Original Research Article

Evaluating the Media Platforms, Devices and Challenges Associated with Online Teaching and Learning during the COVID-19 Pandemic

Abstract

The study investigates the usage of online educational media platforms and devices used to access online learning. It also identifies the challenges Mathematics pre-service teachers encountered in teaching and learning of Mathematics during the COVID-19 pandemic in Northern Region of Ghana. The research design was descriptive cross-sectional survey with a sample of 345 Mathematics pre-service teachers selected from Northern Region Colleges of Education via simple random and purposive sampling. Closed ended questionnaire was developed by the researchers via Google forms and used as the main research instrument. Data were collected via a link sent through WhatsApp and Telegrams to the pre–service teachers. The results revealed that Zoom, Telegram, WhatsApp, and Google Classrooms were the mostly used online platforms. Again, the devices used were desktop computer, laptops, tablets, iPads, with smartphones being the most commonly device used. The results further indicated that the two most challenges among others were; High cost of data for internet subscription, and poor internet services in remote areas.

Keywords: COVID-19 Pandemic, e-learning, Pre-Service teachers, Challenges, Platforms, Devices

Introduction

Since the 1990s, the world has witnessed significant influence of technology in education. An example is the implementation of online learning across different learning environments such as residential or remotely. Since the outbreak of the COVID-19, teachers and students gradually adopted e-learning, where teachers deliver lessons that are interactive, share resources, enhance student collaboration and interaction (Elaish et al., 2019; Garcia et al., 2018). Barrot, (2020) indicated that online learning has since long been acknowledged for its efficacy. However, Boelens et al. (2017) and Rasheed et al. (2020) indicated that implementation challenges of online learning continues to build up.

World Health Organization (WHO) on 12th March, 2020, officially declared COVID-19 as global pandemic. As a result of this declaration, educational institutions throughout the world were either closed or observing certain restrictions. COVID-19 pandemic in Ghana has affected the educational system. The president of Ghana on 15th March, 2020 gave a directive on the closure of first and second cycle schools effective 16th March, 2020, which meant that administrators of the various institutions employ strategies to ensure continuous teaching and

learning during the COVID-19 pandemic lockdown. One of such strategies was to quickly shift their education delivery from conventional (face-to-face) learning to online learning which can enable a more flexible approach to teaching and learning (Vlachopoulos, 2020). Agbele and Oyelade (2020) opined that e-learning offers a platform for teachers to teach from anywhere, at any time and by any means where both the student and teacher can connect computer/mobile phone to a network or radio/television. As researchers, we also think that e-learning is a means of delivering lessons where students and teachers use their home computers and phones to connect to the internet for exchange of both conceptual knowledge and procedural knowledge. For e-learning to be effective teachers and students may need to download and install educational platforms like Zoom, among others to promote efficient e-learning. Mukhtar et al. (2020) indicated that e-learning encompasses the use of advanced technology to direct, design and deliver learning content, which encourages two-way communication between students and faculty. They further opined that e-learning encompasses features such as whiteboards, chat rooms, polls, quizzes, discussion forums and surveys that permit teachers and students to communicate online and share course content side by side.

There are several benefits of e-learning in the educational sector for both the teacher and student. For instance, Adeoye et al. (2020) reported that the benefits of the e-learning education comprises of quality content delivery, interactivity, and building of confidence of teacher and learners. The authors went further to indicate that e-learning allows students to study at their own pace and convenience time since the lecture material is readily available and quite accessible to the student. Also, Eduard and Lucian (2020) indicated that e-learning is transmission of knowledge and skills to the learners via innovative platform. They further stressed that it benefits include it been cheap, saving time, has a wider coverage, which also promotes team and collaboration learning. Currently, social media platforms provides an easy access for student engagement, independent and collaborative learning. Ansari and Ali Khan (2020) indicated that there advantages and challenges in the Use of social media and mobile devices. They also indicated the benefits are accessing course contents, video clip, transfer of the instructional notes etc. For us as researchers we also feel that social media and mobile devices are cheap and suitable tools for receiving significant information.

Most institutions in Ghana adopted an online teaching that used both asynchronous and synchronous. In asynchronous learning, students can communicate and complete activities at their own time and pace, while synchronous learning activities occurred through live video and/or audio with immediate feedback (Hrastinski, 2008). To ensure no student was disadvantaged in Ghana, first and second cycle schools had asynchronous lessons through TV channels such as Joy TV and Ghana Learning TV in different subject areas.

The situation in Ghanaian Colleges of Education

16th of March, 2020 was the scheduled date for Colleges of Education in Ghana to resume academic work for the second semester of the 2019/2020 academic year. As a result of the

COVID-19 pandemic effects on educational institution, colleges had to switch to online teaching and learning. The National Council for Tertiary Education, (NCTE) now Ghana Tertiary Education Commission (GTEC) in collaboration with Transforming Teacher Education and Learning in Ghana (T-TEL) instituted a task force which included all the five mentoring universities, and Principals of Colleges of Education whose purpose was to meets regularly to ensure that teaching and learning continued through virtual and online until such a time that the COVID-19 pandemic lockdown restriction are lifted and colleges of education can re-open (Salifu & Todd, 2020). The colleges of education also employed asynchronous and synchronous. For the asynchronous, course materials and pre-recorded lecture videos were made available to the pre- service teachers via the distribution of subsided smart phones which has learning material imbedded in the phones and online educational platforms such as Google Classroom, WhatsApp groups and telegram through the efforts of T-TEL. The outbreak of the COVID 19 pandemic necessitated the colleges of education to implement online teaching using social media which are essential tool in the learning process.

Literature Review

In a study by Gichuhi et al. (2020) purpose among others was to investigate use of social media on content delivery in higher education in Kenya. The sample used were 150 students and 20 lecturers revealed that 73% used WhatsApp to receive and 96.0% used it to send educational content, 22.0% and 5.0% of the students used YouTube and Facebook respectively to receive educational content. Similarly, Agormedah et al. (2020) used descriptive survey design with 467 students explore students' response to online learning in higher education in Ghana. The results among others indicated that students used the following devices; (76.7%) used Smart phone, 1.3% used Desktop, 8.6% used Laptop, 0.2% used Tablet/iPad to learn during the COVID-19 pandemic online learning. The results further indicated that students used these online media platforms such as Facebook/Twitter, YouTube/Skype, Zoom and Google meeting for learning during the COVID-19 pandemic. Also, Ogbonnaya et al. (2020) used descriptive survey research design focused on the pre-service teachers' preparedness for online learning in terms of their digital literacy and technological devices used for online learning, their positive online learning experiences, and the challenges they encountered learning online during the COVID-19 lockdown. A sample of 147 pre-service teachers was used for the study. Their study results revealed that the pre-service teachers used multiple devices but 92% used smartphones, 51% used laptops, 7% used tablets and 3% used a desktop computer. The results further indicated that poor internet connectivity, the high cost of data, erratic power supply, lack of appropriate devices, inability to effectively manage their time, and family interruptions were some of the challenges during the COVID-19 pandemic online learning. Again, 49% used both the Zoom and Sakai learning management systems, 27% used WhatsApp, last but not the least 5% used Screencast, Google meet, and Google classroom during the study. Furthermore, Elfirdoussi et al. (2020) used a quantitative case study whose purpose was to find out the limitations faced by professors and students when using e-learning platforms. The sample used was 3037 students

and 231 professors from 15 universities in Morocco. From the results 66.8% used for Personal computers and laptops, 66% used smartphones, 3.4% used television, 2.8% used tablets and 1.6% did not use any device during the COVID-19 pandemic online learning. The results further indicated that 54.7% used Moodle, 48.8% used Microsoft Teams, 23.9% used Zoom, 15.9% used Google Classroom and 17.4% used YouTube channels or others. Lastly, Ujunwa (2021) purpose was on challenges of e-learning during COVID-19 pandemic in colleges of education in south east states, Nigeria. The results showed that the challenges of e-learning during COVID-19 pandemic were epileptic power supply, high cost of procurement of electronic devices, high cost of maintenance of ICT equipment for e-learning, poor internet connectivity, shortages of relevant software, low level of incentive to lecturers, low level of student accessibility to internet facilities, poor technical support from management and high cost of data bundle to connect e-learning platform when descriptive survey design was adopted with 437 lecturers used as the sample.

Statement of the Problem

Currently, the educational system in Ghana has encountered an unprecedented shake up in its foundation as a result of the coronavirus. To militate against the adverse impact of the coronavirus pandemic on education, the government of Ghana launched crisis response strategies which includes; curriculum revisions, provision for technological resources, revisions in academic calendar, online instructional delivery and assessment. These strategies forced educational institutions to migrate to online teaching and learning. Per the uncertainties today, it is very crucial to gain a deeper understanding of students' online learning experience during the COVID-19 pandemic.

However, there are limited studies in Ghana with respect to COVID-19 online teaching and learning. The few studies by Gyampoh et al. (2020) concentrated on tutors from Eastern and Greater Accra Region. Also, Ogbonnaya et al. (2020) used Pre–Service teachers from University of Ghana. Furthermore, Owusu-Fordjour et al. (2020) used second cycle schools and tertiary institutions while Agormedah et al. (2020) used undergraduate students from university of Cape Coast. Lastly, Aboagye (2020) participants were College of Education tutors. From the above analysis, the gaps are that, there is no single study on online teaching and learning in Northern Ghana. Also, there is only one study that involved Pre-service teachers in the colleges of education. To fill these gaps, the present study will use Mathematics pre-service teachers from the four (4) Colleges of Education in the Northern region to conduct this study which is titled evaluating the media platforms, devices and challenges associated with online teaching and learning during the COVID-19 pandemic in Northern Ghana.

Purpose of the Study

The purpose of this present study is to examine online educational media platforms and devices used to access online learning of Mathematics. Also to identify the challenges Mathematics pre-service teachers encountered in teaching and learning of Mathematics during the COVID-19 pandemic in Northern Region of Ghana.

Research Questions

The study explores the following three research question:

1. What are the educational media or platforms used by Mathematics Pre-service teachers during the COVID-19 pandemic lockdown online learning?
2. What are the devices used by Mathematics Pre-service teachers during the COVID-19 pandemic lockdown online learning?
3. What challenges did the Mathematics Pre-service teachers encounter during the COVID-19 pandemic lockdown online learning?

Methodology

Research design

The research design for this was descriptive cross-sectional survey with the main aim of obtaining answers to a series of items which were adequately organized for administering using purely quantitative research approach.

Population, Sample Size and Sampling Procedure

The population for the study was all Mathematics pre-service teachers in Northern Ghana Colleges of Education. The research used simple random and purposive sampling. Cohen et al. (2007) indicated that simple random sampling enables researchers to ensure that all respondents have equal chance of being selected for the study. Purposive sampling was used because the study targeted Mathematics pre-service teachers. A sample of 345 Mathematics pre-service teachers were selected from the following Northern Region Colleges of Education; E.P. College of Education, Bimbilla, Tamale College of Education, Bagabaga College of Education, and St. Vincent College of Education. The sample constituted 21.71% females while 68.29% was made up of males. The modal age range was 21-25 years, most participants were from level 400.

Research Instrument

Closed ended questionnaire was developed by the researchers in line with the research questions and used as the main research instrument in collecting the data for the study. The questionnaire was divided into four (4) parts as follows; (i) demographic data (ii) types of educational media/online platforms (iii) types of devices used for online learning (iv) Challenges encountered for online teaching and learning. The Likert scale for research questions 1 used “not utilized” and “utilized” as the main options. Research questions 2 also used the same options as research question 1. Research question 3 used four point response options as Strongly Disagree -

1, Disagree-2, Agree-3 and Strongly Agree-4. Likert scale is the most used techniques to measure studies on descriptive survey. The questionnaire was designed by the researchers using Google forms.

Validity and Reliability

The questionnaire was subjected to face validation. To ensure this, the researcher presented a copy of the questionnaire with the title, purpose of the study and the research questions to two experts who are experienced tutors in Mathematics education. The experts' suggestions were taken into consideration which helped the researchers to produce the final copy of the questionnaire after revision and amendments based on their comments. The internal consistency of the items yielded Cronbach alpha coefficient of 0.81 after a pilot.

Data Collection

Data were collected using an online survey questionnaire developed with Google forms which was sent to the pre–service teachers via a URL through WhatsApp and Telegrams by the researchers. Two weeks was used to collect the data.

Data Analysis

Research questions 1 and 2, were analyzed using frequency and percentages while research questions 3 used mean and standard deviation via data generated from SPSS version 22. For research question 1, any statement or item below 50% was considered "not utilized" and any statement with percentage of at least 50% was regarded as "utilized". For research question 2, simple frequency and percentages used reported on. For research question 3, a four–point response option of Strongly Agree (SA-3.50-4.49), Agree (A-2.50-3.49), Disagree (D-1.50-2.49) and Strongly Disagree (SD-0.00-1.49) was used in rating the responses to the questionnaire items. Any item with a mean response value of 0.00-2.49 was regarded as Disagree, while any item with a mean response value of 2.50 and above was regarded as Agree.

Results and Discussion

This section presents the results, interpretation and discussion of the findings in relations to the research questions that were formulated.

Research question 1: What are the educational media or platforms used by Mathematics Pre-service teachers during the COVID-19 pandemic lockdown online learning?

Table 1: Frequency and percentage of responses on the educational media or platforms used by Mathematics pre-service teachers during the COVID-19 pandemic lockdown

S/No.	Item	Frequency	Percent	Response	Decision
1	Google Hangouts	53	15.4	Utilized	
		292	84.6	Not utilized	Not utilized
2	Google Classroom	282	81.7	Utilized	
		63	18.3	Not utilized	**Utilized**
3	Google Meet	49	14.2	Utilized	
		296	85.8	Not utilized	Not utilized
4	WhatsApp	307	89.0	Utilized	
		38	11.0	Not utilized	**Utilized**
5	Skype	11	3.2	Utilized	
		334	96.8	Not utilized	Not utilized
6	Microsoft Teams	44	12.8	Utilized	
		301	87.2	Not utilized	Not utilized
7	Zoom	188	54.5	Utilized	**Utilized**
		157	45.5	Not utilized	
8	Facebook	40	11.6	Utilized	
		305	88.4	Not utilized	Not utilized
9	Interactive Whiteboard	53	15.4	Utilized	
		292	84.6	Not utilized	Not utilized
10	Moodle	42	12.2	Utilized	
		303	87.8	Not utilized	Not utilized
11	Voice over PowerPoint	116	33.6	Utilized	
		229	66.4	Not utilized	Not utilized
12	YouTube	57	16.5	Utilized	
		288	83.5	Not utilized	Not utilized
13	Telegram	279	80.9	Utilized	
		66	19.1	Not utilized	**Utilized**
14	Edmondo	22	6.4	Utilized	
		323	93.6	Not utilized	Not utilized

From the Table 1 above, it can be seen that, the top four platforms that were mostly utilized during the lockdown for learning were Google Classroom, WhatsApp, Zoom and Telegram. A total of 282 respondents representing 81.7% agreed to use Google Classroom platform for learning. Again, 307 respondents used WhatsApp to learn during the COVID-19 and it represents 89.0%. Zoom was another online platform that was used to learn during the pandemic. From the data generated from the Mathematics pre-service teachers, it was found out that, 188 agreed to use Zoom which translates to 54.5 in percentage-wise. Telegram usage was peaked at 80.9% which represents a frequency of 279. The data shows that WhatsApp was the popular App and platform that was used with 89.0 % in the learning process by the Mathematics pre-service teachers in the Colleges of Education in the Northern part of Ghana during the COVID-19 pandemic. This is a result of the fact that, WhatsApp is commonly used as the medium of

communication and information access and almost all the students have the app installed on their smart phones and a higher percentage of the students use smartphones and it was seen in the data that was gotten from the respondents as the app stood out tall among the others in percentage-wise. Telegram was the next most popular platform that was used among the Mathematics pre-service teachers because it is easily accessible and common among the Mathematics pre-service teachers and was used by tutors to send information and course materials are sometimes kept on the platform for the Mathematics pre-service teachers to download and read. It is obvious from the data that, the educational media platforms that were used by these Mathematics pre-service teachers in the pandemic to carry on with teaching and learning of Mathematics mostly fall within the bracket of Zoom, Telegram, WhatsApp and Google Classroom which tallies with studies done by Gichuhi et al. (2020) in Kenya about the use of social media on lesson delivery in higher education. This study

results also agrees with a study done by Agormedah et al. (2020) which was about usage of online platforms. Also, the current study corroborates with the study done by Elfirdoussi et al. (2020) where 23.9 % used Zoom, 15.9 % used Google Classroom and 17% of the respondents asserted to using other online learning platforms such as Microsoft Teams and YouTube channels for learning during the COVID-19 lockdown in some selected Moroccan universities.

Research question 2: What are the devices used by Mathematics Pre-service teachers during the COVID-19 pandemic lockdown online learning?

Table 2: Frequency and percentage of responses on devices used by Mathematics pre-service teachers during the COVID-19 pandemic lockdown

S/No.	Device	Decision	Frequency	Percent
1	Desktop	Used	22	7.3
		Did not use	279	92.7
2	Laptop	Used	64	20.6
		Did not use	246	79.4
3	Tablet	Used	19	6.3
		Did not use	283	93.7
4	iPad	Used	8	2.7
		Did not use	288	97.3
5	Smartphone	Used	334	97.7
		Did not use	8	2.3

The research question 2 of the current study sought to elicit from the Mathematics pre-service teachers on the devices that were used for teaching and learning during the COVID-19 pandemic lockdown. The results here are analyzed based on the most used device in descending order in terms of percentages. From Table 3, 334 of the Mathematics pre-service teachers asserted and agreed to the fact that they used smartphones to learn representing 97.7 % during the lockdown. The second most used device was the laptop, 64 (20.6%) used it to access teaching and learning of Mathematics during the lockdown. Desktop computers were the next device that 22 (7.3%) respondents mentioned they used. The next device that was used in the teaching and learning process during the lockdown was Tablet with 19 (6.3%). The least used device from the data gathered shows that, it is the iPad with only 8 (2.7%). This could be among other reasons for being expensive and not easy to afford by the pre-service teachers. The findings from the data gathered on the question of devices used by the Mathematics pre-service teachers during the lockdown agrees with Elfirdoussi et al. (2020), Agormedah et al. (2020) and Ogbonnaya et al. (2020) whose studies indicated majority of students used smart phones and a few used Tablets and computers.

Research question 3: What challenges did the Mathematics Pre-service teachers encounter during the COVID-19 pandemic lockdown online learning?

Table 3: Mean rating of the challenges by Mathematics pre-service teachers during the COVID-19 pandemic lockdown.

S/No.	Statement	N	Mean	Standard Deviation	Decision
1	Feeling of isolation while learning	345	2.86	.938	Agree
2	High cost of data for internet subscription	345	3.68	.734	Agree
3	Poor internet services in remote areas	345	3.65	.717	Agree
4	Inadequate electricity supplies to keep device always charged before lectures	345	3.10	.922	Agree
5	Lack of smart device (phone, Laptop, tablet) due to high cost	345	3.33	.807	Agree
6	Technical issues like poor internet connectivity and signals causing interruption during classes	345	3.48	.763	Agree
7	Lack of motivation for independent learning	345	3.04	.885	Agree
8	Classes were not interactive	345	3.00	.905	Agree
9	I missed seeing my lectures face -to- face during lectures	345	3.21	.881	Agree
10	Online Examination	345	2.60	1.063	Agree
11	low level of incentive to lecturers	345	2.97	.826	Agree
12	Resistance to change among lecturers and students	345	2.90	.777	Agree
13	Poor level of lecturers' readiness to adopt e-learning	345	2.99	.905	Agree
14	Insufficient skills among lecturers to use the digital platforms	345	3.02	.918	Agree
15	Eye straining	345	3.10	.813	Agree

Research question 3 was seeking to find out the various challenges that were encountered by the Mathematics pre-service teachers. From Table 3 above, it was realized that the Mathematics pre-service teachers agree to all the 15 items as the challenges they encountered during the COVID-19 pandemic lockdown. But key among these challenges were; high cost of data for internet subscription, lack of smart device due to high cost, poor internet services in remote areas, technical issues like poor internet connectivity and signals causing interruptions during classes with mean scores of 3.68, 3.33, 3.65 and 3.48 respectively. The rest of the challenges were pre-service teachers having to miss seeing their lecturers face-to-face during lectures for more active interaction and feedback with a mean of 3.21, inadequate electricity supplies to keep device always charged before lectures with a mean of 3.10 and the issue of eye straining by pre-service teachers with a mean score of 3.10. The findings of this study agrees with that of Ujunwa (2021) who also found challenges of e-learning during COVID-19 pandemic in Colleges of Education in Nigeria as follows; intermittent cuts in power supply, high cost of procurement for electronic devices, high cost of maintenance for ICT equipment for e-learning, poor internet connectivity, poor technical support and high cost of data bundle. Furthermore, the findings from this study also concur with those of Boelens et al. (2017) and Rasheed et al. (2020) whose studies were conducted to find out about the implementation challenges in institutions of higher learning of online learning platforms.

Conclusion

From the results, the following conclusions were made;

Beginning with the issue of the educational media platforms that were used by the Mathematics pre-service teachers during the COVID-19 pandemic, it was evident that Zoom, Telegram, WhatsApp, and Google Classrooms were the mostly used online platforms. Others that were not used greatly were Google Hangouts, Google Meet, Skype, Microsoft Teams, and Facebook.

Secondly, the most common devices that were used by the Mathematics pre-service teachers during the COVID-19 pandemic lockdown included Desktop computer, laptops, tablets, iPads and smartphones. However, smartphone was the most common device used for the online teaching and learning of Mathematics during the COVID-19 pandemic.

Last but not least, key among the challenges that were encountered by the Mathematics pre-service teachers in learning Mathematics were, high cost of data for internet subscription, lack of smart device due to high cost, poor internet services in remote areas, technical issues like poor internet connectivity and signals causing interruptions during classes. The rest of the challenges were pre-service teachers having to miss seeing their lecturers face-to-face during lectures for more active interaction and real time feedback, inadequate electricity supplies to keep device always charged before lectures and the issue of eye straining by pre-service teachers.

Recommendations

Based on the findings after the data was analyzed, it is recommended that

Firstly, the Government of Ghana through the Northern Electricity Distribution Company (NEDCo) and Volta River Authority (VRA) should work hard to add more and additional stand-by power generators for Colleges of Education in the unlikely events of power outage in the country especially during this era of Covid-19 where almost every pre-service teacher and tutors are online using electricity to study and teach.

Also, Tutors and College Management should make it a priority to organize orientation and seminars for all students on how to use and access online contents and using devices to accomplish e-learning for no one knows when and how the next pandemic or epidemic could hit the world again and it may again, lead to schools closure and learners having to go online yet again with their tutors. It is therefore highly recommended that, students be given training on how to use these online resources and applications so that they may be able to use it with ease during emergencies which will lead to closure of schools now or in the future.

While the challenges facing students at tertiary institutions in this Covid-19 era have been examined by Aboagye et al. (2020), the current study reported on the Usage of Online Media platforms, Devices and Challenges for Teaching and Learning during COVID-19 pandemic in Northern Region Colleges of Education. A study to investigate tutors and students in Colleges of Education in a single comparative analysis should assist to identify and address the challenges in future.

Again, the Government of Ghana should assist students in Colleges of Education to acquire laptops and smartphones and ensure that tertiary institutions are well furnished with technological gadgets such as LMS and wireless networks to make internet accessibility easier on campus.

Last but not least, the Curriculum should be designed to incorporate both online and conventional learning approaches at Colleges of Education so that a change in pedagogy in case of another pandemic should not be a problem to educational institutions. This is important to make instructors and learners familiar with both pedagogical models.

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