

Virtual learning environment on satisfaction and academic performance of students in institutions of higher learning

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Article Info

Article history:

Received Apr 7, 2024

Revised Dec 16, 2024

Accepted Feb 28, 2025

Keywords:

Distance learning

Google classroom

Learning management

Online learning

Virtual learning

ABSTRACT

As a result of the COVID-19 outbreak in 2020, education institutions across the world had to come to a functional standstill since they had to protect their students from viral exposures thereby affecting academic activities. However, several institutions had to adopt online virtual learning environments (VLE) using basic information and communication technology tools to provide platforms for teaching and learning thereby mitigating the effects of the pandemic on the students. This study was focused on the identification of the various types of VLE tools that were adopted alongside the impact that these tools had on learning satisfaction and the academic performance of students of higher learning in Nigeria. This study adopted a purposive simple random selection of undergraduate students of the department of computer science who had adopted the use of VLE to learn during the period of the pandemic. The results of the study showed that the most popular VLE tools were Zoom, Google Classroom, WhatsApp, Telegram, Coursera, Google Forms and learning management systems (LMS) while the least popular VLE tools were Microsoft Teams, Moodle/Edmodo, and Google Meet. The results showed that the students agreed to their behavioral intention to use VLE, the impact of VLE on learning satisfaction, and the impact of VLE on academic performance alongside the existence of a positive correlation among the research variables.

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1. INTRODUCTION

The advent of the COVID-19 pandemic caused many schools to have no option but to use Virtual Learning Environments (VLEs) extensively for online schooling, leading to a global trend in education. Though this change ensured that learning could go on, several challenges regarding contentment, success in learning, and participation among learners have come to light. Various tools with different effectiveness are mostly used by existing methods to teach online—these tools are synchronous or asynchronous in nature and they include Zoom, Google Classroom, or learning management systems (LMS) [1], [2]. There are several constraints these platforms typically face including limited accessibility, varying student interest, and mandatory extensive digital expertise. The study aims to provide an unbiased assessment of the impact of

different VLE technologies on academic results as well as student contentment at the university level. Commonly, these platforms are faced with problems like inaccessibility, inconsistent enthusiasm among students as well as a need for deep digital knowledge. The objective of the research is to investigate the impact of academic achievement and student satisfaction in higher education from different VLE technologies.

Due to the outbreak of COVID-19, also known as the coronavirus disease, several nations have recommended the suspension of all forms of education [3], [4]. As a result, educational institutions had ground to a halt as they did not want to expose their students to any viral exposures, which are prone to taking place in a highly socializing student community. The negative impact of COVID-19 on education: the case of Japan, infection outbreaks as disaster situations. In mid-march 2020, the national levels of School closures in over 150 countries as a result of the COVID-19 pandemic had put one student in fifth of the world out of schools and universities. According to United Nations Educational, Scientific and Cultural Organization (UNESCO). In this case, UNESCO (2020) reported that by the end of April 2020, 190 countries had announced country wide closure disrupting 73.8% of the total learners currently enrolled. Even if it is true that lockdown and social distancing were the only effective measures to mitigate the spread of COVID-19 by disrupting the chain of transmission, the temporary closure of schools and colleges meant that a significant population of students was affected.

Due to the lockdown of the educational institutions for an undefined time, both these institutions and the students were coming up with methods of covering their given syllabi as per the academic calendar [5]. This undoubtedly caused some difficulties but it had also generated some new cases of educational creativity through the use of digital means [6].

This was the saving grace, given how slow reforms started penetrating the academic institutions, which during this period still focused on the archaic one-way communication teaching model, had structural barriers, and outdated learning environments. Anyway, the scenarios of educational establishments all around the planet, experiencing COVID-19 have been put in practice very shortly at the initiative of institutions. In that period, the majority of the universities had gone to the online mode with the usage of such tools as Blackboard, Microsoft Teams, Zoom, or other ones.

This study is important since it authenticates the effectiveness of VLEs when faced with unexpected interruptions such as the COVID-19 pandemic. This research reinforces the scientific consensus that VLEs can help maintain academic performance and student satisfaction during times of crises. Moreover, it underlines how flexible digital platforms can be for different educational requirements, thereby countering some previous studies which questioned the ability of online learning platforms to ensure quality education during such periods.

The educational establishments in areas affected were looking for temporary measures in order to go on with teaching even with the understanding that the quality of learning greatly depended on the levels and effectiveness of embrace of technology as noted by [7], [8]. There were no comparative benefits of online learning over face to face learning in terms of motivation, satisfaction, and interaction across the learners [9]. The community of inquiry (COI) model provides a practical baseline for the enhancement of the online teaching and learning process [10]. As per the premises of the COI framework, the basic condition in the provision of web-guided instruction is the establishment of a learners' group. In this group setup which can be likened to a physical classroom, learning occurs via three equal elements of social, cognitive, and teaching presence [11].

One of the areas which challenges online learning is students' learning experiences and achievement. According to Sampson *et al.* [12], Zen and Ariani [13], a student's satisfaction and his or her outcomes is a good measure of gauging the quality and the efficiency of the online programs. There is an interest on the part of the institutions to find out if the students, in this case, are generally happy with the learning experience [14]. Another important aspect of online education's quality is learner engagement [15]. Learner engagement is the degree of effort that the learner exerts to enhance and engender psychological commitment towards staying in the learning process, wanting to learn, and developing oneself intellectually [16], [17]. There are different ways of how student engagement is conceptualized [18], [19] but it seems that engagement in online learning especially for the learning analytics advocates is understood in terms of the analysis of the platform accessed log files including the number of clicks on the learning resources [20]. The assertion is that participation in an online course is demonstrating by logins or clicks on a person's profile resulting in better performance. Nonetheless, this model is-in principle, the best suited for traditional classroom-based e-learning courses where such limitations exists. However, there are few working papers assessing the level of student engagement in activity-driven blended learning settings where both online and offline activities are implemented [21], [22].

Arsenijevic *et al.* [23], the aim of this research is about elements from the Community of Inquiry (CoI) model of online learning to investigate the features of satisfaction in e-learning during the period of the COVID-19 pandemic. According to the results of the Kruskal-Wallis test, satisfaction with online learning does not vary depending on whether students have high or low academic achievement but social presence is

rated significantly higher (“Tools and platforms for online learning allow students to work with each other”) by those who have poor performances.

Amir *et al.* [24], worked on the assessment of the students’ perception of classroom and distance learning during the COVID-19 pandemic. The study used a structured questionnaire for collecting information from undergraduate students studying dentistry at a higher institution in Indonesia. The results of the study showed that a higher number of first-year students preferred distance learning to classroom learning compared to their seniors. The results also showed that students preferred classroom learning for group discussions because the difficulty in communication via distance learning provided less satisfaction. The study concluded that the students could adapt to changing technologies however a blended learning approach that combined both was recommended. The study focused on a comparison of the perception of classroom and distance learning concerning preference, effectiveness, and learning satisfaction.

Sharma *et al.* [25], assessed students’ satisfaction towards online learning alongside its associated predictors. A structured online questionnaire was used to collect information from students covering four areas of student satisfaction via Google Forms. The results of the study showed that the majority of the students were satisfied with online learning and the bivariate analysis revealed that all four domains were positively correlated with each other as well as with overall students’ satisfaction. The study also revealed that significant predictors of student satisfaction include being female gender, Wi-Fi as a modality for learning, and the learner’s dimension score. The study was focused on the assessment of students’ satisfaction with online learning and its associated predictors.

Fatani [26], studied the students’ satisfaction with video-conferencing teaching quality during the COVID-19 pandemic. The study adopted the reduced students’ evaluation of educational quality (SEEQ) survey for the collection of information from undergraduate students. The results of the study showed that the majority of the students were satisfied with the video-conferencing technology adopted for learning but they were intellectually challenging [27]-[30]. The study concluded that the use of video-conferencing had an overall positive outcome on students’ satisfaction but teaching quality relied on teaching, cognitive, and social presence rather than on technology. The study focused on the assessment of students’ satisfaction based on video-conferencing teaching quality.

Weng *et al.* [30], assessed the attitude towards the use intention of multimedia among school teachers. The study collected information from school teachers covering areas that include perceived usefulness, perceived ease of use, attitude towards using technology, and the intention to use technologies based on the technology acceptance model (TAM). The results of the study showed that the ease of use of technology and attitude towards use would enhance the intention to use the technology. The study was limited to the assessment of the teachers’ intention to use multimedia technologies in teaching.

2. METHOD

This section presents the various data analysis techniques that were adopted for performing the descriptive and inferential statistical analysis of the data collected in this study. An attempt was made to assess the impact of VLE on student’s satisfaction and academic performance. To achieve this, an attempt was made to assess the students’ perception of the various types of VLE tools that are available for use across academic institutions in Nigeria. This study attempts to assess the causal relationship that exists between the perception of the behavioral intention to use VLE, the perception of the impact of VLE on students’ satisfaction, and the perception of the impact of VLE on students’ academic performance. To this effect, four research questions were proposed in this study to understand the underlying relationship existing between them. They are:

- a) What is the causal relationship between the perception of the students’ behavioral intention to use VLE and the perception of the impact of VLE on students’ satisfaction?
- b) What is the causal relationship between the perception of the students’ behavioral intention to use VLE and the perception of the impact of VLE on students’ academic performance?
- c) What is the causal relationship between the perception of the impact of VLE on the students’ satisfaction and the perception of the impact of VLE on the student’s academic performance?
- d) What is the causal relationship between the perception of the students’ behavioral intention to use VLE and the perception of the impact of VLE on students’ satisfaction on the impact of VLE on the student’s academic performance?

2.1. Sample size

This study considered a sample size of 100 undergraduate students consisting of male and female students. The students were selected from the department of computer science because of their vast

understanding of trending ICT technologies and because they tend to easily adopt such technologies with little or no interference.

2.2. Instrument of data collection

A structured questionnaire was constructed to collect the data required in this study. The purpose for which the questionnaire was completed was explained to each respondent who was given the questionnaire to respond to. The respondents were given enough time to complete the questionnaire while the areas of difficulty in the questionnaire were further explained to the students.

2.3. Demographic Information

This is the bio-data to be filled by the participants. Tables 1 to 4 shows the VLE perception on student behaviors. For each of the questions presented below, select the option that best describes you:

1. Gender: Male () Female ()
2. Age group: Below 18 years () 18 – 25 () above 25 years ()
3. Method of Entry: UTME () JUPEB () DE () others (specify): _____
4. Ethnicity: Yoruba () Igbo () Hausa () others (specify): _____
5. Father's Highest Education: Secondary () Polytechnic degree () Undergraduate degree () Postgraduate degree () MBA () others (specify): _____
6. Mother's Highest Education: Secondary () Polytechnic degree () Undergraduate degree () Postgraduate degree () MBA () others (specify): _____
7. Father's occupation: Clerical () Teacher/Lecturer () Trader/Business () Banker () Lawyer () Medicine/Nursing () Clergy () others (specify): _____
8. Mother's occupation: Clerical () Teacher/Lecturer () Trader/Business () Banker () Lawyer () Medicine/Nursing () Clergy () others (specify): _____
9. DeA devices to access Virtual Learning Environment (VLE) (select as many as possible): Smartphone () Tablet () Laptop Computer () Personal Computer ()
10. Availability of Internet access for using VLE: Always () Sometimes () Rarely ()

Table 1. Perception of VLE

S/N	Virtual learning tools	Yes	No
1.	Microsoft® Teams		
2.	Google® Meet		
3.	Zoom® Video Conferencing		
4.	Google® Classroo		
5.	Moodle® or Edmodo® or Blackboard Learn®		
6.	Learning Management Systems (LMS)		
7.	WhatsApp®		
8.	Telegram		
9.	Google® Forms		
10.	Coudera® or EdX®		

Key: Strongly agree (SA), Agree (A), Disagree (D), Strongly disagree (SD)

Table 2. Perceived student behavioural intention to use VLE

S/N	Statements	SA	A	D	SD
1.	I have sufficient skills to use VLEs				
2.	I was willing to make use of VLEs upon introduction by lecturers				
3.	I was willing to adopt VLEs for performing my academic activities				
4.	I was willing to make use of VLEs regularly				
5.	I was willing to recommend VLE to other students to use				
6.	I plan to use VLE to support lectures in the future				

Table 3. Perceived impact of VLE on student satisfaction

S/N	Statements	SA	A	D	SD
1.	I have confidence in using VLE with little or no assistance				
2.	I have confidence in using onlinelarnings via VLEs				
3.	I have confidence when using VLE features				
4.	I feel that I have a variety of experiences without any interference				
5.	I feel that VLE meets my academic needs as a student				

Table 4. Perceived impact of VLE on student academic performance

S/N	Statements	SA	A	D	SD
1.	The use of VLE has improved my academic performance				
2.	The volume of assignments via VLE improved my concentration				
3.	The use of VLE was better compared to face-to-face learning				
4.	Taking quizzes and exams online via VLE was more convenient				
5.	The use of VLE made learning less challenging				
6.	The use of VLE improved my access to learning materials				
7.	The use of VLE improved my imagination by obtaining more information				

3. RESULTS AND DISCUSSION

Data for this study was collected from undergraduate students of higher institutions of learning in Nigeria using a purposive sampling technique. The data was collected using a structured questionnaire consisting of the socio-demographic information, students' perception of VLE tools, perceived behavioral intention to use VLE tools, perceived impact of VLE tools on satisfaction, and perceived impact of VLE tools on academic performance.

3.1. Results of the distribution of the socio-demographic information

Table 5 in APPENDIX shows the distribution of the socio-demographic information of the data collected for the students selected for this study. The results regarding the distribution of the gender showed that 81.0% of the students were male while 19.0% of the students were female owing to a majority of male students. The results regarding the distribution of the age group of the students showed that 88.1% of the students were aged between 18 and 25 years, 7.1% were aged below 18 years and 2.4% were aged above 25 years owing to a majority of students aged between 18 and 25 years. The results of the distribution of the mode of entry showed that 95.2% were admitted via UTME while 4.8% were admitted via DE owing to a majority of students being admitted being a UTME. The results of the distribution of the ethnicity of the students showed that 64.3% were Yoruba, 16.6% were Igbo, 7.1% were from Delta and 9.6% were from other tribes owing to a majority of students who were of Yoruba origin.

The results of the distribution of the educational qualification of the students' fathers showed that 23.8% had polytechnic OND/HND degrees, 14.3% had undergraduate degrees, 26.2% had postgraduate degrees, 21.4% while 21.4% had MBA degrees owing for a majority of fathers with a postgraduate degree. The results of the distribution of the educational qualification of the students' mothers showed that 4.8% had SSCE, and 19.0% had polytechnic OND.HND degree, 21.4% had undergraduate degrees, 28.6% had postgraduate degrees, and 11.9% had MBA degrees while 2.4% had other degrees.

3.2. Results of the distribution of the students' perception of VLE tools

This section presents the results of the distribution of the student's perception of the various VLE tools that are available. The distribution of the responses of the students was shown using the frequency of response alongside the percentage proportion of the total number of students. Table 6 shows the frequency distribution of the responses of the students regarding their perception of the various VLE tools available for use.

Table 6. Distribution of the students' perception of VLE tools

VLE tools	Label	Frequency	Percentage (%)
Microsoft Teams	Yes	9	21.4
	No	33	78.6
Google Meet	Yes	20	47.6
	No	22	52.4
Zoom	Yes	40	95.2
	No	2	4.8
Google Classroom	Yes	39	92.9
	No	3	7.1
Moodle/Edmodo	Yes	17	40.5
	No	25	59.5
Learning Management System (LMS)	Yes	30	71.4
	No	12	28.6
WhatsApp	Yes	38	90.5
	No	4	9.5
Telegram	Yes	37	88.1
	No	5	11.9
Google Forms	Yes	34	81.0
	No	8	19.0
Coursera	Yes	35	83.3
	No	7	16.7

The results of the response regarding the perception of Microsoft Teams showed that the majority of the students were not familiar with the VLE tool owing to a proportion of 78.6% of the students. The results of the response regarding the perception of Google Meet showed that the majority of the students were not familiar with the VLE tool owing to a proportion of 52.4% of the students. The results of the response regarding the perception of Zoom showed that the majority of the students were familiar with the VLE.

According to the results of the perception of students about the VLE tools, it was observed that the most popular VLE tools among the students were Zoom, Google Classroom, WhatsApp, Telegram, Coursera, and Google Classroom over 80% of the students. The least popular VLE tools among the students were Microsoft Teams, Moodle/Edmodo, and Google Meet less than 50% of the students while about 70% of the students were familiar with LMS. Figure 1 shows a bar chart plot of the student's perception of VLE tools.

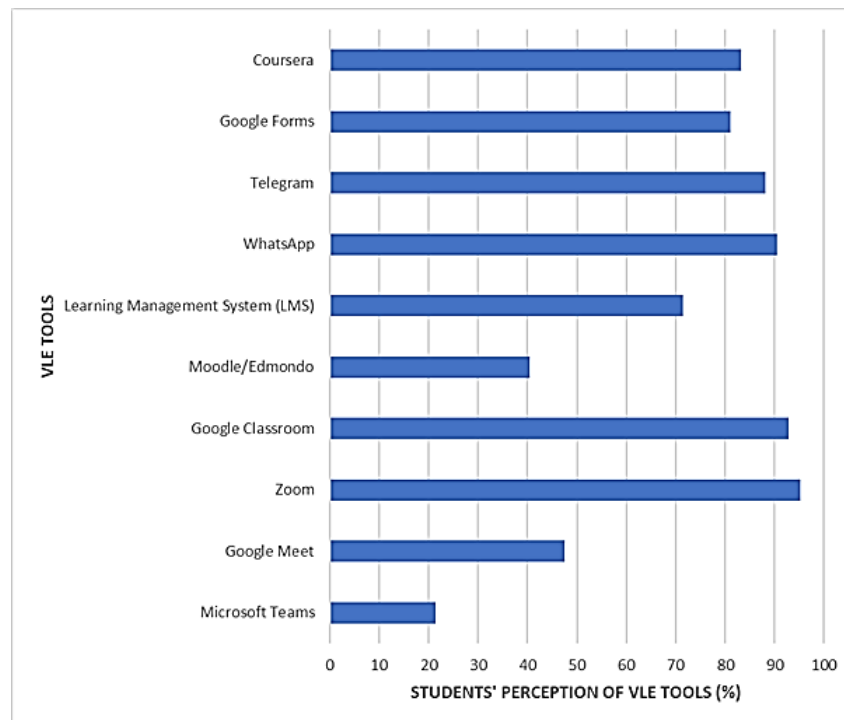


Figure 1. Bar chart plot of students' perception of VLE tools

3.3. Results of the distribution of the perception of behavioral intention to use VLEs

This section presents the results of the distribution of the responses to students' perception of behavioral intention to use VLE tools as a frequency distribution alongside, the mean and standard deviation of each response alongside the overall mean and standard deviation of the students' perception of behavioral intention to use. The result of the interpretation of the mean response was done by considering the interval of 0.50 to 1.49 for strongly disagree (SD), 1.50 to 2.49 for disagree (D), 2.50 to 3.49 for agree (A) and 3.50 to 4.00 for strongly agree (SA). Table 7 shows the distribution of the responses to the student's perception of behavioral intention to use VLE tools.

Table 7. Distribution of the perception of behavioral intention to use VLE

S/N	Item	SD	D	A	SA	Mean	Standard deviation
1.	I have sufficient skills to use VLEs	3	1	22	15	3.12	0.942
2.	I was willing to make use of VLEs upon introduction by lecturers	3	6	22	11	2.98	0.841
3.	I was willing to adopt VLEs for performing my academic activities	2	4	25	11	3.07	0.745
4.	I was willing to make use of VLEs regularly	3	10	23	6	2.76	0.790
5.	I was willing to recommend VLE to other students to use	2	13	16	10	2.76	0.958
6.	I plan to use VLE to support lectures in the future	4	9	18	11	2.86	0.926
Overall						2.93	0.647

The results regarding the response to “I have sufficient skills to use VLEs” (item 1) showed that the majority of the students agreed with a mean opinion value of 3.12 and a standard deviation of 0.942. The results regarding the response to “I was willing to make use of VLEs upon introduction by lecturer” (item 2) showed that the majority of the students agreed with a mean opinion value of 2.98 and a standard deviation of 0.841. The results regarding the response to “I was willing to adopt VLEs for performing my academic activities” (item 3) showed that the majority of the students agreed with a mean opinion value of 3.07 and a standard deviation of 0.745. The results regarding the response to “I was willing to make use of VLEs regularly” (item 4) showed that the majority of the students agreed with a mean opinion value of 2.76 and a standard deviation of 0.790.

The majority of the students agreed with a mean opinion value of 2.86 and a standard deviation of 0.926. Overall, the students’ perception of behavioral intention to use VLE tools showed that they agreed with a mean value of 2.93 and a standard deviation of 0.647. Figure 2 shows a bar chart plot of the distribution of the response to students’ perception of behavioral intention to use VLE tools.

Table 8 shows the distribution of the responses to the student’s perception of the impact of VLE on students’ academic performance. The results regarding the response to “The use of VLE has improved my academic performance” (item 1) showed that the majority of the students agreed with a mean opinion value of 2.79 and a standard deviation of 0.782.

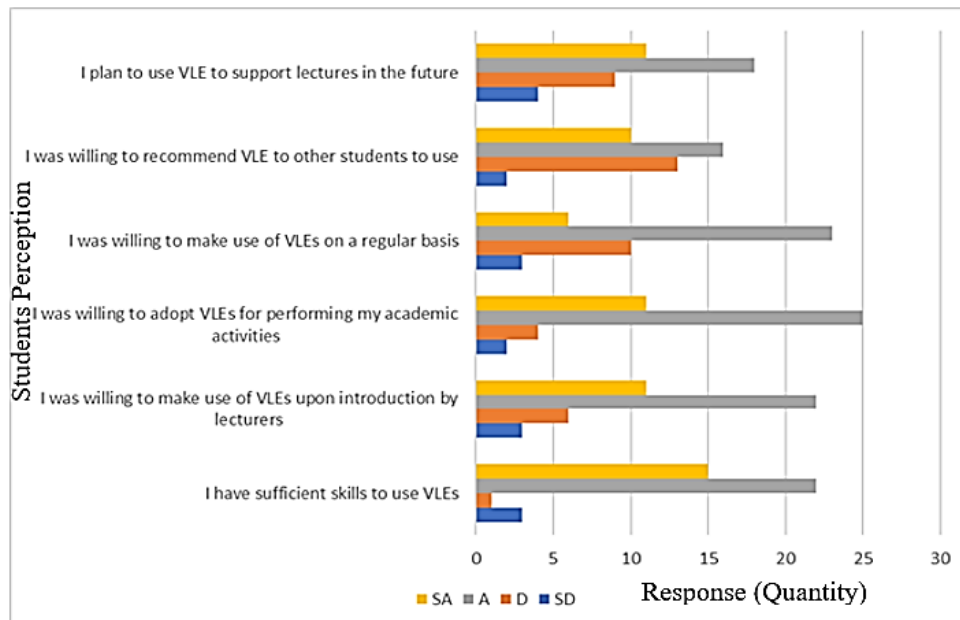


Figure 2. Bar chart plot of response to students’ perception of behavioural intention to use VLE tools

Table 8. Distribution of perception of the impact of VLE on students’ academic performance

S/N	Item	SD	D	A	SA	Mean	Standard deviation
1.	The use of VLE has improved my academic performance	2	12	21	7	2.79	0.782
2.	The volume of assignments via VLE improved my concentration	4	13	17	8	2.69	0.897
3.	The use of VLE was better compared to face-to-face learning	5	18	12	7	2.50	0.917
4.	Taking quizzes and exams online via VLE was more convenient	2	5	17	18	3.21	0.842
5.	The use of VLE made learning less challenging	1	13	15	13	2.95	0.854
6.	The use of VLE improved my access to learning materials	3	2	19	18	3.24	0.850
7.	The use of VLE improved my imagination by obtaining more information	1	6	21	14	3.14	0.751
Overall						2.93	0.535

The results regarding the response to “The volume of assignments via VLE improved my concentration” (item 2) showed that the majority of the students agreed with a mean opinion value of 2.69 and a standard deviation of 0.897. The results regarding the response to “The use of VLE was better compared to face-to-face learning” (item 3) showed that the majority of the students disagreed with a mean

opinion value of 2.50 and a standard deviation of 0.917. The results regarding the response to “Taking quizzes and exams online via VLE was more convenient” (item 4) showed that the majority of the students strongly agreed with a mean opinion value of 3.21 and a standard deviation of 0.842. Figure 3 shows a bar chart plot of the distribution of the response to students’ perception of the impact of VLE on students’ academic performance.

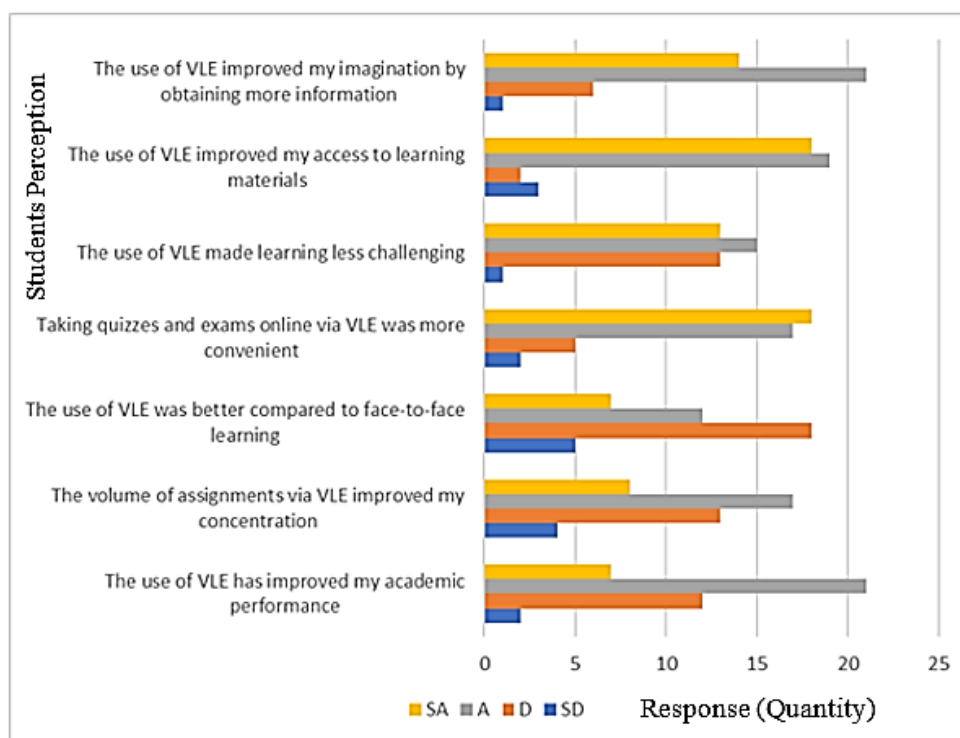


Figure 3. Bar chart plot of response to students’ perception of the impact of VLE on students’ academic performance

3.4. Results of the reliability analysis

The last three sections of the questionnaire were used for the collection of data which consisted of information regarding the perception of students on three different subject matters. Section C was used to assess the students’ perception of behavioral intention to use VLE tools and it consists of 6 items. Section D was used to assess the students’ perception of the impact of VLE on students’ satisfaction and it consists of 5 items. Section E was used to assess the students’ perception of the impact of VLE on students’ academic performance and it consists of 7 items. To test the internal consistency of the items in each section, the correlation coefficient of the items in each section was determined. Pearson’s product-moment correlation coefficient was used to determine the correlation coefficient of the items in each section. The Cronbach’s alpha of each category was determined alongside the effect of the removal of an item in a section on the value of the Cronbach’s alpha.

Table 9 shows the results of the item and reliability analysis of the last three sections of the questionnaire. The correlation coefficient of the perceived behavioral intention to use VLE was between 0.505 and 0.745 and Cronbach’s alpha of the section has a value of 0.838. There was no item among its 6 items that increased the Cronbach’s alpha of the section upon deletion. This reveals that all the items used to assess the perception of behavioral intention to use VLE were internally consistent.

The correlation coefficient of the perceived impact of VLE on students’ satisfaction was between 0.280 and 0.693 and Cronbach’s alpha of the section has a value of 0.789. Among its 5 items, item 4 (I feel that I have a variety of experiences without any interference) is the only item that increased Cronbach’s alpha of the section upon deletion to a value of 0.851. This reveals that among the items used to assess the perception of the impact of VLE on students’ satisfaction, item 4 (PI-SS-4) was not internally consistent with the remaining items in the section.

The correlation coefficient of the perceived impact of VLE on students' academic performance was between 0.305 and 0.673 and Cronbach's alpha of the section has a value of 0.752. Among its 7 items, item 3 (the use of VLE was better compared to face-to-face learning) is the only item that increased the Cronbach's alpha of the section upon deletion to a value of 0.760. This reveals that among the items used to assess the perception of the impact of VLE on students' academic performance, item 3 (PI-AP-3) was not internally consistent with the remaining items in the section.

Table 9. Item and reliability analysis

Factor	Item No.	Correlation coefficient	Cronbach's α if the item deleted	Cronbach's α
Behavioural Intention to Use (BI)	BI-1	0.505	0.835	0.838
	BI-2	0.745	0.786	
	BI-3	0.671	0.804	
	BI-4	0.523	0.828	
	BI-5	0.542	0.828	
	BI-6	0.737	0.785	
Perceived Impact of VLE on Student Satisfaction (PI-SS)	PI-SS-1	0.678	0.718	0.789
	PI-SS-2	0.684	0.709	
	PI-SS-3	0.693	0.720	
	PI-SS-4	0.280	0.851	
	PI-SS-5	0.608	0.736	
Perceived Impact of VLE on Student Academic Performance (PI-AP)	PI-AP-1	0.531	0.709	0.752
	PI-AP-2	0.413	0.735	
	PI-AP-3	0.305	0.760	
	PI-AP-4	0.337	0.750	
	PI-AP-5	0.514	0.711	
	PI-AP-6	0.673	0.674	
	PI-AP7	0.552	0.706	

3.5. Results of the causal relationship between variables

This section presents the results of the analysis of the causal relationships that exist (if any) between the three sections of the questionnaire. The causal relationships between the perception of behavioral intention to use VLE, perception of the impact of VLE on students' satisfaction, and perception of the impact of VLE on the student's academic performance. Regression analysis was used to infer the causal relationships between the independent and dependent variables. Four relationships were examined to explore the coefficients and differences among these variables as shown in Table 10.

Table 10. Pearson correlation coefficient of the three factors

	BI	SS	AP
BI	1.000	0.714	0.644
SS	0.714	1.000	0.676
AP	0.644	0.676	1.000

3.6. The results of the regression analysis of the perceived impact of VLE on students' satisfaction over the perceived behavioral intention to use VLE

This section presents the results of the linear regression analysis of the perceived impact of VLE on students' satisfaction (PI-SS) over the perceived behavioral intention to use VLE (BI). The perceived behavioral intention to use VLE was considered as the independent variable while the perception of the impact of students' satisfaction was considered as the dependent variable. Tables 11 and 12 shows the results of the analysis consisting of the model summary, ANOVA, and linear regression of coefficients.

Table 11. Regression analysis of behavioural intention to use on perceived impact of VLE on students' satisfaction

Model summary of behavioural intention to use to perceived impact of VLE on students' satisfaction					
Model	R	R2	Adjusted R2	Standard Error of the Estimate	
	0.714	0.510	0.498	0.45720	
ANOVA of behavioural intention to use to perceived impact of VLE on students' satisfaction					
Model	Sum of Squares	df	Mean Square	F	Sig.
egression	8.718	1	8.718	41.705	0.000
Residual	8.361	40	0.209		
Total	17.079	41			

Table 12. LR of coefficients behaviour intention to use to perceived impact of VLE on students' satisfaction

Linear regression of coefficients of behavioural intention to use to perceived impact of VLE on students' satisfaction					
Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	1.055	0.330		3.194	0.003
BI	0.712	0.110	0.714	6.458	0.000

In testing the good behavior, the perceived behavioral intention to use VLE. We suggest that the tables be split into Tables 1 and 2 to make it easier for readers to understand. VLE would be able to elucidate the R^2 value of 0.510 of the perceived impact of VLE on students' satisfaction which reveals that 51% of the data fits well into the regression model. The results of the ANOVA show that the perceived behavioral intention to use VLE reliably predicts the perceived impact of VLE on students' satisfaction since the p -value < 0.05 ($p = 0.000$). The results of the regression analysis show that the coefficient for BI (0.712) is statistically different from 0 because its p -value < 0.05 (p -value = 0.000).

3.7. Discussion of results

The results of this study revealed several findings relating to the perception of students about the various types of VLE tools. Among the various VLE tools identified, the most popular VLE tools among the students were Zoom, Google Classroom, WhatsApp, Telegram, Coursera, Google Forms, and LMS while the least popular VLE tools were Microsoft Teams, Moodle/Edmodo and Google Meet. The popularity of the VLE tools could be attributed to the fact that these tools were made freely available, for example, WhatsApp, Telegram, and Zoom alongside Coursera which was made free to students across the world during the period of the outbreak of the COVID-19 pandemic while others were value-added services to Gmail users such as Google Classroom and Google Forms.

The findings of the study revealed that the students selected for this study agreed to use VLE tools upon deployment in their schools; the students also agreed to the impact of VLE tools on their satisfaction and they also agreed to the impact of VLE tools on their academic performance. The findings of the reliability analysis of the various items of the questionnaire revealed that all the six items used to assess the behavioral intention to use VLE tools were consistent; one of the five items used to assess the impact of VLE tools on the students' satisfaction and one of the 7 items used to assess the impact of VLE tools on the student's academic performance was not consistent.

The strength of this study is attributed to the sound methodological process which is supposed to be in line with a well-structured questionnaire that is meant to cater to many dimensions which might include students' perception of VLE tools, and behavioral intentions among others (Unwin and Trimarco, 2009). Combining both descriptive and inferential statistics increased the trustiness of the findings since correlation coefficients and regression analysis were used to establish causal relationships between the variables (Cumming, 2014).

Nevertheless, the study has faced some limitations. For instance, the small sample size from just one department, which consisted of 100 undergraduate students, is thought to be not enough for the generalization of findings to other students in various institutions of higher learning across the world. As students answer questions in the form of questionnaires, their responses may be influenced by their views and pasts in contrast to empirical data that shows the true state of their levels of VLE involvement and academic achievement. In addition, the use of self-administered questionnaires risks introducing bias since the answers students offer may be based on their perceptions and past experiences instead of empirical data capturing their relationship with VLEs.

The purpose of the study is to discover the VLE tools that were the most and least favored and look into the reasons why students' utilitarian intentions to use such tools coincided with certain academic results they thought they had achieved. The study that is needed due to the outbreak of COVID-19 should seek to unravel the influence that digital platforms have on the goodness of education and the student's interest in the same.

4. CONCLUSION

The study concluded that the most commonly identified VLE tools among the students starting with the most popular are Zoom, Google Classroom, WhatsApp, Telegram, Coursera, Google Forms, and LMS. The study concluded that there exists a positive correlation between the perceived behavioral intention to use VLE, the perceived impact of VLE on students' satisfaction, and the perceived impact of VLE on the student's academic performance. The study concluded that a causal relationship exists between the research variables considered in this study. As a result of this, a student's behavioral intention to use VLE tools can

affect the impact of VLE on the student's satisfaction or the student's academic performance; likewise, the impact of VLE on the student's satisfaction can affect the impact of VLE on student's academic performance. The future research direction could expand on Long-term studies to measure the continued effect of VLEs on student performance and satisfaction.

FUNDING INFORMATION

The authors wish to declare that there is no funding received in carrying out this study.

AUTHOR CONTRIBUTIONS STATEMENT

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Odunayo Dauda	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	
Olanloye														
Peter Adebayo Idowu		✓				✓		✓	✓	✓	✓	✓		
Abidemi Emmanuel	✓		✓	✓		✓			✓		✓		✓	
Adeniyi														
Afolake Afusat					✓		✓			✓		✓		✓
Badmus														
Oluwasegun Julius	✓		✓	✓		✓			✓		✓		✓	
Aroba														

C : Conceptualization

M : Methodology

So : Software

Va : Validation

Fo : Formal analysis

I : Investigation

R : Resources

D : Data Curation

O : Writing - Original Draft

E : Writing - Review & Editing

Vi : Visualization

Su : Supervision

P : Project administration

Fu : Funding acquisition

CONFLICT OF INTEREST STATEMENT

The authors state no conflict of interest.

DATA AVAILABILITY

Data availability is not applicable to this paper as no new data were created or analyzed in this study.

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APPENDIX

Table 5. Distribution of socio-demographic information of students

Variable name	Labels	Frequency	Percentage (%)
Gender	Female	8	19.0
	Male	34	81.0
Age-Group (in years)	Below 18	3	7.1
	18 to 25	37	88.1
	Above 25	1	2.4
	No response	1	2.4
	UTME	40	95.2
Mode of Entry	DE	2	4.8
	Yoruba	27	64.3
Ethnicity	Igbo	7	16.6
	Delta	3	7.1
	Others	4	9.6
	No response	1	2.4
	Polytechnic	11	23.8
Father's Education	Undergraduate	6	14.3
	Postgraduate	11	26.2
	MBA	9	21.4
	No response	6	14.3

Table 5. Distribution of socio-demographic information of students (*continued*)

Variable name	Labels	Frequency	Percentage (%)
Mother's Education	Secondary	2	4.8
	Polytechnic	8	19.0
	Undergraduate	9	21.4
	Postgraduate	12	28.6
	MBA	5	11.9
	Another degree	1	2.4
	No response	5	11.9
Father's Occupation	Engineer	3	7.1
	Trader	12	28.6
	Clergy	2	4.8
	Clerical	2	4.8
	Army officer	2	4.8
	Accountant	2	4.8
	Lawyer	2	4.8
	Others	10	23.7
	No response	7	16.6
Mother's Occupation	Trader	19	45.2
	Teacher	5	11.8
	Clergy	2	4.8
	Accountant	2	4.8
	Others	7	16.7
	No response	7	16.7
Device Used	Smartphone		
	Yes	32	76.2
	No	10	23.8
	Tablet		
	Yes	19	45.2
	No	23	54.8
	Laptop		
	Yes	23	54.8
	No	19	45.2
	Personal Computer		
Internet Availability	Yes	13	31.0
	No	29	69.0
	Always	12	28.6
	Rarely	5	11.9
	Sometimes	24	57.1
	No response	1	2.4

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