses. Often notes were just sent without video lectures.	Lectures were not done according to schedule sometimes and that affected my study time.	Average	Location of students and class should be considered. Online should only be for clarification and questions.
Participant 9	Had a psychological impact coz it delayed my graduation	First time having online lessons hence I was tempted to do other things on the phone because no one was watching me	It reduced	Online learning could be better if only lecturers could find ways of making it more interesting.
Participant 10	It had a negative impact because I wasn't always able to attend online lectures thus not being able to learn and understand effectively. As the only girl child at home, I had a lot of chores and I was expected to do them during class time.	Distracting environment, tiredness from doing chores and so I'd find myself sleeping during classes, lack of data bundles and all this led to lack of motivation	My performance dropped.	If at all this situation should persist blended learning should be the compromise for medical students and not just online learning.
Participant 11	I felt demotivated and depressed most of the time. It made me realize I was better off using textbooks than attending lectures	I have a short attention span and require active involvement to be able to follow through.	It was okay.	Online learning should only be used during emergency and the school should ensure face to face learning takes place we're students are taught and not just memorizing.
Participant 12	My understanding of certain topics was slow due to the fact that there was not that guidance that is given in normal circumstances.	Because not everything can be learned just by reading, certain topics require practical effort.	Academic performance was poor.	Online lessons are a great initiative for learning but practical cannot be learned online unfortunately
Participant 13	I had to study more to comprehend certain concepts	The network was bad at times and connection would be lost.	Fair	Allow for both face to face and online lessons
Participant 14	Had loads of unfinished work which made it hard to move to the next items of studying	Too much work within a short period of time	It was average	Online learning is conducive for bulky courses like biochemistry. Because of recorded lesson, one would watch over and over again until one understands.
Participant 15	I became lazy to study and spent more time on social media.	Lack of interaction with the lecturer about the subject he/ she was teaching, poor quality of network sometimes you don't hear properly the lecturer.	Nothing changed	None

Participant 16	During the COVID-19 closure I had no classes not until we opened. This impacted my academics negatively because it delayed my academic calendar.	With a mobile device, you easily get distracted by social media and calls.	Wasn't so impressive	Incorporating both physical and online lessons during this pandemic would be very effective
Participant 17	Couldn't be hands on when I needed to be	Lack of seriousness	Remained the same	Lecturers need to educate themselves on different social media platforms
Participant 18	Having not been using online learning before, my attention span was limited online. And had a hard time taking classes seriously.	Mostly it was due to internet. Data bundles were too expensive. And also, house chores	It was fair	Some lecturers don't seem to be well acquainted with the technology. When there is need for online classes, there should be better internet and management must make sure all students are able to access the lessons or else there shouldn't be online learning.
Participant 19	Couldn't get proper learning access, no access to ward rounds and no motivation to study	The lecturers weren't active they left the work to us and added minimal or no information at all	Terrible	Lecturers should be more active and willing to teach
Participant 20	It reduced my interaction with lecturers and compromised my learning of clinical skills	Difficulties adjusting to online learning. Eye irritation with long periods on the screen	Reduced performance, compared to offline education	Face to face learning is better.

of students stated that they were both reduced. To add on, the study revealed that students did not experience efficacious and continuous online education during COVID-19 related school closures due to a number of reasons. Primarily, the school had clearly not prepared for a transition from face-to-face to online learning. Both students and lecturers were not well acquainted with online education evidenced by majority of students stating that they had not attended online education before the COVID-19 pandemic and that lecturers had difficulties navigating through online learning platforms and could not tailor lessons to engage students and keep them motivated during online classes [5]. Suggested that previous experience of online teaching and learning was related to a positive student adaptation to the closure of higher education institutions. In addition, students were facing a lack of resources (e.g. internet bundles) and facilities (e.g. separate study room). These and many other limitations impeded students' involvement in learning during the COVID-19 related school closures. The findings of this study are in line with findings of studies by [10,12,17,24,27,28] who reported that students did not experience effective learning and they faced various challenges in education activities during the COVID-19 pandemic due to lack of enough resources which hindered their learning. Nonetheless, they refute the findings of the studies by [1,32,36-39] who found out that students were satisfied with online learning because it was effective for them during COVID-19 pandemic. Studies show that online education is effective when all the students have equal access to resources and facilities [5,24,27].

In answering the first research question as to what was the impact of the COVID-19 pandemic on medical students' learning at the Copperbelt University School of Medicine, the findings disclosed that the majority of students indicated that the pandemic severely impacted their learning. Participants in this study confirmed that the COVID-19 pandemic has had an effect on various aspects of medical students' learning including, their academic performance, quality of learning, class projects, load of assignments, subject knowledge, future education goals, duration of studies, motivation for learning and educational opportunities. These findings support the findings of the studies conducted by [4,13,15,21,24,26,27] who concluded that the COVID-19 pandemic has negatively impacted students' learning. Responses from the qualitative results did not reveal any stated positive impact of the pandemic on students' learning. For instance, participant 1 said "we could not be on the wards as clinical students learn mostly on the wards and interact with patients or learn from senior Doctors as they treat patients." In their study on the impact of the pandemic on medical education in Africa stated that the partial or total lockdowns have disrupted in-person educational and clinical training and have also resulted in cancellation or delays in academic and professional medical exams—final. In addition, the delays have extended graduation times and caused delays in commencing postgraduate medical training and may also disproportionately affect female medical students who may face cultural pressures to drop-out or students from low-income families who find it difficult to cope with the extended stay in school.

The second research question analysed the medical students' perspective on online education. Study findings show that most respondents had a negative perspective on online education. Statistical analysis revealed that more than 80% of respondents stated that they could not adapt very well to online learning, experienced poor communication during online classes, had too many learning tasks as compared to offline learning and overall were not satisfied with online learning as it was not as effective as offline learning. Furthermore, respondents indicated several disadvantages of online education which include absence of face-to-face contact with lecturers, reduced interaction with lecturers during online classes, distracting effect due to study environment which resulted in poor concentration, lack of specific teaching methods, and absence of laboratory and other practical activities. Respondents found very few advantages of online learning of which include, opportunity to download recorded lessons and reduction in travel time necessary to reach the university. And when asked what mode of learning they preferred, 54.17% indicated that they preferred face-to-face teaching and the rest preferred mixed teaching. In rating their overall online learning experience, majority of students rated it 4-5/10. The findings of this study are in line with findings by Kapasia, Nanigopal, et al, Noori, Abdul Qawi. In contrast, [2,34,36] found that students had a favourable perspective on online learning amidst of the COVID-19 pandemic, were satisfied with online learning and that online learning was constructive and practical and the students' interaction was good. The finding of the qualitative part showed that most of the students were unsatisfied with online education. They stated that they had problems with the distracting environment, internet connectivity and challenges with buying internet bundles. For example, participant 3 said that 'the poor network, challenges with money for buying data bundles and the home environment wasn't conducive for my studies.' Study findings by Pokhrel, Sumitra, et al. agree with the qualitative findings that internet bandwidth is relatively low in low income countries, with fewer access points, and data packages are costly as compared to the income of people in many developing countries, thus making accessibility and affordability inadequate.

The other research question determined to establish whether there was any relationship between medical students' perspective on online teaching and learning and the impact of COVID-19 pandemic on medical students' learning. Regression analysis showed that there was no statistically significant relationship between the two. It can therefore be concluded that the effects that the COVID-19 pandemic had on students' learning were not related to the perspective of students on online education. Hence the pandemic effects on learning of medical school were significant whether students had a positive or negative perspective on online. This is in contrast with findings by Noori, Abdul Qawi who found that there was statistically a significant relationship between teaching and learning and the impact of COVID-19 pandemic on students' learning in higher education of Afghanistan [29]. As cited in Noori, Abdul Qawi

believed that when students do not have access to enough facilities in online learning activities, they achieve low grades and experience negative effects regarding their achievement.

The fourth research question inquired into the effects of the COVID-19 pandemic and online teaching and learning on medical students' academic performance. The findings of this study disclosed that both the pandemic and online education affected students' academic performance. Quantitative results showed that more than 80% of respondents indicated that the pandemic had impacted their academic performance. Results from the qualitative data indicated that most participants stated a reduction in their academic performance during online education. For those that stated no change in their academic performance, it was most likely due to the fact that they did not have exams during the online learning period and therefore couldn't determine whether there were any changes in their academic performance or not. The findings of this study are in line with findings by Hashemi, Aminuddin, Mahdy, Mohamed A.A, Noori, Abdul Qawi. Findings of the study by Hashemi, Aminuddin showed that COVID-19 has negatively affected the performance of students in many aspects such as their ability to perform well in each course activity, their performance in doing assignments, and their grades. His findings were in line with the findings of studies conducted by whose findings also revealed that COVID-19 affected the academic performance of students. However, studies conducted by Gonzalez, Teresa, et al. reported that there were no considerable effects of COVID-19 on students' exams and that there was a significant positive effect of the COVID-19 confinement on students' performance.

The final research question analysed whether medical students' demographic variables e.g. gender, age, place of residence, year of study, etc. have a significant impact on their responses.

Statistical analysis showed that the students' gender, religion, family SES, program of study, educational sponsorship, having a separate study room or not, and area of place residing (rural or urban) do not have any significant impact on their responses. However, age, year of study and the place they were residing (at own home, boarding house, relatives place etc.) had a significant impact on their responses also found that students' gender did not have any significant impact on their responses and that the respondents' class and age had a significant impact on their responses. Analysed differences as a function of gender in the adaptation to online teaching and learning, and found that there were few significant differences between male and female students. Also found that students with certain socio-demographic characteristics (male, part-time, first-level, applied sciences, a lower living standard, from Africa or Asia) were significantly less satisfied with their academic work/life during the crisis.

Furthermore, this study also analysed students' emotional wellbeing during COVID-19 related school closures. Responses show that majority of respondents experienced some level of sadness. Pessimism about the future, loss of energy, changes in their sleeping patterns and concentration difficulties while the majority did not experience loss of pleasure, irritability or changes in appetite. These findings reveal that the pandemic had a psychological impact on students. These findings are in agreement with findings by most studies reviewed in the literature which indicate that the pandemic had a negative effect on the psychological well-being of students (Table 7).

Conclusion

The COVID-19 pandemic has impacted all aspects of our lives and caused severe disruption to everyday life around the world. And as any other sector, education has been affected by the COVID-19 pandemic in many ways. This study found that students' learning at the Copperbelt University School of Medicine was negatively impacted because of limited resources and facilities and students did not experience stable teaching and learning activities during COVID-19 related school closures. Respondents indicated several disadvantages of online education which include, absence of face-to-face contact with lecturers, reduced interaction with lecturers during online classes, distracting effect due to study environment which resulted in poor

concentration, lack of specific teaching methods, and absence of laboratory and other practical activities while opportunity to download recorded lessons and reduction in travel time necessary to reach the university were the most selected advantages of online education. Besides, the results the revealed that there were statistically significant differences in students' responses by their age, year of study and place residing during the COVID-19 related school closures. Additionally, the finding of the study exposed that there was no statistically significant relationship between teaching and learning and the impact of COVID-19 pandemic on students' learning at the Copperbelt University School of medicine.

Recommendations

The challenges created by COVID-19 are not invincible and early implementation sensible solutions would enable Countries to take advantage of this opportunity to build better medical education systems. Long-term policies that engage relevant stakeholders, are well coordinated and funded are more likely to have the greatest impact. Stakeholders must pay attention to the following policy goals and action steps including:

- Protecting and increasing funding for medical education and research
- Improve e-learning and telehealth services
- Provide professional training for online teaching applications and devices
- Provide Wi-Fi facilities, cheap internet packages for students, and provide virtual resources and ensure they are available to all students.
- Ensure constant supply of electricity
- Ensure adequate personal protective equipment (PEP) for health personnel including clinical students to enable them to be on the wards even when there is a surge in cases of COVID-19.

Also, it is recommended for teachers to provide interactive and comprehensive online lessons along with supportive guidance and constructive feedback that could enable the students with motivation to attend online classes and satisfaction with online teaching.

In addition, future studies should be conducted with a larger sample size involving other medical schools.

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