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Research Article

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Medical and Dental Students in a Sub-Saharan African Country Re-think Teaching, Learning and Assessment During and After COVID-19 Pandemic: A Cross-sectional Study

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Abstract

Background: *The advent of COVID-19, the speed and scale of its global transmission and disruption led to lockdowns and school closures. The pandemic triggered a rethinking of the predominantly face-to-face, traditional educational strategies and methodologies in sub-Saharan African countries. This survey aimed to gain insights on the perspectives of undergraduate medical and dental students on teaching, learning and assessment during and after COVID-19 pandemic in a public medical school in Lagos, Nigeria.*

Methods: *This was a descriptive, cross-sectional e-survey-based study undertaken in 2021 over six months involving 230 undergraduate medical and dental students randomly recruited across all five training levels (200-600) of the College of Medicine University of Lagos. Respondents were variably distributed across the pre-clinical and clinical years; and across two curriculum pathways (SPICCES and the traditional curricula).*

Result: *The questionnaire response rate was 93.3%, and respondents consisted of 78.6% and 21.4% medical (MBBS) and dental students, and 55.7% and 44.3% females and males respectively, with a mean age of 22.1 ± 2.39 years (range: 18 – 33 years). Students perception of overall effect of COVID-19 pandemic on undergraduate medical and dental education was negative in 90.7%, compared with 2.2% positive and 7.1% neutral respondents respectively. The majority (96.8%) of the respondents had never been tested for COVID-19 and 3.2% of respondents had contracted symptomatic COVID-19. Teaching and learning were rated average relating to conduciveness of environment (mean score 2.5 ± 1.012), personal and workplace safety (mean 2.8 ± 1.01), and personal protection and safety measures (mean 2.7 ± 1.00) prior to COVID-19 pandemic. Increased risk of infection to students during clinical and laboratory activities was a dominant concern. Over 60% expressed concern for increased risks of infection to students on school resumption and over 70% recommended curriculum modifications including incorporation of online learning, curriculum modification to decentralize teaching and learning in multiple health facilities for clinical clerkships. About 80.4% were willing to return to the traditional method of face-to-face teaching if adequate infection control protocol is deployed and over 75%*

agreed that curriculum modifications that incorporate online learning will be beneficial to learning and safety.

Conclusion: *Overall, teaching and learning were perceived to be poor by medical and dental students. Frustrations predicated on pandemic lockdown, protracted disruption of academic work, delayed academic progression and graduation as well as safety concerns, may have contributed to their overall poor perception. The findings from these surveys are germane for institutional leaders, policy-makers, educational managers, and for future interventional research.*

Keywords: Quantum-Resistant Smart Contracts, Blockchain Security, Post-Quantum Cryptography, Data Protection

1. Introduction

COVID-19 is a viral respiratory illness caused by a newly discovered coronavirus known as Systemic Acute Respiratory Syndrome Coronavirus 2 A (SARS-COV-2) [1-2]. The first case of COVID-19 worldwide was identified in December 2019 in Wuhan, China. It was declared a Public Health Emergency of International Concern (PHEIC) on 30th January 2020, and then a pandemic on 11th March 2020 by the World Health Organisation (WHO) [3]. The advent, speed and scope of the global transmission of COVID-19 pandemic and the consequent disruption led to lockdowns and school closures. Due to the propensity of the SARS-COV-2 virus for a rapid human-to-human transmission and spread globally, lockdown measures were implemented to prevent and reduce the human-to-human transmission of the virus. The Federal Government of Nigeria directed the closure of all universities on the 23rd of March, 2020, effectively suspending undergraduate medical and dental training across Nigeria [4]. For over 6 months, all tertiary institutions were forced to either move to online learning or pause academic activities. Initiatives aimed at limiting the transmission or "flattening the curve" posed serious challenges to the delivery of medical and dental education. Universities were forced to seek ways to redevelop their curricula to become more flexible [5], and also to shift learning, teaching, and assessment to online platforms in order to continue medical and dental education. Some universities in countries like the UK and USA, with pre-existing infrastructure for online learning and management were able to continue school work virtually by various methods such as teleconferences, webinars, online learning, telemedicine, simulations, virtual reality, use of open-book examinations, and screen-based assessments with video footage [6-8]. In Nigeria and other low- and middle-income countries (LMICs), implementing these distance learning methods posed serious challenges due to a myriad of reasons, ranging from lack of appropriate technology infrastructure, non-availability of learning management system (LMS) software, lack of access to laptops and internet, poor internet connectivity, and inadequate number of skilled personnel to support e-learning programmes [9,10].

Medical and dental education at the College of Medicine, University of Lagos (CMUL) is divided into preclinical and clinical years of study. The 200 and 300 levels make up the pre-clinical years, while the 400 to 600 levels make up the clinical years. There two curricula pathways: a new SPICCES (Student-Centred, Problem-Based, Integrated, Competency, Community Based, Electives, Systematic) curriculum pathway, implemented in the institution in 2017; a traditional curriculum that was being phased out. Data on the impact of past pandemics and the ongoing SARS-COV-2 pandemics on the Nigerian medical education system are poorly designed and mostly secondary rather than primary data. The body of evidence on the perspectives of Nigerian students on medical and dental education during and after disease outbreaks, is non-existent. Although students a major stakeholder in the business of education, there insights and perspectives on critical components of the curriculum are rarely undertaken or considered in decision-making. Students perspectives and insights can contribute to creating student-oriented learning system that produce improvement in their academic experience, satisfaction and performance. It was therefore imperative to ascertain the perspectives of students on best adaptations to teaching, learning, and assessment in the wake of the pandemic [11]. Inclusion of student perspectives and insights has been advocated as unique voice that can influence educational policies including evaluation and revision of traditional methods of education that are currently in use. Their insights can be applied to effect student-cantered changes to the curriculum, teaching and assessment methods, and to building adaptable resilient systems in the face of disruptive events such as global pandemics [11,12]. This study aimed to explore the perspectives and line of thinking of undergraduate medical and dental students in a leading public medical school in Lagos, Nigeria, on their teaching, learning and assessment during and after COVID-19 pandemic. It is hoped that findings from this study will reinforce the critical role of students' perspectives in driving their education, and in evaluating their capabilities and willingness to adapt to changing educational systems brought about by the global pandemic. The pandemic triggered a rethinking of the predominantly face-to-face, traditional educational strategies and methodologies in sub-Saharan African countries.

2. Methods and Materials

This was a descriptive, cross-sectional study based on 127-item questionnaire involving a total of 300 medical and dental students in a 6-year program of the College of Medicine University of Lagos, Idi-Araba, Lagos, Nigeria, who were recruited using the Cochran's formula and a stratified sampling method. The 127-item questionnaire were pretested and distributed using online Google forms. Questions were in two formats: multiple-choice on five-point scale (Likert scale). For statistical analysis of the Likert scale questions, and score1 was attributed for "strongly disagree" for

some questions or "very poor" for others, a score of 2 was assigned to "disagree" for some questions or "poor" for others, a score of 3 was attributed to "neutral" for some questions or "average" for others, a score of 4 was ascribed to "agree" for some questions or "good" for others, and a score of 5 was assigned to "strongly agree" for some questions or "very good" for others. For statistical analysis of some 'Yes or No' multiple-choice questions, a score of 1 was assigned to 'Yes' while a score of 0 was assigned to 'No' and 'I don't know'. The questionnaire comprised 7 sections assessing socio-demographic characteristics, knowledge, and perspectives on COVID-19, students' perceptions about their educational experience before, during, and after the COVID-19 pandemic, the attitude of students towards e-learning, students' readiness towards e-learning, and challenges to e-learning. Ethical approval for the study was obtained from the Health Research and Ethics Committee (HREC) of the Lagos University Teaching Hospital (LUTH). Data were analysed using the Statistical Package for the Social Sciences (SPSS version 22) software. The analysis included descriptive statistics, chi-square test, p-value, and mean square contingency coefficient test. Results were expressed as mean, standard deviation, and percentages. The significance level was stated as $p < 0.05$.

3. Results

3.1. Basic Demographic Characteristics

A total of 280 questionnaires were completed giving a response rate of 93.3%, comprising 78.6% Medicine and Surgery and 21.4% Dentistry students, and 55.7% females and 44.3% males, respectively with a mean age of 22.1 ± 2.39 years (range: 18 – 33 years). A total of 183 (65.4%) and 97 (36.8%) respondents were on the SPICCES curriculum and traditional program pathways, respectively.

3.2. Students Knowledge on COVID-19

A total of 74.6% of respondents had good knowledge of COVID-19, while 25.4% had poor knowledge of COVID-19. Information about COVID-19 was mainly sourced from the internet (96.4%) and electronic media (89.3%). The majority of the respondents (90.7%) assessed the overall effect of the COVID-19 pandemic on undergraduate medical and dental education to be negative, while 7.1% were neutral and 2.2% positive, on the overall effect of COVID-19. The majority of the respondents had never been tested for COVID-19 and 3.2% of respondents had contracted and tested positive for symptomatic COVID-19. Respondents' knowledge on COVID-19 seemed to influence their perceptions on safety. A total of 12.7% of respondents with poor knowledge (compared to 4.3% with good knowledge) were not willing to return to clinical postings/laboratory sessions even with infection control protocols in place. ($\chi^2 = 9.167$, $P = 0.010$, $\varphi = 0.181$)

3.3. Perspectives on Medical and Dental Education Prior to the COVID-19 Pandemic

The majority of respondents had an unfavourable perspective on teaching and learning prior to the COVID-19 pandemic (53.2%). Their perspective on teaching and learning prior to the pandemic was not significantly associated with their curriculum pathway [$\chi^2 = 0.804$, $p = 0.370$] or level of training [$\chi^2 = 3.090$, $p = 0.543$]. 73.8% of respondents with unfavourable perspectives on teaching and learning reported that resumption of physical clinical postings/ laboratory sessions can lead to increased risk of infection to students ($\chi^2 = 10.289$, $p = 0.036$, $\varphi = 0.192$), compared with 68.7% of those with favourable perspectives. There was no statistically significant relationship between favourable or unfavourable perspectives on teaching and learning prior to the COVID-19 pandemic and incorporating into the program safety measures such as PPEs, movement restrictions, social restrictions and social distancing policies are more beneficial than changes to curriculum [$\chi^2 = 6.453$, $p = 0.168$]. Table 1 shows the opinion of students on teaching and learning prior to the COVID-19 pandemic.

Perspectives on Teaching and Learning Prior to the COVID-19 Pandemic	Mean ± SD	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		Frequency (%), n = 280				
There is overall conduciveness of teaching and learning environment	2.5 ± 1.012	48 (17.1)	93 (33.2)	82 (29.3)	55 (19.6)	2 (0.7)
Number of students during lab sessions is conducive for teaching and learning	2.6 ± 1.06	50 (17.9)	93 (33.2)	67 (23.9)	69 (24.6)	1 (0.4)
Number of students in clinical units is conducive for teaching and learning	3.0 ± 0.98	29 (10.4)	45 (16.1)	119 (42.5)	81 (28.9)	6 (2.1)
Active engagement of students occurs	3.30 ± 0.93	11 (3.9)	47 (16.8)	82 (29.3)	128 (45.7)	12 (4.3)
There are personal and workspace safety measures in the laboratories	2.8 ± 1.01	31 (11.1)	76 (27.1)	92 (32.9)	77 (27.5)	4 (1.4)
There is personal protection and safety measures for students	2.7 ± 1.00	39 (13.9)	86 (30.7)	87 (31.1)	67 (23.9)	1 (0.4)
There is adequate workplace safety and hygiene	2.8 ± 0.99	34 (12.1)	78 (27.9)	92 (32.9)	75 (26.8)	1 (0.4)

Table 1: Students' Perspectives on Teaching and Learning Prior to COVID-19 Pandemic

3.4. Perspectives on Medical and Dental Education During and After the Pandemic

3.4.1. Perspectives on Safety and Willingness for Physical Resumption

Most respondents expressed a willingness to resume their education physically as long as appropriate infection control measures were in place. Respondents in 600 level (14.9%) and 500 level (8.0%) indicated the highest percentages of willingness to return to clinical postings/laboratory sessions with infection control protocol as compared to 200 level (4.0%), 300 level (3.2%) and 400 level (4.2%) [$\chi^2 = 22.016$, $p = 0.005$, $\varphi = 0.280$].

Table 2 summarizes students' views on the safety of medical and dental education and suggested modifications during and after the COVID-19 pandemic.

Perspectives on Risk for Infection and Required Changes.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Frequency (%), n = 280				
Resumption of academic activities can lead to increased risk of infection to students	6 (2.1)	37 (13.2)	65 (23.2)	116 (41.4)	56 (20)
Resumption of physical clinical postings/ laboratory sessions can lead to increased risk of infection to students	6 (2.1)	22 (7.9)	52 (18.6)	129 (46.1)	71 (25.4)
Curriculum modifications that reduce physical exposure will be beneficial to student learning and safety	6 (2.1)	14 (5.0)	21 (7.5)	138 (49.3)	101 (36.1)
Curriculum modifications that incorporate online learning will be beneficial to student learning and safety	7 (2.5)	24 (8.6)	37 (13.2)	105 (37.5)	107 (38.2)
Curriculum modifications that incorporate decentralized learning (teaching and learning in multiple health facilities in smaller groups) will be beneficial to student learning and safety	1 (0.4)	7 (2.5)	20 (7.1)	130 (46.4)	122 (43.6)
Incorporating safety measures like use of PPE, movement restrictions, social restrictions and social distancing policies are more beneficial than changes to curriculum	8 (2.9)	32 (11.4)	55 (19.6)	93 (33.2)	92 (32.9)

Table 2: Students' Perspectives on Safety of Medical and Dental Education During and after the COVID-19 Pandemic

3.5. Students' Perspectives on Online Assessment

Majority of the respondents (83.9%) had an unfavourable perception to online assessments however those in their final year were less likely to have an unfavourable perception. As many as 60% of those who felt that there were no significant challenges to e-learning still recorded unfavourable perceptions of online assessment.

There were mixed opinions on whether a respondent's level of technological skill could affect the use of online assessments. 48.6% felt that their level of technological skill could affect their use of online assessment, 47.5% felt that it would not affect them while 3.9% of participants reported that they did not know [$\chi^2 = 10.091$, $p = 0.039$, $\varphi = 0.190$]. There was a statistically significant relationship between respondents' average monthly income and an unfavourable perspective towards online assessment. 93.3% of respondents with average income below ₦10,000 had an unfavourable perception of online assessment, compared to 82.1% of those with incomes equal to or over ₦10,000 [$\chi^2 = 12.119$, $p = 0.033$, $\varphi = 0.208$].

3.6. Perspectives on E-Learning

81.4% students reported that they had experience with online/e-learning prior to the pandemic, while 18.6% reported no prior experience. Respondents that were self-sponsored had a lower proportion (85.7%) of favourable perspectives towards students' readiness for e-learning compared to those that received funding from their parents/guardians (99.2%) and scholarships (100%) [$\chi^2 = 11.869$, $p = 0.003$, $\varphi = 0.206$]. More clinical students (17.2%) thought that e-learning was not feasible compared to preclinical students (1.8%) [$\chi^2 = 31.003$, $p = 0.013$, $\varphi = 0.408$].

Of the pre-clinical students, more 300 level students (17.7%) agreed that lab work can be replicated by e-learning compared to those in 200 level (8%) [$\chi^2 = 33.088$, $p = 0.007$, $\varphi = 0.344$]. Of the clinical students, a greater proportion of final year students

(70.2%) believed that clinical scenarios could be replicated with e-learning as opposed to those in 400 level (50.0%) and 500 level (38.0%) [χ^2 = 30.041, p = 0.018, φ = 0.401]. Of the respondents that had a favourable perception of readiness for e-learning, 80.8% were in favour of e-learning for studies during the pandemic [p = 0.000, χ^2 = 29.306, φ = 0.324] while only 52.8% were in favour of e-learning for studies after the pandemic eases [p = 0.001, χ^2 = 19.518, φ = 0.264].

There was a higher proportion of medical students (50.0%) in favour of e-learning for clinical studies after the lockdown eases than dental students (31.7%) [χ^2 = 10.842, p = 0.028, φ = 0.242].

There was a statistically significant relationship between average monthly income and a favourable perspective towards e-learning after the lockdown [χ^2 = 36.374, p = 0.014, φ = 0.360] and pandemic [χ^2 =38.321, p = 0.008, φ =0.370]. Respondents that indicated an income of ₦10,000 and above were more likely to be in favour of e-learning for studies after the lockdown as 49.6% agreed, compared to 35.5% of respondents that earned below ₦10,000. This difference in percentage was maintained when responses in favour of e-learning for studies after the pandemic eases were evaluated as 53.19% of respondents that earned a monthly income of ₦10,000 and above agreed compared to 46.6 % of respondents that earned below ₦10,000.

In assessing students' technological readiness to adopt e-learning, availability of tools to access the internet was evaluated. Nearly all the students surveyed (99.3%) owned phones capable of accessing the internet. 20.7% students did not own any kind of computer while 78.9% had access to a laptop. Of those who had access to computers (laptop and/or desktop), 73.6% were available solely for personal use. 95.4% of respondents agreed that they had tools for e-learning such as mobile phones, smartphones, laptops etc. This majority was maintained despite differing income levels of respondents [χ^2 = 43.055, p = 0.000, φ = 0.392]. Table 3 shows the responses of students to questions assessing their readiness and access to necessary tools for e-learning.

Cultural Readiness Towards E-Learning (n = 280)	**Mean ± SD**	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
Readiness of students		**Frequency (%), n = 280**				
I have basic computer skills	4.4 ± 0.69	2 (0.7)	1 (0.4)	17 (6.1)	112 (40.0)	148 (50.9)
I can use online search engines e.g. Google	4.6 ± 0.50	0 (0.0)	0 (0.0)	3 (1.1)	96 (34.3)	181 (64.6)
I have used online platforms like email, WhatsApp	4.6 ± 0.51	0 (0.0)	0 (0.0)	4 (1.4)	89 (31.8)	187 (66.8)
I have used video conferencing tools such as Zoom, Skype, Google Classroom, etc. for some form of learning	4.2 ± 1.03	8 (2.9)	20 (7.1)	19 (6.8)	91 (32.5)	142 (50.7)
I have tools for e-learning such as mobile phones, smartphones, laptops etc.	4.5 ± 0.63	0 (0.0)	4 (1.4)	9 (3.2)	112 (40.0)	155 (55.4)
Have access to internet connectivity	4.2 ± 0.81	4 (1.4)	4 (1.4)	31 (11.1)	126 (45.0)	115 (41.1)
Have attended trainings/ workshops on e-learning	3.5 ± 1.30	13 (4.6)	79 (28.2)	30 (10.7)	77 (27.5)	81 (28.9)
I find it easy to use e-learning tools such as video conference tools	3.9 ± 0.99	80 (28.6)	120 (42.9)	47 (16.8)	29 (10.4)	4 (1.4)
I've had clear and understandable interactions with e-learning tools	3.9 ± 0.90	75 (26.8)	135 (48.2)	48 (17.1)	19 (6.8)	3 (1.1)
E-learning will motivate learning	3.3 ± 1.10	38 (13.6)	84 (30.0)	92 (32.9)	48 (17.1)	18 (6.4)
E-learning will improve quality of my learning	3.3 ± 1.06	37 (13.2)	78 (27.9)	104 (37.1)	46 (16.4)	15 (5.4)
E-learning may increase my productivity	3.5 ± 1.10	51 (18.2)	96 (34.3)	79 (28.2)	40 (14.3)	14 (5.0)
E-learning will allow me learn more efficiently	3.3 ± 1.06	41 (14.6)	83 (29.6)	94 (33.6)	50 (17.9)	12 (4.3)
Perception of Institution's Readiness for E-Learning						
Learning institution has ICT infrastructure to support e-learning	3.0 ± 1.14	32 (11.4)	67 (23.9)	89 (31.8)	67 (23.9)	25 (8.9)

Learning institutions has support staff to assist e-learning	2.9 ± 1.12	32 (11.4)	73 (26.1)	95 (33.9)	56 (20.0)	24 (8.6)
Learning institution has ICT infrastructure to support e-learning	3.0 ± 1.14	32 (11.4)	67 (23.9)	89 (31.8)	67 (23.9)	25 (8.9)

Table 3: Readiness and Access to Tools for E-learning

60% of respondents had a favourable perception of institutional readiness for e-learning. Despite having a favourable perspective of the institution's readiness for e-learning, a significant percentage of respondents still had an unfavourable perspective towards online assessment (47.9 %) compared to those with a favourable perspective (12.1%) [$\chi^2 = 5.406$, $p = 0.020$, $\varphi = 0.139$].

3.7. Perspectives on Challenges to E-Learning

A high proportion (92.9%) of respondents reported that there were significant challenges to e-learning. Despite acknowledging significant challenges to e-learning e.g., limitations in internet connectivity, frequent electrical power failures, etc, 68.5% of the respondents were in still in agreement that e-learning was feasible for students [$\chi^2 = 18.810$, $p = 0.01$, $\varphi = 0.249$]. Of the respondents that indicated that there are no significant challenges to e-learning, 0.0% had an income less than ₦10,000, 10.0% had an income of ₦10,000 – ₦20,000, 25.0% had an income of ₦20,001 – ₦30,000, 30.0% had an income of ₦30,001 – ₦40,000, 5.0% had an income of ₦40,001 – ₦50,000 and 30.0% had an income greater than ₦50,000 [$\chi^2 = 18.995$, $p = 0.002$, $\varphi = 0.260$]. About 82.1% and 46.4% of respondents in favour of e-learning during and after the pandemic respectively were also in agreement that there were significant challenges to e-learning [$p = 0.289$, $\chi^2 = 4.983$], [$p = 0.058$, $\chi^2 = 9.127$].

4. Discussion

The inclusion of student perspectives and insights has been advocated as unique voice that can influence educational policies. This study aimed to gain insights on the perspectives of the undergraduate medical and dental students perspectives and educational experience relating to teaching, learning and assessment during and after COVID-19 pandemic, in a public medical school in Lagos, Nigeria. Our survey is the first primary data on students' perspectives during any outbreak or pandemic prior to COVID-19 pandemic in a medical in Nigeria.

Overall, the respondents (students) had unfavourable perspectives on teaching, learning and assessment prior to the pandemic (53.2%). About 50.0% of all respondents disagreed that the teaching and learning environment were conducive, while 51.1% and 26.5% of respondents disagreed that the number of students in laboratory and clinical groups respectively, were conducive for teaching and learning. And 44.6% cited dissatisfaction with personal protection and safety measures for students, while 20.7% of students did not feel that they were actively engaged during learning. This is in contrast to a report at a Wisconsin academic surgical programme where medical students attested to being intentionally engaged by educators in training and educational opportunities through feedback and debriefing, ready availability for support and questions, and through clear learning performance expectations [12].

Plausible reasons for the overall negative perspectives of students on teaching, learning and assessment prior and during COVID-19 pandemic may be predicated on the frustrations associated with the protracted disruption of academic work, stagnation of academic progression and delayed graduation posed by the COVID-19 pandemic and lockdown. Confounding contributors to students negative rating may also include the ongoing industrial action by academic staff in public universities in Nigeria, during this survey, which may have contributed to the frustrations and disappointment of the students. These findings are germane for institutional leaders, policy-makers, educational managers and administrators for planning and guiding course and program modifications. We found that unfavourable perspectives on teaching and learning were correlated with students' confidence that they could be kept safe in the event of physical resumption. About 73.8% of those with unfavourable perspectives believed that resumption of physical clinical and laboratory sessions would lead to an increased risk of infection to students. However, most students were willing to return to physical academic activities provided that appropriate infection control measures were put in place, and students in higher levels (600 level and 500 level) indicated more willingness to return to their clinical postings and laboratory sessions. This is likely due to their desire to resume learning and complete their medical and dental education that has been prolonged by a number of factors, such as repeated strike actions and the pandemic.

Interestingly, most students had unfavourable perspectives on the use of online assessments (83.9%). Even students who were favourably disposed to e-learning in spite of concerns on challenges, recorded unfavourable perceptions of online assessment (60%). The unpopularity of online assessment may be justified by students' perspectives of the challenges associated with online education such as limitations in internet connectivity, frequent electrical power outages and failures, and cost of internet facilities. Other challenges specific to online assessment may have informed their position such as an increased risk of student malpractice, poor institutional infrastructure being perceived to be unequipped for online assessment, and online assessment ICT and virtual learning infrastructure. This finding is similar to a study conducted among dental students at the University of Jordan, aimed to assess their perspectives on online education, where more than half of respondents (56.4%) felt that online assessment was not a good method for evaluation [13]. However, respondents from our study in their final year were less likely to have an unfavourable perception towards online assessments, Students were overwhelmingly in support of the use of e-learning during

the pandemic (78.9%), but disagreed in the use of e-learning for practical hands-on education such as laboratory sessions and clinical scenarios. Similarly, in the study of dental students' perspectives on online learning at the University of Jordan, most respondents in their 4th and 5th years noted that the activity most affected by quarantine was clinical training [13].

In our study however, students' support for e-learning after the duration of the lockdown dropped to 47.5%, while support for e-learning after the pandemic eases equally dropped to 52.8%. A 2020 study conducted among medical students from more than 13 medical schools in Libya showed that 73.6% of students disagreed that e-learning could replace traditional teaching methods, their concern being the poor quality of the local internet connectivity, which critical for e-learning platforms [14]. This is similar to the challenges to e-learning cited in the present study.

In assessing students' perspectives on their readiness for e-learning, we found that a very high proportion (95.4%) of the respondents had the necessary technological tools and skills required for e-learning such as mobile phones, smartphones, laptops; and 90.0% agreed that they had basic computer skills. This is similar to a study conducted among medical students of the College of Medicine, University of Nigeria, Enugu, Nigeria which found that 96.9% of respondents owned internet-enabled devices [15].

However, only 21.8% and 22.2% reported that e-learning would improve the quality of their learning and allow them learn more efficiently, respectively. Students' perspectives on their institution's readiness for e-learning were also assessed, and results were very similar: 35.3% did not feel that their learning institution had the ICT infrastructure to support e-learning and 37.5% did not agree that the institution had the necessary trained human resource to support e-learning. Additionally, a high proportion of respondents (92.9%) believed that there were significant challenges to e-learning. Regardless, 77.7% of students who noted significant challenges to e-learning were favourably disposed to e-learning during the pandemic. The most frequent reported challenges include frequent electrical power failures and outages, cost of internet facilities, and limitations in internet connectivity. These challenges are similar to those identified in a study on the value of internet tools in undergraduate surgical education in a federal medical college in South-Eastern Nigeria, where some of the most common possible challenges to using internet tools for surgery teaching were cited as the cost of accessing the internet, and network availability [15].

From these results, it is evident that e-learning is seen as a necessary intervention to ensure that medical and dental education continues during restrictions posed by the COVID-19 pandemic. About 50% of respondents were in favour of using e-learning even after COVID-19 lockdowns and post pandemic, indicating that alternatives to traditional forms of teaching and learning such as e-learning may serve as useful adjuncts to medical students' education, despite their inherent challenges.

In conclusion, several concerns and plausible frustrations predicated on disruption and delay of academic work, progression and graduation posed by the COVID-19 pandemic and lockdown, negatively affected the perspectives on teaching, learning and assessment, by medical and dental students at the College of Medicine, University of Lagos. These findings are germane for institutional leaders, policy-makers, educational managers, administrators and course/curriculum planners, for student-centred undergraduate medical and dental education. Additionally, based on students' support for e-learning even after the pandemic was controlled, there is need for the adoption of blended learning, where e-learning can be combined with traditional teaching and learning methods. However, there is need to provide necessary infrastructure to support the e-learning component of any blended learning. Five years after the implementations of the new SPICCES curriculum at the College of Medicine University of Lagos, there is need to undertake a robust review to determine opportunities and challenges from the multiple stakeholders that include students, staff, employers of garduates, community end-users among others. The findings from our survey, the first primary data on students' perspectives during any outbeak or pandemic in Nigeria, are germane for decision-making on educational practice, policy and future research. Primary data are critically needed for student-centered modifications in training programs especially in resource-limited countries such as Nigeria, where traditional educational strategies persist.

5. Conclusion

Overall, teaching and learning were perceived to be poor by medical and dental students. Frustrations predicated on pandemic lockdown, protracted disruption of academic work, delayed academic progression and graduation as well as safety concerns, may have contributed to their overall poor perception. The findings from these surveys are germane for institutional leaders, policy-makers, educational managers, and for future interventional research.

Limitations

The cross-sectional and single-centre design of the present study as well as the potential recall bias pose limitations on extrapolation and generalization of the study findings. A mixed study design (quantitative and qualitative with thematic analyses) is more appropriate for a survey of this nature. Also, representational bias associated with the disproportionate distribution of medical and dental students (220 to 60) without a subgroup analysis may have obscured the perspectives of the two groups. Also, students' perspectives and preferences on e-learning should have been assessed in relation to different learning activities such as didactic lectures, small group discussions, video-based learning sessions, clinical demonstration etc.

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Author Contributions

CO and JO conceptualized concept for the survey. JO, FS, GU, OB, JI, MN, OO and UE contributed to the creation and development of all of the instruments and content; JO coordinated the team of FS, GU, OB, JI, MN and OO for the implementation of the survey, and statistical analysis; UE contributed to the statistical analysis. All the authors contributed to creating the first draft of the manuscript. CO created the final copy of the manuscript that was submitted to journal.

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Data Availability

Only data generated in this study are included in this manuscript.

Declarations

Competing Interests

The authors declare no competing interests.

Ethics Approval and Consent to Participate

Ethical waiver was applicable to the survey by the Health Research Ethical Committee of the Lagos University Teaching Hospital. Verbal informed consent was obtained from the student participants.

Consent for Publication

Not applicable.

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