Evaluating The Usability and Attitude of Teachers Towards Virtual Learning Environment

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Abstract

Teaching using Virtual Learning Environments (VLEs) is the order of the day. Teachers are expected to switch from their usual or traditional mode of teaching to embrace the new Virtual Learning Environment and its methods resulting in attitudinal and usability problems. The objective of the study was to evaluate the usability, attitudes, and setbacks if any, of teachers in the use of VLEs in Colleges of Education in Ghana. The study adopted a mixed research paradigm using quantitative and qualitative Research methods involving 150 tutors randomly sampled from five colleges of education in Northern Ghana to ascertain the usability levels and attitudes using System Usability Metris (SUM). Effectiveness, Efficiency and Satisfaction were measured using Task Completion Rate, Overall Relative efficiency and Single Ease Question (SEQ) respectively whiles attitudes were measured using Semantic Differential Scale (SDS). The results showed that there is moderate usability by teachers and there are positive attitudes of teachers towards adopting and using VLEs. It was realized that several challenges exist that account for the moderate usability and the relatively slow change of attitudes and behavior towards VLS.

Introduction

The advancement and the ubiquity of technology and its subsequent deployment in virtually all areas of human existence including E-learning systems calls for attitudinal and behavioral changes in teaching and learning processes (Henry &Abala, 2009, Nasreen &Chaudhary, 2018, Abuhlfaia & Quincey, 2019). This new learning paradigm is a shift away from the traditional method of teaching where the teacher is a repository of knowledge and comes to stand with students to deliver, unlike the new VLEs where the content material is provided to the learner from a remote location. E-learning is a form of transferring skills, attitudes, values of an educational process into the learners using technological media. It there stands to reason that, with the new wave of changes occasioned by technology and other natural phenomena such as the COVID-19 that makes it relatively difficult for people to group or congregate, the need for virtual teaching is a must.

A lot of work has been done about E-learning systems including but not limited to attractive user interface designs, ease of use, transferability or portability of skills, platform compatibility and usability (Babic, 2012, Majeed & Afzal, 2016, Paesons, 2017 and Vertesi et al, 2018). Notwithstanding the works on the subject, there still remain a problem with usability and attitudes of teachers as it is difficult to measure easily their usability and attitudes due to time and other resource constraints and also the need for active participation of same.

A change to and from what one is used to doing will usually be met with some resistance occasioned by the fear of the unknown and lack of proper change management processes (Laudon & Laudon, 2010).

With the recent requirement to employ technology in the teaching and learning process as a matter of policy and due to natural occurrences such as Covi19, the need for teachers to adopt and adapt to the new way of teaching has become increasingly non-negotiable by teachers. This study sought to investigate the usability, the attitudes and the challenges of staff of colleges of education in Ghana towards the use of the VLEs.

To effectively and efficiently do this, we asked the broad question "how is the level of use and attitudes of staff towards the use of VLES". This broad question was broken down into three (3) sub-research questions as follows:

 i. To what extend do Tutors adopt and adapt to the use of VLEs in their lesson delivery
 ii. How are tutors' attitude towards the use of VLEs/?
 iii. Do tutors encounter setbacks in the adoption and use of VLEs?

Relative to these research questions, this paper contributed to knowledge in three-fold;
i. We empirically evaluated the usability levels of staff in terms of efficiency, effectiveness and satisfaction in VLEs.
ii. We have demonstrated and empirically measured the attitudes of staff towards the adoption and adaptation to the use of VLEs as the new mode of teaching.
iii. We have qualitatively gain insights into the factors or challenges that staff of COE faces in the pursuit and adoption of the new mode of teaching using VLEs.

The rest of the study will be presented as in the following sections: a brief background to usability and attitudinal change, the methodology of the study, the result of the study, the discussion of the study, the conclusion drawn and future work and the recommendations and followed by references.

2. Background to Usability and Attitudinal Change
2.1. Usability
All information systems developed needs to be actively accepted and used by the intended users without unsurmountable problems. Usability therefore is the ability of users to easily learn and use a system with minimal or without challenges (Abuhlfaia & Quincey, 2019).

Thus to be able to use a system such as VLEs, it must be easily used without much problems. Such a system needs to have high user satisfaction, less error rate, portable, efficient and has easy learnability (Nielson, 1993). He contends that when the user gives positive commendations to the system; (user satisfaction), when they are unlikely not to make errors when using the system; (less error rate), portability has to do with the ability of users to transfer knowledge from other platforms into the new platform easily, efficiency is being able to achieve the intended goal with minimum effort whiles memorability looks at the ability to remember the system after some time of use.

Therefore, for E-learning systems to be accepted and used, such variables as mentioned needs to be considered. One way of knowing that a system is accepted is carrying out usability levels of users and other variables that makes usability complete. Constabile et al, (2005) studied a usability evaluation whiles Harati et al (2016) explored user satisfaction in e-learning systems and concluded that usability alone is not sufficient enough to evaluate a system but the need for other variables.

Quality and usability issues was considered by Ivanovic et al (2018) and stressed the need for quality consideration in usability whiles Olarewaju and Omiola (2018) carried out a survey study on undergraduates extend of use of e-learning system. In all these, they fail to address the usability in context of mandatory or policy perspective and how the attitudes of the users are in such context. They also failed to address the issue of usability as a multi-factor phenomenon comprising effectiveness, efficiency and satisfaction in the context of user attitudes to change.

Notwithstanding the various studies carried out on the subject of usability in different forms and shapes, we proposed to study it in context of tutors' ability and willingness to use/adopt the VLEs and their perceived attitudes towards such drastic demand of change necessitated by policy and natural occurrences as being observed in the COVID 19 pandemic.

2.2. Attitudinal change
When implementing any form of information system and or the deployment of any form of technology, there is bound to bring significant changes to the users of that system. If such changes are not properly managed, it may lead to the failure of such a project (Saetren and Laumann, 2017; Cummings and Worley, 2015).

Change is inevitable and will always occur as businesses, educational curricular and technology dictates. However, change usually occasion resistance from the beneficiaries and usually requires proper change management processes. The process of managing the change and the direct impact of that change on beneficiaries, their culture and behavior is called change management and has a bearing on their attitudes. This if not managed well will lead to resistance (Greg, 2006; Armenakis and Harris, 2009). They argued that attitudes are mental pictures that shows an individual reaction or tendency to react in a certain manner towards an object favorably or unfavorably. It is a mixture of cognitive, affective and behavioral construct towards an object of interest.

It is clear from the various studies that, attitudes and behavior change is not an event and thus needs time to occur

and involve the affective, cognitive and behavioral aspect of the individual and needs training and time to adapt to new things. Hence, understanding and measuring the attitudes is of essence to show and seek the opinion of an individual or group of individuals towards an object.

It is therefore worthy of note that, notwithstanding the various studies aimed at understanding system usability and attitudes, most of these adopted a single approach either qualitative or quantitative. We intend among other things wish to adopt the mixed research paradigm which will maximize the strengths of both approaches and which will complement their weaknesses. This will give a better and holistic view of the subject under study within the context.

3. Methodology

The study aimed at measuring the usability and attitudes of Tutors towards the use VLES for teaching. A questionnaire was developed to gather the demographic data of the participants and observations were used to measure the actual use of the VLE and their impressions about its use. One hundred and fifty (150) Tutors of five colleges of Education were randomly recruited. We measured Usability of participants using System Usability Metric(SUM) as proposed by ISO/IEC9126-11. The ISO/IEC9126-11 standard defines usability as "*the extent to which a product can be used by specified users to achieve specified goals with **effectiveness, efficiency** and **satisfaction in a specified context of use"***. The Attitudes of users were measured using Semantic Differential Scale(SDS) as proposed by Osgood, Suci& Tannerbaum (1957). The SDS is a collection of rating scales using bipolar adjectives such as "good…………bad"," honest…Dishonest", satisfied…………..unsatisfied to measure an attribute of an object.

To do this the participants were given a task of logging in and setting up a virtual class within a time frame to present a lesson from which we measured the time used to complete a task of failed to complete a task, the number that successfully completed a task in the case of effectiveness, while total number tasks or goal, number of users as discussed in the next subsection as in the case of efficiency and satisfaction.

For the attitudes and challenges part, participants were given a SDS questions to respond to whiles one open-ended question was given for participants to state their challenges if any associated with using the VLEs. This was to measure qualitative views of participants on the challenges if any in using the VLEs.

3.1 Measuring Usability

We first of all measured all the three metrics using different methods such as Task Completion Rate for Effectiveness, Overall Relative Efficiency method for efficiency and the Single Ease Question(SEQ) method for the satisfaction

3.1.1 Effectiveness (how accurate and completely users achieve specific goals. It was measures using the task completion rate method which is the number of tasks completed successfully/ the total number of tasks undertaking expressed as a percentage.

$$\frac{number\ of\ tasks\ completed\ successfully}{the\ total\ number\ of\ tasks\ undertaking}*100\%$$

3.1.2 Efficiency (the resources used relative to accuracy and completeness with which users achieve specified goals). This was measured in terms of task time (Sauro, 2010). We used the **Overall Relative Efficiency** to measure the efficiency of staff towards the use of a VLE. This is given as

$$\frac{\sum_{j=1}^{R}\ \ \sum_{i=1}^{N} n_{ij}t_{ij}}{\sum_{j-1}^{R}\ \ \sum_{I=1}^{N} t_{ij}} * 100\%$$

Where N= total number of tasks or goal(s), R= number of users, nij = result of task i by user j, if the user is successful, the value is one; if unsuccessful, the value is 0. t_{ij} is the time spend by user j to complete task i, if task is successful, tij=1, else if not successful, time is measured till user quits the activity.

3.1.3 Satisfaction is the comfort and acceptability of use of a system or object. We measured satisfaction using the Single Ease Question(SEQ) metric. It is a 7-point scale rating system used to evaluate how difficult or easy users find a task to be usually administered after a task completion exercise in usability studies Sauro (2012).

 Dumas and Sauro (2010) contend that SEQ is reliable, sensitive and valid. Its advantages are that, it is usually a single question and it is short, easy to respond to and easy to administer and usually asked after the completion of a tasks. Hence, after the task was completed, participants were asked the question; "overall, how satisfied or

unsatisfied did you find the task?"? The scale below was used

Very satisfactory   **very unsatisfactory**

| 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 |

3.1.4. **Attitudes of staff:** The attitude of staff was measured using the SDS with Bipolar words describing how the participants felt about the VLE used for the study on a scale of 1-7. Scale 1-3 depicting negative attitudes, 4 being the neutral point and 5-7 representing positive attitudes towards the use of the VLE in teaching. Attitudes are mental pictures that shows an individual reaction or tendency to react in a certain manner towards an object favorably or unfavorably.

Unfavourable   **favourable**

| 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 |

3.1.5. **Qualitative views of staff**: To obtain the views of the participants concerning the VLE, at the last item of the questionnaire required that they state the challenges inherent in the VLE used. The results of which was also analyzed using themes to identify the challenges involving in switching from the traditional mode of teaching to teaching in the VLEs.

A pilot study was conducted to ascertain the reliability and validity and or consistency of the questions. This procedure assisted as to make amendment to the questionnaire with Cronbach alpha or the co-efficient of reliability equal to 0.7 which demonstrate an appropriate level of internal consistency and reliability of the measurements.

To ensure ethicality of the study which is usually required in studies involving humans and animals, all participants' concerns were explicitly sought and their approval obtained before the administration of the questionnaires.

The demographic information of the respondents and the years of teaching experience were presented using descriptive statistics such as frequency tables as shown below:

Table 1: Demographics of participants, years of teaching experience and the experience.

S/N		Frequency	Percentage
Age	20-30	5	3.33
	30-40	106	70.67
	40-50	25	16.67
	50-60	14	9.33
	Total	**150**	**100**
Gender	Male	121	80.67
	Female	29	19.33
	Total	**150**	**100**
Level of Education	PhD	6	4.00
	Master	134	89.33
	Undergraduate	10	6.67
	Total	**150**	**100**
Department of study	Maths/ICT	36	24.00
	Languages	30	20.00
	Social sciences	25	16.67
	Education	25	16.67
	Science	23	15.33
	Technical/vocation	11	4.67
	Total	**150**	**100**
Years of teaching	1-5	32	21.33
	5-10	41	27.33
	10-15	41	27.33
	15-20	26	17.33
	20 and above	10	6.67
	Total	**150**	**100**
Experience with the Use of VLES	Never	78	52
	Sometimes	42	28
	Always	30	20
	Total	**150**	**100**

3.1 Reliability and validity of the study

For the quantitative questionnaire, we measured the reliability using Cronbach alpha. The alpha value of this study was .7 indicating internal consistency and reliability of the test items. To ensure that the findings of a qualitative part of the questionnaire was accepted, the reliability and the validity of the study questions was ensured, Johnson and Christenten, (2007). Bryman and Burgress, (1994) stated that many authors regard the findings from qualitative study as more interesting than quantitative, but the analysis of the gathered data remains a problem and that qualitative data is "an attractive mess". Reliability of a qualitative research can be equated to stability Altheide and Johnson (2011); reproducibility of the study by a qualified researcher. It is also called confirmability Leela Demoran,(1996). Creswell (2008) stated that validity is same as accuracy; it truly represents the features that were set out to be studied. Altheide and Johnson (2011); added truthfulness to accuracy, whiles Lincoln and Guba, (1995) emphasized credibility with Hansen (2006) adding usefulness.

4. 0 Results

The results of the study as was described in the previous chapter was displayed; usability measured in terms of effectiveness using the task completion rate method, efficiency using the relative overall efficiency method, user satisfaction using SDS and attitudes using SEQ methods. The results are as stated in the tables below:

Table1: Measure of Effectiveness of staff using the task completion Rate Approach

Department	Total No. of Tasks	No. of Task successfully completed	Effectiveness (%)
Mathematics/ICT	36	30	83.33
Languages	30	18	60.00
Social Science	25	9	36.00
Education	25	11	44.00
Science	23	15	65.22
Vocational/Techical	11	5	45.45
Total	**150**	**83**	55.67

Table 2: Relative Efficiency of Staff by Departments

Mathematics /ICT	user category	No. successful on task	Time used
	category1	15	2
	category 2	11	3
	category 3	4	3
	Category4	6	7
	Overall Relative Efficiency	**54.67**	
Languages			
	category1	7	5
	category 2	6	5
	category 3	5	4
	Category4	12	7
	Overall Relative Efficiency	**66.67%**	
social science			
	category1	4	2
	category 2	4	3
	category 3	1	4
	Category4	16	7
	Overall Relative Efficiency	**56.25%**	

Education

	category1	4	3
	category 2	5	4
	category 3	2	5
	Category4	14	7
	Overall Relative Efficiency	**75%**	

Science

	category1	4	2
	category 2	8	3
	category 3	3	5
	Category4	8	7
	Overall Relative Efficiency	**58.80%**	

Technical/ Vocational

	category1	3	5
	category 2	1	5
	category 3	1	5
	Category4	6	7
	Overall Relative Efficiency	**68.18%**	

Table 3: Measure of staff satisfaction

Metric Value	Number of respondents	Percentage
1	36	24.00
2	35	23.33
3	37	24.67
4	30	20.00
5	4	2.67
6	5	3.33
7	3	2.00
Total	**150**	**100**

Measure of Attitudes using SDS
The attitude of staff was measured using the SDS with Bipolar words describing how the participants felt about the VLE used for the study on a scale of 1-7. Scale 1-3 depicting unfavourable attitudes, 4 being the neutral point and 5-7 representing favourable attitudes towards the use of the VLE in teaching. The result is as showing below: scale 1had 4(2.67%), 2 had 3(2.00%), 3 had 1(0.67%) while point 4 which is the neutral point had 25(16.67%). The other half of the scale 5 had 37 (24.67%), 6 had 33(22%) and 7 had 47(31.33%).

4.1 Thematic Analysis of Staff Opinions
At the tail end of the questionnaire, staff were requested to suggest some of the issues they had with using the system. Their responses were put into identical themes and analyzed using Thematic Analysis (Braun & Clerke, 2006; Cropley, 2019, Lee et al, (2018). Out of the total number of the respondents, only 35 respondents agreed to state their views. This sample is more than 20% of the sample size and therefore a valid conclusion can be drawn based on their responses.

A careful analysis of the responses showed that, the following themes were identified
Convenience: staff were of the view that the use of VLEs in teaching offers them the luxury to teach and evaluate students from a remote location and at any time convenient to both students and teachers. For example, "*the convenience alone for me makes me prefer it*" "*you can teach from anywhere*" etc.

Usefulness: the participants showed that it is very useful when you can bring students together for a class. "*In short it is beneficial*", "*I found this very useful in today's world*" were some of the comments.
Network issues: there was a problem with my network making it difficult to log into VLE. Many express their frustrations with the system. *Network is bad, data is costly, the school network is also very bad and others were*

some of the comments.

Training*: the platform teaching is good. But some of us didn't get training so it was difficult for us to easily use the platform to teach. The ICT departments should organize trainings on these areas for us, if you learn the system very well, it would enhance my teaching in the College. etc.*

5. Discussion

The study aimed at evaluating the usability and attitudes of teachers in the colleges of education in Ghana towards the use VLEs and explored challenges facing the adoption and adaptation to the new mode of teaching in the VLEs. We evaluated usability based on three criteria; **effectiveness, efficiency and staff satisfaction**. This is in tandem with the ISO 9241-11 standard which defines usability as" the extent to which a product can be used by a specified user to achieve specified goals with effectiveness, efficiency and satisfaction and in a specified context of use". It therefore stands to reason that usability is a multivariate concept and measuring it must take into account such factors as effectiveness, efficiency and satisfaction.

Effectiveness is defined as the extent to which a stated goal or objective is met; whether the intended program, product or service meet the intended goal that it was set out to do. This can be narrow or broad depending on the owner of the objective. Overall, the average Usability in terms of Effectiveness as shown in table 1 was 55.67% based on the **task Completion Rate** approach. This means that, a good number of the staff failed to achieve the intended goal which was independently setting up a virtual Learning Environment to be able to teach a lesson using the Google Classroom within a stipulated time frame. This shows that whiles in some jurisdictions, many staff are already ahead in the use of these platforms, the situation is not the same especially in the third world countries. This call for efforts by governments and stakeholders to employ the technologies in schools to enable teachers become effective users of VLEs.

Relatively, staff in the Mathematics/ ICT departments seem to be effective with a score of 83.33%, followed by the sciences with 65.22% and Languages with 60%. The seemingly relative effectiveness as stated may be accounted for by the fact that, most of the teachers in these department have a prior knowledge with these systems and might have practiced with these systems before the study.

To measure or evaluate the **efficiency** of the participants, we employed the **Overall Relative Efficiency** formula and the result is shown in table 2. Efficiency is how accurate and completely users achieve specific goals. The efficiency component of the usability was varied across the departments as can be seen in the table with education, technical/Vocational and English Departments scoring above 60%. On the whole, the average efficiency of the participants was 63.26%. This implies that, there were few people whose efficiency affected the overall. It therefore stands to reason that, while some teachers may not be practicing, there are some who probably learns ahead of the system and has become efficient in handling such tasks.

In terms of satisfaction, 72% felt very satisfied with the use of VLEs, 20% were neutral and 8% felt very unsatisfied. This is an indication that, while many of the participants felt satisfied, others were indifferent while the others showed their lack of satisfaction. This is expected because, satisfaction comprises many factors and is difficult to objectively measure it due to its subjectivity. However, an overall satisfaction rate of 72% and 20% staying neutral with only 8% indication or expression some level of dissatisfaction is a very good positive outcome. This implies that, staff are satisfied with the idea to use VLEs in the delivery of lessons. Such positive attitude suggest that, with the necessary environment, staff are willing to change their attitudes and accept new and innovative approaches to teaching and learning.

Overall, the objective of usability criteria is aimed at assessing the product or design use in terms of how the users' performance can be improved. Thus, to evaluate usability of a product or design, such measurement must meet three main criteria; effectiveness, efficiency and satisfaction as proposed by ISO 9241-11 standard and collaborated by Lumpapun Punchojit (2017). Hence, the average usability in terms of the three main criteria as displayed gives a true picture of the effective measure of usability.

On the attitude of teachers towards the use of VLEs, the results showed that participants have favorable attitudes. Attitude is how prepared an individual is to change behavior and act in a certain way. For one to survive in the emerging world order, change must be part and parcel of life as new technologies drives the changes and corresponding need for attitudinal changes. From the study, 73.33% of the participants showed favorable attitudes towards the use of VLEs using the SDS. It therefore means that, participants are willing and ready to use such mode of teaching. The other participants' seemingly unfavorable attitude may be occasioned by the lack of training

and other bottlenecks that militate against the full adoption and adaptation of technology in the teaching in Virtual environments.

With respect to the challenges that faces the full adoption of and use of VLEs, the study showed that, issues bordering on lack of available and reliable internet service, lack of training of staff on the use of VLEs, challenging user interface designs and lack of portability across platforms. From the thematic analysis of the views of participants, it is quite clear that, the enthusiasm to learn and adapt to the new wave of virtual teaching is high. However, this is constrained by the numerous challenges militating against VLEs adoption in he studied location. The implication of this trend is that, with globalization, population growth that makes it difficult to house learners in the traditional brick and mortar classrooms and other natural phenomena such as covit19 that makes it difficult for grouping, the use of VLEs has become a non –negotiable option for teachers especially those in Colleges of Education and higher learning institutions calling for radical technological reforms and innovation in the classroom in the study environment.

6. Conclusion and future work

The study was conducted to evaluate the usability and attitudes of teachers towards the use of VLES in teaching their lessons. The study showed that, usability fell below the standard proposed by SUS in terms of all the criteria such as effectiveness, efficiency and satisfaction.

On attitude of teachers towards the use of VLEs, it was realized that, participants had favorable or positive attitude towards the use of VLEs with 73.33% measured using the SDS.

Furthermore, it was also confirmed that, a number of problems militate against the smooth adoption and adaptation of participants towards the use of the VLEs such as lack of or inadequate training (in-service inclusive), cost of internet data, lack of equipment, poor system interface design issues, portability etc. consequently, the concluded that, teacher usability to virtual learning environments is relatively low to moderate but teachers show a very strong positive attitudes towards the use of the platforms which is constrained by various challenges. In the future, a more quantitative study will be carried out to measure the perception of staff and students on the use of VLEs as a teaching and learning tool.

7. Conflict of interest. No conflict of interest

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