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## Assessment of the Perception and Impact of Anatomy Education via Virtual Learning Environment: A Study Using Edo State University Uzairue

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**ABSTRACT**

Advancement in technology has created virtual resources such as; anatomy applications and virtual dissection tables, which has positively transformed Anatomy education. The objective of this research is to ascertain the students' perception of learning anatomy via virtual learning environment (VLE), determine respondent's preferred virtual resource for learning anatomy and assess the outcome of employing VLE in Anatomy education. This study population comprises of undergraduates enrolled into the departments of Anatomy, Nursing and Medical laboratory Science, Edo State University, Uzairue, Nigeria. Questionnaire was designed, tested for reliability and distributed after securing respondents informed consent. Results were analyzed using SPSS version 21 for windows and reported as percentage in tables and charts. Closed-ended questions were analyzed using Pearson Chi-Square test. From the results 214 students (85.3%) completed the questionnaire. Majority were female (77.6%). 63.1% of respondents were between 19 – 22 years. 84 respondents (39.3%) uses android phone for virtual study, although, another 33 respondents (15.4%) uses a combination of android and laptop. Anatomy applications were used by 50.5% of students, and most of them (26.2%) preferred the TeachMe Anatomy application. Students' perceived the use of VLE as advantageous to their learning anatomy ( $\chi^2 (28, N=214) = 291.678, p < 0.01$ ). Furthermore, student's involvement in learning anatomy through virtual technology had a positive impact on their learning attitude, assimilation and retention ( $\chi^2 (28, N=214) = 100.495, p < 0.01$ ). Conclusively students of Edo State University acknowledge learning of anatomy through VLE, as it makes the learning of anatomy accessible, interesting, and easy to comprehend as well as assimilate, although with challenge of high data consumption.

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**Introduction**

There has been a diverse perception of learning anatomy via virtual technology by students of which Edo State University is a micro community of such students' populations. Human anatomy is a branch of science that deals with the study of human structures. It is an essential discipline for students in health-related fields [1, 2]. The discipline of anatomy can be studied under three major areas; macroscopic anatomy (Gross Anatomy), microscopic anatomy (Histology) and developmental anatomy (Embryology) [3].

One of the main features of modern anatomy education has been the application of new technologies for learning and teaching [4]. In Nigeria, anatomy education began as early as the year 1963 at the University of Ibadan and as at then, anatomy was taught as a subject for health-related degree programs [5]. In addition, it is presently taught as a course leading to the award of bachelor's degree at various Nigerian Universities [6]. So far, several studies on anatomy education have revealed various methods involved in learning and teaching anatomy, although; there are still debates on the most suitable method of delivering anatomy education [7]. Unlike in developed countries where there are advances in several

areas related to anatomy teaching, Nigeria and Africa are still caught with the traditional and ancient philosophies of teaching anatomy, which in turn has affected the learning approach [6].

The revolution and easy access to virtual resources like anatomy applications, e-book, educational videos and conferences has open paths for teaching and learning anatomy using the virtual learning environment [8, 9]. Virtual learning environment (VLE) is a digital space for teaching and learning using web-based software systems without restriction of time and place [10, 11]. Various studies have outlined websites, lectures (captured with PowerPoint slides), audio recording, software applications, video conferences, social network, online documents and online databases as essential resources in acquiring knowledge virtually [11, 12].

The use of virtual learning environment (VLE) supported by the internet is increasingly becoming of interest among education institutions, students and teachers [13]. Some studies investigating the impact of VLE on students' performance suggested that learning with multimedia technology and video clips including those assessed from YouTube has resulted to better grades [3, 14, 15]. Furthermore, the impact of virtual technologies in learning has been summed up to four main aspects as follows; increases students' motivation and engagement, allowing a constructive

approach of learning, affordability and accessibility, especially to disabled students [9]. Also, virtual technology has the potential of making students feel more committed to studying, increasing their learning performance and cognition skills [16].

Despite these advantages, students complain that assessing the resources from virtual technology is expensive and time consuming [17]. In addition, their perception is that the voluminous course content in the respective areas of Gross Anatomy, Histology, Embryology and Neuro anatomy is less interactive when learning virtually [18]. Therefore, in order to confirm the perception and impact of VLE in a Nigerian student population, this study has identified Edo State University, Uzairue as presently the only Nigerian educational institution using both the CANVASS Learning Management System and Anatomage virtual dissection table as virtual learning resources in teaching anatomy [19]. This study is therefore designed to ascertain the students' perception of virtually learning anatomy courses/modules, determine respondents preferred virtual resource for learning anatomy and access the outcome of employing VLE in Anatomy education.

## Materials and Methods

### Study Design/ Population

This is a cross-sectional survey. The study was carried out among undergraduate students that were recently taught and currently learning these anatomy courses with their practical contents implied – Gross Anatomy, Embryology, Histology or Neuroanatomy during the 2020/2021 academic session as they are mandatory components of anatomy course for medical examinations at Edo State University, Uzairue, Nigeria. Although, these students were enrolled into different programs; Anatomy, Nursing and Medical Laboratory Science.

Exclusion criteria included first year students who have not been taught any anatomy course, students not within their 2nd or 3rd year of their study and students with anatomical impairment that might affect the use of the virtual learning environment.

### Instrumentation

Hard copy questionnaire was designed by the authors and reviewed by experts in a random sampling technique. The questionnaire was further tested for reliability. The questionnaire consisted of basic demographic data, multiple-choice questions and closed ended questionnaire. The multiple-choice questions were used to access the devices and virtual means in which respondent's used in learning anatomy. The closed ended questions were designed on a five-point quantitative Likert scale [20]. The closed ended questions were grouped into two sections having eight questions each. The first section accessed the students' perception of learning anatomy by virtual technology while the second section accessed the outcome of employing the virtual learning environment in learning anatomy. The purpose of the study, the importance of candid responses and the pattern in which the questionnaire was design were clearly explained to the respondents before distributing the questionnaire. 20 minutes was given to the students for adequate time and then retrieved afterwards. All respondents were conveniently accessed in their classrooms during their free/break period for maximum attention and focus.

### Ethical Consideration

The ethical consideration for questionnaire administered research was followed after approval by the Institutional/Faculty research ethical board (IRB) and as such identity of the respondents were kept secret and responses treated based on confidentiality. We got the informed consent of all the students (respondents) after we

explained the aim of the study.

### Statistical Analysis

All data were keyed into an Excel spreadsheet and then analyzed with the statistical package for social science (SPSS) version 21 for Windows. Closed ended questions were analyzed using Pearson Chi-Square test for independence. Demographic data and other categorical variables in this study were explored using frequencies, percentages and presented using tables and stacked bar chart.

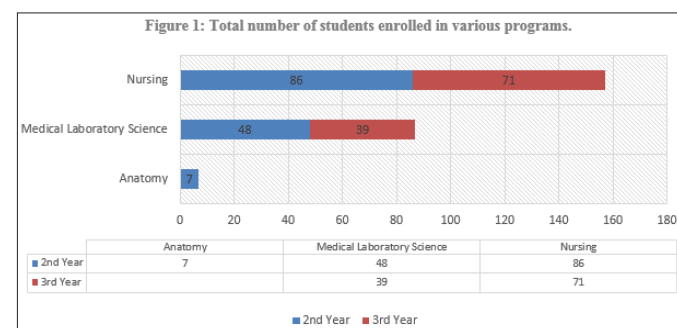
### Reliability Test of the Questionnaire

The reliability assessment was done for the two sections of closed ended questions after data collection. A Cronbach's alpha value of 0.717 was revealed for section C (containing 8 statements) and 0.811 for section D (containing 8 statements), which was indicative of an acceptable questionnaire [21].

## Results

### Study population

Figure 1 depicts the total number of students that enrolled into various B.Sc. programs in each year during the 2020/2021 academic session. 7 students enrolled for anatomy, 87 students enrolled for medical laboratory science while 157 students enrolled for nursing program. Out of the 251 students enrolled in all programs, 214 students were around and volunteered to complete the questionnaire, which represent 85.3% of the total population enrolled into these programs at the University.



Demographic Characteristics of the respondents.

The demographic characteristics of respondents are presented in Table 1.

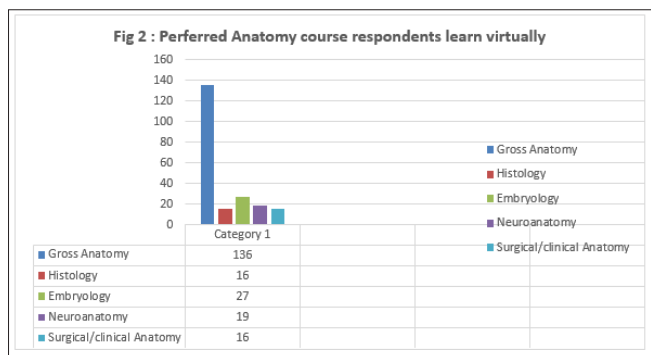
**Table 1: Demographic Data of Respondents**

Variables	N (214)	Percentage (%)
Sex		
Male	48	22.4
Female	166	77.6
Age in years		
15 – 18	65	30.4
19 – 22	135	63.1
23 – 26	13	6.1
27 – 30	0	0
>30	1	0.4
Enrollment Pattern		
Regular	187	87.4
Direct Entry	20	9.3
Transfer	7	3.3

Of the 214 students, about 77.6% were female, while 22.4% were male. The age of respondents ranged from 15 years to above 30 years. Majority of students (63.1%) were between 19 – 22 years, while only 0.4% of students were above 30 years. Based on the enrollment pattern, around 87.4% of the students enrolled as regular students, 9.3% were admitted through direct entry, and 3.3% were transfer students.

### Virtually learning Anatomy

Figure 2 shows the Anatomy courses which the students prefer learning through virtual means.



Most of the Students (136, 63.6%) prefer learning Gross Anatomy by virtual technology, 27 students (12.6%) prefer Embryology, and 19 students (8.8%) prefer learning Neuroanatomy through virtual learning environment.

### Device and Means of Learning Anatomy Virtually

The students' response to questions that accessed the devices and methods used in learning anatomy virtually are summarized in Table 2. Eighty-four students (39.3%) uses android phone, forty students (18.7%) uses laptop, thirty-seven students (17.3%) uses iPhone, thirty-three students (15.4%) uses a combination of android and laptop, fourteen students (6.5%) uses a combination of iPhone and laptop, while the others use either tablet (1.9%) or blackberry (0.9%).

50.5% of the students preferred using anatomy applications. It is observed that from the 50.5%, 26.2% preferred using the TeachMe Anatomy application. 20.6% chose Anatomage virtual dissection Table as their preferable virtual means of learning anatomy. 17.3% preferred online platforms, such as CANVASS (13.6%), Coursera

(2.3%) and Goggle Meet (1.4%). 11.6% of the students preferred using multimedia technology, such as videos (5.1%), PowerPoints (4.2%) and flash cards (2.3%).

**Table 2: Devices and means used to learn anatomy virtually**

Variables	N= 214	Percentage (%)
<b>DEVICE</b>		
Android phones	84	39.3
iPhone	37	17.3
Laptop	40	18.7
Tablet	4	1.9
Blackberry	2	0.9
Android and Laptop	33	15.4
iPhone and Laptop	14	6.5
<b>MEANS</b>		
<b>i. Anatomage</b>		
<b>ii. Online Platform</b>		
- CANVASS	29	
- Coursera	5	
- Goggle Meet	3	
<b>iii. Anatomy Applications</b>		
- 3D Atlas	19	8.9
- TeachMe Anatomy	56	26.2
- Complete Anatomy	8	3.7
- 3D Bones	7	3.3
- Essential Anatomy	3	1.4
- Kenhub	15	7.0
<b>iv. Multimedia Technology</b>		
- Videos	11	5.1
- PowerPoints	9	4.2
- Flashcards	5	2.3

Learning Anatomy via virtual learning environment.

**Table 3: Students' perception towards learning Anatomy via virtual means (N = 214)**

	Statement	Response, n (%)					Mean	Median
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree		
1	I understand better when I use virtual methods to learn Anatomy than theoretical classes.	23 (10.7%)	64 (29.9%)	26 (12.1%)	58 (27.1%)	43 (20.1%)	2.96	3.00
2	I like the communication flow in terms of feedback and content sharing	5 (2.3%)	9 (4.2%)	28 (13.1%)	136 (63.6%)	36 (16.8%)	3.86	4.00
3	Virtual learning of Anatomy has isolated me from peer-group study and interactions	19 (8.9%)	68 (31.8%)	42 (19.6%)	66 (30.8%)	19 (8.9%)	2.76	3.00
4	Virtual learning has made it possible to study Anatomy at anytime and anywhere	5 (2.3%)	7 (3.3%)	10 (4.7%)	120 (56.1%)	72 (33.6%)	4.14	4.00

5	I find it easy and less time consuming when I use virtual methods in learning Anatomy	15 (7.0%)	31 (14.5%)	34 (15.9%)	93 (43.5%)	41 (19.2%)	3.45	4.00
6	Virtual means of learning Anatomy makes available more time for self-study	11 (5.1%)	22 (10.3%)	35 (16.4%)	101 (47.2%)	45 (21.0%)	3.63	4.00
7	I feel learning Anatomy virtually will have no reason to halt classes/learning	25 (11.75%)	37 (17.3%)	46 (21.5%)	83 (38.8%)	23 (10.7%)	3.14	3.00
8	I am okay with learning Anatomy virtually but the process consumes data	9 (4.2%)	24 (11.2%)	15 (7.0%)	93 (43.5%)	73 (34.1%)	3.85	4.00

$\chi^2 = 291.678$ ,  $df = 28$ ,  $p < 0.01$ ,

Table 3 shows the responses of students regarding the eight statements aimed to assess their perception of learning anatomy courses/modules using virtual technology. A greater number of students (120, 56.1%) agreed to the fourth statement which is “Virtual learning has made it possible to study Anatomy at anytime and anywhere”. 68 students (31.8%) disagreed to statement three “Virtual learning of Anatomy has isolated me from peer-group study and interactions”, while 66 students agreed (30.8%). Although, 42 students (19.6%) gave neutral response to that statement 3. Most of the students are okay with learning Anatomy virtually but the process consumes data (median = 4). However, the students gave a neutral response (median = 3) concerning statement one and seven which is “I understand better when I use virtual methods to learn Anatomy than theoretical classes” and “I feel learning Anatomy virtually will have no reason to halt classes/learning”. In general, a chi-square value ( $\chi^2$ ) of 291.678 and p-value of <0.01 was observed; hence, students perceived the use of VLE as advantageous to their learning anatomy.

**Table 4: Respondents response regarding the outcome of learning anatomy using virtual technology (N = 214)**

	Statement	Response, n (%)					Mean	Median
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree		
1	Virtual learning has a positive impact on my effectiveness as a student	9 (4.2%)	23 (10.7%)	28 (13.1%)	111 (51.9%)	43 (20.1%)	3.66	4.00
2	I have the ability to remember diagrams I studied from Online Atlas, Anatomage & other virtual means than using hard copy textbooks.	19 (8.9%)	29 (13.6%)	31 (14.5%)	91 (42.5%)	44 (20.6%)	3.47	4.00
3	I easily assimilate lectures delivered with PowerPoints, videos and other virtual means than through handwritten notes.	2 (0.9%)	19 (8.9%)	25 (11.7%)	108 (50.5%)	60 (28.0%)	3.87	4.00
4	I get serious with studying and attending Anatomy lectures because of the virtual learning environment (VLE)	13 (6.1%)	46 (21.5%)	49 (22.9%)	84 (39.3%)	22 (10.3%)	3.10	3.00
5	My exposure to VLE makes me practice research and gives me insights on research even before my dissertation	11 (5.1%)	29 (13.6%)	38 (17.8%)	110 (51.4%)	26 (12.1%)	3.43	4.00
6	VLE has exposed me to an interactive form of learning, hence; has built my confidence and communication skill	20 (9.3%)	34 (15.9%)	41 (19.2%)	98 (45.8%)	21 (9.8%)	3.24	4.00
7	The visuals I get when I learn Anatomy from virtual means reduces the rate of cramming	7 (3.3%)	21 (9.8%)	29 (13.6%)	105 (49.1%)	52 (24.3%)	3.74	4.00
8	I feel excited and motivated learning Anatomy virtually	11 (5.1%)	32 (15.0%)	45 (21.0%)	85 (39.7%)	41 (19.2%)	3.42	4.00

$\chi^2 = 100.495$ ,  $df = 28$ ,  $p < 0.01$

As shown in Table 4, 108 students (50.5%) agreed to statement three “I easily assimilate lectures delivered with PowerPoints, videos and other virtual means than through handwritten notes”. Regarding statement four, 46 students (21.5%) disagreed, 49 students (22.9%) gave neutral response, 84 students (39.3%) agreed. Then, the respondents agreed (median = 4) to all other statements in this section evaluating the outcome of using virtual learning environment in anatomy education. From the chi-square value of 100.495 and p-value of < 0.01, it can therefore be deduced that the student’s involvement in learning anatomy through virtual technology has a positive impact on their learning attitude, assimilation and retention.



## Discussion

The demographic statistics of this study in Table 1 shows that anthropometric index of age and sex plays a role in preference to the use and application of VLE for study and ultimately learning as seen in high percentage rate of females and age between 19 – 22 years old.

From table 2, it is observed that 17.3% preferred online platforms, with CANVAS (13.6%) being the highest as a learning management system among students of Edo State University, Nigeria. This can be said to arise from the basis of its integrative interactive approach to teaching and learning laded with faster, rich resource base for information, which according to [22] promotes new practices and paradigms for education where the teacher has to play new role of mentoring, coaching and helping students in their studies rather to play the conventional role of spoon-feeding in the classrooms in addition to learning independently with a wide choice of selection and access to varied information to enhance understanding and knowledge [23].

The usefulness of multimedia technology of VLE x-rayed in Table 2 and its perception on students' effectiveness in Table 4, statement 1 clearly agrees with work [24] of new experiences gained by both teacher and students. This remark on effectiveness seen with general respondent median value of 4.00 in statement 1 of Table 4 aligns completely with perceived usefulness evaluation of similar work on virtual classroom [25].

The students gave a neutral response (median = 3) to statement 1 in Table 3, which is "I understand better when I use virtual methods to learn Anatomy than theoretical classes", which with the  $p < 0.01$  is not in agreement with [26] on the perception that students who enrolled in e- learning courses are more likely to produce accurate results and solutions than students who enrolled in traditional learning. In reference to table 3 on student perception, it is noted that statement 2 on the interactive potential and information sharing via virtual learning platform is in line with work [27], where above 50% agreed as well as being too expensive due to its data consumption thereby affecting its sustained effectiveness at all times it ought to be. This observation therefore requires a collaborative effort between network providers and institutions of higher learning where large volume of data is utilized for research and learning. It is observed from Table 2 that availability, technicality and understanding of the application of certain VLE devices/tools and means affects its effective usage for learning towards Anatomy as a complex course of study.

The neutrality of perception on isolation for peer group learning in Table 3 of statement 3 clearly aligns with sense of learner isolation noted [28] seen as a source of potential concern towards collaborative learning. As observed from our result, statement 4 of table 3 showed the highest mean value of 4.14. That statement "Virtual learning has made it possible to study Anatomy at anytime and anywhere" does not support the view of [25,29,30] with lower mean value of 3.06 on total flexibility of VLE considering due date and time on quizzes and exams even when not convenient as also revealed on a perception factor report on students at Paisley University [31].

The students' perception on less time consuming highlighted in statement 5 of table 3, though within similar percentage value opposes the view of [32] as 30 percent of participants in their open-ended responses commented that the completion of the online units required too much time. The students' view regarding Anatomy in this study may be attributed to lesser modules and content of work

done at 2nd year of majority of participants analyzed as against that of [33] where majority of the respondents were in their 4th year and with more work loads.

As noted in Table 3, statement 6 on self-study, result showed a very high mean value reflecting overwhelming positive agreement likely to the freedom of managing time by oneself without encroachment by teachers and hence significant as compared to very low mean value of 0.56 in work [33] in India during the covid-19 pandemic peak. Equally largely agreed by respondents in a mean value of 3.14 with slightly collaborate with [25] with mean of 2.87 on not replacing virtual learning environment with physical classes is a perception to maximize to the students' greater gains.

The evaluation of VLE impact on motivation to learning Anatomy as noted in Table 4, statement 8 is exciting but will however support the opinion of [34,35,36] that suggested that motivation is one of the factors that affect online student learning performance and that VLE needs vast amount of motivation and self-control to achieve goal of learning and understanding beyond just being exciting. This is as vividly put [37] "Students who are motivated to learn will choose tasks that enhance their learning, will work hard at those tasks, and will persist in the face of difficulty in order to attain their goals.

Overall assessment of impact in Table 4 can be seen to have enhanced seriousness on students' commitment, effectiveness in learning with better visuals towards minimizing plain memorizing, greater insight on research and a general boost in confidence and communication. This high impact value on effectiveness can be ascribed to appreciation of Gross Anatomy against other branches of the discipline as noted in Figure 2.

## Conclusion

The study and its findings no doubt has provided important insight about students' perceptions of virtual learning environment and outcome assessment of impact with the summary that teaching and learning through virtual learning platforms enhances interactive, independent, rich resource source and a faster means of supportive learning with improved results as impacts of evaluations on the students' studies in the Edo State University case study through the learning of Anatomy. It should be taken into cognizance some of the perceptions of students that seems to have negative implication to achieving the totality of balanced education by Universities and developers of virtual learning platforms such that evaluation of virtual learning environment can help in designing systems and adopting it to fit all ill perceived scenarios.

It is advised that virtual learning environment should not be a total substitute to teacher's role in physical mentoring, guiding, monitoring and evaluation that students constantly need for all round appraisals but rather incorporate where necessary blended learning especially at its growing phase presently to help address the satisfaction visa-vis the impact on goal delivery. As the use of virtual learning environment grows increasingly among students of higher learning in learning and understanding of medical courses especially a structural course like Anatomy, the need to optimize instructional designs and technology to maximize learning opportunities and achievements including more direct interactions for peer groups feedback, simulations and problem solving to real life scenario will be a priority for managers of education process and student's outcome.

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