Classroom Examination Versus Online Examination in Anatomy Courses Before and During Covid-19 Pandemic - Evaluation of Performance, Perception and Preference of Students in a Nigerian University

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ABSTRACT

Introduction: to avoid the disruption of 2019-2020 academic year in our institution during the Covid-19 pandemic, online learning and assessment was activated for all courses including anatomy. This study assessed the performance, perception and preference of students during online examination in anatomy courses compared to classroom examination.

Materials and Methods: the academic performance of eighty five subjects including Nursing science (45), Physiotherapy (27) and Human anatomy (13) students during the classroom examination (pre-pandemic semester) and online examination (pandemic semester) in three anatomy courses (gross anatomy, histology & cytology and human embryology) was comparatively assessed. Furthermore, a survey was conducted to assess their perception and preference regarding the classroom and online examinations. The data obtained from the study was statistically analyzed.

Results: there was significant ($p \leq 0.05$) improvement in the participants' academic performance during online examinations in anatomy courses compared to classroom examinations. Majority (>70%) of participants opined that online learning enabled successful assessments; effective time management was hampered; online examinations were not more effective instead, the standard of questions were comparable to classroom examinations. Majority (> 60%) indicated that learning outcome and level of knowledge acquired during online learning was satisfactory but they still miss classroom examinations. In addition, home distraction, anxiety and stress affected the preparation for online examinations.

Conclusion: the application of technology has enabled an effective students' assessment in anatomy courses during the pandemic. The academic records showed an improvement during the online examination. However, the participants are more inclined towards classroom learning and assessment.

Keywords: Anatomy education; Online examination; Academic performance; Nigerian University.

Introduction

The coronavirus disease 19 (Covid-19) is a highly infectious disease which originated from Wuhan, China in December, 2019 and became rapidly transmitted around the world thereby leading to its declaration as a global pandemic on the 11th March, 2020 by the World Health Organization (WHO)[1,2]. Due to the rapid global transmission of the disease, the first case of covid-19 was soon detected in Nigeria on the 27th February, 2020 and this prompted the Nigerian federal government to declare strict preventive measures which included nationwide lockdown, restriction of human and vehicular movements and suspension of activities in all educational institutions in order to curtail transmission[3]. Following the suspension of the physical academic activities, universities around the world adopted a drastic change in the mode of academic content delivery to online mode of learning and assessment[4]. The primary reason for the adoption of online learning was to ensure a continuous and uninterrupted academic activities during the pandemic period. In addition, it would help to eliminate the risk of transmission of the disease through keeping the students on campus for the conventional classroom learning[5].

Generally, the advancement in technology witnessed in the past two decades has accelerated the usage of online platforms for academic assessment of trainees in different academic programmes and discipline of study[6]. This has enabled a fast, reliable and highly efficient evaluation of academic performances especially when large number or cross-section of trainees with limited human resources is involved[7]. The transition to online learning and assessment during the pandemic also impacted the training of medical and basic medical professionals leading to the adoption of technology-aided platforms for continuous academic engagements by many medical schools[8,9]. Among the crucial foundational course in medical training is anatomical science which is usually delivered and assessed using practical-based and clinically-oriented strategies with cadaveric dissection

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often regarded as the signature procedure[10,11]. In recent years, technological advancement has also impacted the academic learning and assessment in anatomical sciences and in many medical schools, the hybrid model which involves the physical and online platforms for learning and assessment has been adopted[12-14]. By the onset of the pandemic, the online platforms was already a common tool for anatomical science education in many medical colleges and faculties.

Prior to the Covid-19 pandemic, our institution has an online learning capability within the learning management systems (LMS) which is occasionally used for online learning and assessment. Following the closure of all academic institutions in Nigeria due to the pandemic, the online learning resource was fully activated to ensure continuous academic learning and assessments for all course modules including anatomical sciences. In this study, the aim was to comparatively assess the performance, perception and preference of the basic medical students of our institution regarding the physical classroom and online examinations in anatomy course modules conducted before and during the Covid-19 pandemic respectively.

Materials and Methods

Study Participants

This cross-sectional study involved eighty five (85) third year students of the faculty of basic medical sciences of our institution which comprised of 45 students of Nursing science (NSC), 27 students of Physiotherapy (PST) and 13 students of Human Anatomy (ANA) programmes. This represented 75%, 85% and 100% participation among the students of the three programmes respectively. In the second year of their study (2019-2020 academic year of our institution), the study subjects participated in the physical classes and examinations for anatomy course modules during the first semester (pre-pandemic period) and the online classes and examinations during the second semester (pandemic period).

Study Design

The academic performance (results) of study participants in three major anatomy course modules during the first (pre-pandemic) and second (pandemic) semesters of the 2019-2020 academic year was assessed from the official academic records of the Department of Human Anatomy. The three major anatomy course modules include the gross anatomy (GAN), histology & cytology (HCT), human embryology (HEB). Furthermore, a survey was conducted using the Google Forms (Google LLC, Mountain View, CA, USA) to collect data about the perception and preference of the study participants regarding the classroom and online examinations in anatomy courses. The survey form was shared to the study participants via the institutional e-mail starting from 1st September, 2021

till 30th September, 2021. The survey form contained a brief introduction of the study, first section which comprised the demographic information of participants and second section which comprised questions about the perception and preference of the participants regarding the online mode of learning and assessments in comparison with the classroom mode. The questions were derived with minor modifications from the questionnaire of effects from online classes on health and academic performance of university students (QEOC)[15]. The questions were to be answered using a five-point Likert scale which ranges from 5 = Strongly Agree (SA), 4 = Agree (A), 3 = Neutral (N), 2 = Disagree (D) and 1 = Strongly Disagree (SD). This study was conducted in accordance with the code of ethics of the World Medical Association (Declaration of Helsinki) after the institutional ethical approval. The informed consent of the participants was obtained before the commencement of the study and the privacy rights of the participants were observed.

Statistical Analysis

The demographic characteristics and responses of the study participants were presented as frequency and percentage, and other values were presented as mean ± standard deviation. The comparison of data was conducted using one-way analysis of variance (ANOVA) and Tukey's Honestly test for significant difference. The confidence interval level was 95% and $p \leq 0.05$ was statistically significant.

Results

In this study, the socio-demographic characteristics of the study participants include 64.71% under 20 years and 35.29% above 20 years; 43.53% males and 56.47% females; 52.9% Nursing science, 31.8% physiotherapy and 15.3% human anatomy students (Table 1). The academic records showed significant ($p \leq 0.05$) improvement in the academic performance of the study participants during the online examinations in the three anatomy courses compared to the classroom

Table 1. Socio-demographic characteristics of the study participants.

Variables	Number (%)
Age groups	
≤ 20 years	55 (64.71)
> 20 years	30 (35.29)
Gender	
Male	37 (43.53)
Female	48 (56.47)
Academic Programmes	
NSC	45 (52.94)
PST	27 (31.77)
ANA	13 (15.29)

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examinations (Tables 2 and 3). According to the findings of this study (Table 4), significant majority (> 70%) of the participants opined that online mode of learning also enabled the successful undertaking of academic assessments however, about 68% reported inability of effective time management for improved academic performance. Furthermore, significant majority (> 70%) indicated that the online examinations were not more effective than the classroom examinations but posited that the standard of the questions were comparable in both examinations. Among the majority of the participants (> 60%), home distraction, anxiety and stress associated with the online mode of learning affected the preparation for the online examinations and academic performance. Although, majority (> 60%) of the study participants reported a satisfactory learning outcome and level of acquired knowledge in the anatomy courses during online learning however, they still miss the classroom examinations.

Discussion

The assessment of students' knowledge is an important aspect of the medical education and there are different methods of assessments with their characteristics strengths and weaknesses[16]. However, an effective assessment should be contextual and emphasized the application of knowledge more than a recall of fact. Furthermore, learning outcomes which emphasize understanding and application of knowledge would promote knowledge retention more than outcomes at the level of knowledge recall[17]. The study by Ekwochi *et al*[18] had elaborated the factors that determine the academic performance of students in medical school in Nigeria and recommended their continuous review in order to improve the students' academic performance.

According to the results of this study, the academic performance of the study participants in the three anatomy courses (GAN, HCT and HEB) significantly

Table 2. Mean score during the classroom and online examinations in each course module according to academic programmes, gender and age groups.

Variables	Courses	Classroom Examination Scores	Online Examination Scores
		Mean ± SD	Mean ± SD
Age Groups			
≤ 20 years (n = 55)	GAN	52.55 ± 6.33	61.75 ± 5.45*
	HCT	51.33 ± 4.45	68.55 ± 3.48*
	HEB	53.55 ± 7.58	62.43 ± 5.75*
> 20 years (n = 30)	GAN	52.55 ± 5.75	60.35 ± 3.28*
	HCT	51.25 ± 6.75	60.44 ± 6.94*
	HEB	53.55 ± 6.25	65.17 ± 3.85*
Gender			
Male (n = 37)	GAN	52.77 ± 5.45	55.45 ± 4.85
	HCT	51.55 ± 6.75	61.55 ± 4.15*
	HEB	53.45 ± 6.43	56.56 ± 6.05
Female (n = 48)	GAN	54.65 ± 7.67	63.45 ± 4.55*
	HCT	52.33 ± 5.87	69.77 ± 5.65*
	HEB	53.45 ± 4.33	69.15 ± 4.85*
Academic Programmes			
NSC (n = 45)	GAN	54.65 ± 5.57	63.46 ± 4.23*
	HCT	53.66 ± 6.57	65.66 ± 6.55*
	HEB	52.15 ± 3.22	66.55 ± 5.99*
PST (n = 27)	GAN	55.69 ± 5.78	58.67 ± 6.75
	HCT	54.88 ± 6.75	64.74 ± 4.78*
	HEB	51.77 ± 4.84	59.76 ± 4.69*
ANA (n = 13)	GAN	54.43 ± 5.65	65.75 ± 4.33*
	HCT	51.33 ± 4.33	63.22 ± 5.56*
	HEB	53.23 ± 5.65	63.67 ± 4.89*
Total Participants (n = 85)		52.87 ± 6.87	65.77 ± 5.65*

* indicate significant difference at P ≤ 0.05

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Table 3. Distribution of students' performance during the classroom and online examinations in each anatomy module according to age groups, gender and academic programmes. [Grades: ≥ 70% = A (Excellent); 60-69% = B (Very Good); 50-59% = C (Good); < 50% = F (Fail)].

Variables	Courses	Classroom Examination Grades				Online Examination Grades			
		A (%)	B (%)	C (%)	F (%)	A (%)	B (%)	C (%)	F (%)
Age Groups									
≤ 20 years (n = 55)	GAN	4 (7.27)	10 (18.18)	33 (60.00)	8 (14.55)	10 (18.18)	18 (32.73)	23 (41.82)	4 (7.27)
	HCT	4 (7.27)	7 (12.73)	34 (61.82)	10 (18.18)	12 (21.82)	17 (30.91)	22 (40.00)	4 (7.27)
	HEB	5 (9.09)	8 (14.55)	33 (60.00)	9 (16.36)	11 (20.00)	18 (32.73)	23 (41.82)	3 (5.45)
> 20 years (n = 30)	GAN	2 (6.67)	4 (13.33)	18 (60.00)	6 (20.00)	5 (16.67)	9 (30.00)	14 (46.67)	2 (6.66)
	HCT	1 (3.33)	4 (13.33)	18 (60.00)	7 (23.34)	4 (13.33)	9 (30.00)	16 (53.34)	1 (3.33)
	HEB	2 (6.67)	6 (60.00)	17 (56.67)	5 (16.66)	5 (16.66)	11 (36.67)	14 (46.67)	0 (0.00)
Gender									
Male (n = 37)	GAN	2 (5.41)	5 (13.51)	20 (54.05)	10 (27.03)	5 (13.51)	12 (32.43)	16 (43.24)	4 (10.81)
	HCT	1 (2.70)	4 (10.81)	17 (45.95)	15 (40.54)	7 (18.92)	13 (35.14)	14 (37.84)	3 (8.10)
	HEB	2 (5.41)	6 (16.21)	18 (48.65)	11 (29.73)	4 (10.81)	12 (32.43)	19 (51.35)	2 (5.41)
Female (n = 48)	GAN	4 (8.33)	9 (18.75)	31 (64.59)	4 (8.33)	10 (20.83)	15 (31.25)	21 (43.75)	2 (4.17)
	HCT	4 (8.33)	7 (14.58)	35 (72.92)	2 (4.17)	9 (18.75)	13 (27.08)	24 (50.00)	2 (4.17)
	HEB	5 (10.41)	8 (16.67)	32 (66.67)	3 (6.25)	12 (25.00)	17 (35.42)	18 (37.50)	1 (2.08)
Academic Programmes									
NSC (n = 45)	GAN	3 (6.67)	8 (17.78)	30 (66.66)	4 (8.89)	7 (15.56)	14 (31.11)	19 (42.22)	5 (11.11)
	HCT	3 (6.67)	5 (11.11)	29 (64.44)	8 (17.78)	6 (13.34)	15 (33.33)	22 (48.89)	2 (4.44)
	HEB	4 (8.89)	8 (17.78)	27 (60.00)	6 (13.33)	8 (17.78)	17 (37.78)	18 (40.00)	2 (4.44)
PST (n = 27)	GAN	2 (7.41)	4 (14.81)	14 (51.85)	7 (25.93)	5 (18.52)	8 (29.63)	14 (51.85)	0 (0.00)
	HCT	2 (7.41)	3 (11.11)	16 (59.26)	6 (22.22)	6 (22.22)	7 (25.93)	11 (40.74)	3 (11.11)
	HEB	2 (7.41)	4 (14.81)	16 (59.26)	5 (18.52)	5 (18.52)	7 (25.93)	14 (51.85)	1 (3.70)
ANA (n = 13)	GAN	1 (7.69)	2 (15.38)	7 (53.85)	3 (23.08)	3 (23.08)	5 (38.46)	4 (30.77)	1 (7.69)
	HCT	0 (0.00)	3 (23.08)	8 (61.54)	3 (23.08)	4 (30.77)	4 (30.77)	5 (38.46)	0 (0.00)
	HEB	1 (7.69)	2 (15.38)	7 (53.85)	3 (23.08)	3 (23.08)	5 (38.46)	5 (38.46)	0 (0.00)

improved in the online examination during the pandemic semester compared to the classroom examination held during the pre-pandemic semester. Essentially, the online mode of learning has been described to foster the intuitiveness and adaptability of students' learning style which could engender an improved motivation and performance[18]. Similarly, the characteristic isolation from socially-interactive environment of classroom learning during Covid-19 pandemic has been reported to have a significant positive impact on the learning strategies, efficiency and academic performance of the students[19]. However,

studies have reported contrasting influences of social media on the students' academic performance due to its role as veritable platform for academic interaction or information sharing as well as a potent source of addiction or distraction[20,21].

Previous studies have reported the different factors that determine the academic performance of university students to include learning differences, grit and resilience, learning environment, mode or style of teaching, study habits and absenteeism[22,23]. Furthermore, the academic performance of students in medical colleges have been reportedly impacted

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Table 4. Distribution of responses about the participants' perception and preference between the classroom and online learning and assessments in anatomy courses scored on the Likert scale.

S/N	Questions	SA (5) No. (%)	A (4) No. (%)	N (3) No. (%)	D (2) No. (%)	SD (1) No. (%)
1	Had the online mode of learning helped you to undertake academic assessments successfully?	14 (16.47)	46 (54.12)	19 (22.35)	4 (4.71)	2 (2.35)
2	Had the online mode of learning enabled effective time management for improved academic performance?	2 (2.35)	13 (15.29)	12 (14.12)	46 (54.12)	12 (14.12)
3	Were the online examinations more effective than classroom examinations?	3 (3.53)	9 (10.59)	13 (15.29)	48 (56.47)	12 (14.12)
4	Were the online examination questions of comparable standard with those of classroom examinations?	14 (16.47)	47 (55.29)	11 (12.94)	8 (9.41)	5 (5.89)
5	Did the home comfort cause more distraction during preparation for the online examinations?	15 (17.65)	38 (44.70)	17 (20.00)	10 (11.76)	5 (5.89)
6	Did anxiety and stress associated with online mode of learning negatively impact your academic performance?	3 (3.53)	14 (16.47)	12 (14.12)	46 (54.12)	10 (11.76)
7	Was the learning outcome in anatomy courses during the online learning period satisfactory?	9 (10.59)	43 (50.59)	20 (23.53)	9 (10.59)	4 (4.70)
8	Was the knowledge of anatomy acquired during the online learning satisfactory?	10 (11.76)	38 (44.70)	15 (17.65)	17 (20.00)	5 (5.89)
9	Were your grades in anatomy courses improved during the online learning?	17 (20.00)	36 (42.35)	17 (20.00)	12 (14.12)	3 (3.53)
10	Did you miss classroom examination during the Covid-19 pandemic period?	10 (11.76)	45 (52.94)	15 (17.65)	12 (14.12)	3 (3.53)

by factors such as anxiety, stress, insomnia, time management, quality of teaching methodology[24]. Further studies among the university students regarding the online learning and assessment adopted during the Covid-19 pandemic reported the adverse impact of the new learning environment and behaviour as well as other environmental factors on the learning outcome and academic performance[15,25]. The adverse impact on the learning outcome and performance of students could be associated with the lack of access to instructional tools or procedures such as anatomical models and cadaveric dissection due to change in the learning environment[25]. However, the study by Kaur et al[26] reported that students' performance could be independent of the learning mode notwithstanding, some courses are more challenging than others during online learning compared to classroom learning.

Based on the findings of this study, the academic performance of the study participants during both the classroom or online examination showed no significant differences across the different demographic strata. This is in contrast to findings of previous studies that showed a sex-related differences in the academic performance wherein the females significantly out-perform their male counterparts. This sexual dimorphism in academic performance was associated with absenteeism and low self-esteem which were mostly prevalent among the male students[23,27]. Furthermore, a previous study has underscored the impact of social competence and emotional intelligence

leading to differential academic performance among medical students across different demographics[28].

Basically, the transition to online mode of learning and assessment was a strategy to achieve an uninterrupted academic engagements during the pandemic period when physical classroom learning was prohibited. The modality of assessment, semester examination and the resultant academic performance in anatomy courses had posed a concern to the faculty lecturers in our institution during the early period of the pandemic. Generally, the academic performance of students in medical and allied health courses has been described as a matter of interest to many stakeholders including faculty lecturers and committees saddled with students' selection, curriculum planning and teaching planning[29]. Furthermore, the existence of an institutional online learning and assessment resource had enabled non-disruption of the academic activities during the second semester of the 2019-2020 academic year. The study by Alsoufi et al[30] further emphasized that the adoption of online platforms for examination in medical course modules during covid-19 pandemic had helped to ensure uninterrupted training of medical students and avoid any disruption during their training period.

Conclusion

The application of technology has enabled a relatively effective students' assessment strategy in

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anatomy courses during the cessation of the physical classroom assessment due to the Covid-19 pandemic. The academic performance of students showed an improvement in the online examination compared to the classroom examination. However, regardless of the perceived positive impact of the online learning and assessment, majority of the students opined their preference for classroom learning and assessment.

Recommendation

The anatomical science learning and assessment strategy in medical colleges in Nigeria and beyond requires some urgent review in order to integrate effective online teaching and assessment system that would enable a continuous and uninterrupted academic engagements during unforeseen global emergencies.

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