Journal of Science and Technology, Vol. 37, No. 3 (2017), pp67 –79 67

http://dx.doi.org/10.4314/just.v37i3.7

RESEARCH PAPER

E-LEARNING UTILIZATION AND EXPERIENCES IN HIGHER EDUCATION: INSIGHTS FROM KNUST-BASED BSU SURVEY

W. Oduro[1], ***R. B. Lamptey**[2], **R. Tawiah**[3], **G. A. Okyere**[4] and **M. O. Thompson**[5]
[1]*Department of Wildlife and Range Management, FRNR, CANR, KNUST*
williamoduro@yahoo.co.uk
[2]*College of Science Library, KNUST, Kumasi*
**Corresponding author: phanerosis75@gmail.com*
[3]*School of Medicine, Griffith University. Brisbane, Australia*
rtawiah64@yahoo.com
[4]*Department of Mathematics, KNUST, Kumasi*
goasare@yahoo.co.uk
[5]*University Library, KNUST, Kumasi*
thompson.mdo@gmail.com

ABSTRACT
E-learning is increasingly becoming common in higher education institutions due to the potential benefits deemed to be derived from its exploitation. Accordingly, the Kwame Nkrumah University of Science and Technology (KNUST) has employed a range of technologies and tools to allow and enhance e-learning within the University. However, there is absence of documentation describing the extent of utilization given the problems of teacher/student inabilities in ICT among others. Moreover, the specific teaching and learning activities that incorporate e-learning have not been addressed by previous studies. This paper reports on the e-learning environments of KNUST, with particular focus on utilization and experiences. Data for this study was extracted from the KNUST-based Building Stronger Universities (BSU) project. This included 1,145 participants being educational managers, teachers, IT experts and students of the university. Test of proportions, count regression analysis and graphical procedures were employed to implement data analysis. The study revealed that utilization of e-learning was high, particularly among the student (97.8%) and teacher (64.3%) participants. Results from the count regression model showed that students from College of Agriculture and College of Engineering more frequently use e-learning compared to their counterparts from other colleges of the University. The e-learning experiences among teachers and students are outlined and discussed, few are: use of online video lectures, public address system for lecture delivery, use of e-journals for accessing articles and delivery of course materials through emails. The study contributes to understanding of the extent of acceptance and application of e-learning in Ghanaian on-campus higher education, using KNUST as a case study.

Keywords: *E-learning, learning, Ghana, resource, teaching, University, library resources*

INTRODUCTION

The use of Information and Communication Technologies (ICTs) in the form of e-learning in higher education is well acknowledged to afford potential benefits including widening access to education and information, reducing

costs, improving quality of education and enhancing collaboration, pedagogical skills and academic performance (Oye, *et al*., 2012; Rodgers, 2008; Sife, *et al*., 2007; Andersson and Grönlund, 2009). Owing to this enormous potential, the Kwame Nkrumah University of Science and Technology (KNUST) in Ghana has employed a range of technologies and tools that allow and enhance e-learning within the university (Marfo and Okine, 2011). An appraisal report on e-learning confirms that KNUST has been working with e-learning since 2006 (Larsen and Rytkønen, undated). Today, the University has installed a third generation (3G) data network to enable students and teachers access e-learning platform anywhere on the University's campus (Agyekum, *et al.,* 2014). However, there is an absence of documentation describing the extent of utilization, given the problems of teacher/student inabilities in ICT among others. The use of e-learning in teaching and learning activities demand some special skills. In particular, students have to exhibit their learning efforts through different types of technology and teachers often need to restructure their courses to incorporate electronic devices (Pirani, 2004). For many universities, the use of e-learning may present significant challenges in the sense that, many teachers and students may lack the skills required to facilitate e-learning and thus this may potentially affect the extent of utilization. Khasawneh (2015) explored the factors that influence the use of e-learning technologies among academic staff of Jordanian Universities.

The study found that self-efficacy and facilitating condition have positive effect on behavioral intention to use e-learning in the higher educational system. It is estimated that 32% of lecturers and 35% of students in public universities in Kenya utilize e-learning (Makokha, and Mutisya, 2016). However, at KNUST, the extent of utilization among academic staff and students has not been investigated. Moreover, it is unknown whether the colleges within the university and the level of study play a key role in the rate of utilization among students. Also, the specific e-learning experiences among teachers and students have not been clearly established. Therefore, the purpose of this study is to assess the extent of utilization and clarify the specific e-learning experiences among teachers, students and IT experts of the university. Data for the study were gathered from the KNUST-based Building Stronger Universities (BSU) project which included 1,145 participants.

E-learning is understood in a variety of contexts such as online learning, virtual learning, distributed learning, network and web-based learning (Naidu, 2006). The use of e-learning entails some form of interactivity through the internet, including online interaction between the learners and their teachers or peers (Ministry of Education New Zealand, 2009). Moore and Kearsley (1996) proposed three types of interactions that allow students to learn effectively in e-learning environments leading to the success of e-learning initiatives, see (Salim, 2005).

The first is learner-content interaction that refers to the student's interaction with the course materials (Salim, 2005). This type is facilitated through the design of electronic or web-based materials and activities. The second is the learner-instructor interaction that refers to the student's interaction with the instructor, which is an essential component of e-learning (Salim, 2005). The third is the learner-learner interaction through student collaboration (Salim, 2005). Accordingly, e-learning has been defined as the use of computer network technology, primarily over or via the internet, to deliver information and instructions to individuals (Ong and Lai, 2006). Naidu (2006) however, argues that e-learning comprises all educational activities that are carried out by individuals or groups working online or offline and synchronously or asynchronously via networked or standalone computers and other electronic devices. The devices or tools frequently used include laptops or personal computers, CD ROMs, MP3 players, mobile phones, televisions, data projectors, digital cameras, global positioning systems, personal digital assistants (PDAs) and interactive whiteboards. These allow the use of several technologies such as internet, intranet, extranet, Local Area Network (LAN), Wide Area Network (WAN), and video and audio conferencing (Ministry of Education New Zealand, 2009; Oye, *et al*., 2011). The

CDs and Web page technologies are the older type, while the audio-conference is recent (Moore and Kearsley, 2011).

Synchronous e-learning is real time interaction between the instructor and the learner through chat and video conferencing (Koller *et al*., 2001; Hrastinski, 2008). It takes the form of virtual classroom tuition which allows students to ask and instructors to answer questions right away through instant messaging. Conversely, asynchronous e-learning can be carried out even while the students are offline. This involves coursework delivered through web, email and message boards that are then posted on online forums (Hrastinski, 2008; Koller *et al.,* 2001).

E-learning is becoming increasingly prominent in higher education and gradually changing many institutions, particularly with respect to how teaching and learning activities are carried out. It offers institutions and their students the flexibility of place and time of delivering or receiving learning information (Al-adwan, and Smedley, 2012). Furthermore, it allows distance learning and consequently eliminates geographical barriers in education. Presently, some institutions are applying the hybrid mode of learning, utilizing both the traditional face-to-face tuition and e-learning (Al-Shboul, *et al.,* 2013). It is well recognized that utilization of e-learning in higher education institutions afford the potential of widening access to education, improving quality of education (Andersson and Grönlund, 2009) and enhancing academic performance of students (Oye, *et al*., 2012; Rodgers, 2008). Notwithstanding these potentials, e-learning in higher education is not without challenges.

According to Naidu (2006) the basic obstacle to the growth of e-learning is lack of access to the necessary technology infrastructure. Technological obstacles in an e-learning environment often occur in one of three basic components, namely hardware, software and bandwidth capacity (Al-adwan, and Smedley, 2012). In many developing countries, essential infrastructure for e-learning such as computers, electricity and skills are lacking (Heeks, 2002; Rajesh, 2003; Dhanarajan, 2001). Moreover, acquiring and getting access to other important infrastructure such as internet, extranet, intranet and LAN networks constitute one of the biggest challenges in these countries (Fares, 2007). Where these exist, they may be in poor states and even insufficient. A recent study conducted in Ethiopia revealed that lack of e-learning policy and awareness about e-learning by teaching and administration staffs are the main challenges in most universities (Anberbir, 2015). A study by Atsumbe *et al*. (2012), conducted at the Federal University of Technology in Nigeria, found out that the university has inadequate e-learning infrastructure. Inadequate e-learning infrastructure/ resources affects the extent of e-learning utilization (Ochuko, 2013). Naidu (2006) states that poor or insufficient technology infrastructure can lead to unsavory experience that can cause more damage than good to teachers, students and the learning experience.

Using the Decomposed Theory of Planned Behavior, Khasawneh (2015) found that self-efficacy, and facilitating conditions have positive effects on behavioral intention to use e-learning in the higher educational system. In developing countries like Kenya, e-learning in public universities is at its infant stage and the extent of utilization is low among lecturers (32%) and students (35%) (Makokha, and Mutisya, 2016). Ghavifekr and Mahmood (2017) investigated the factors that affect the use of e-learning platform in a Malaysian University. The authors uncovered that co-participatory activities are among the main factors that motivate the use of e-learning. Furthermore, demographic factors of study participants were as well identified among the factors influencing the rate of utilization. Ellis *et al* (2009) conducted a study to explore the key aspects of e-learning that might be related to the learning experiences among universities students. Four underlying factors described as e-teaching, design, workload and interactivity were identified as the most meaningful aspect of e-learning used to support student learning experiences, predominantly in the face to face environment.

MATERIALS AND METHODS

Survey data

Data used in this study was derived from the KNUST-based Building Stronger University

(BSU) phase two project funded by the Danish International Development Agency (Danida) was to strengthen the research and educational capacities of universities in selected Danida priority countries (Dahms, and Zakaria, 2015). The KNUST chapter of the project considered a cross sectional survey of 1,145 participants being staff and students of the University. The survey was conducted in the year 2016 with well-structured questionnaires built from a proposed matrix (Dahms, and Zakaria, 2015) for mapping PBL. The staff survey participants were educational managers, teachers and Information Technology (IT) experts of KNUST. Among students the target population was undergraduates in second and third year, and postgraduate students in first year. Students were drawn from thirty-three (33) programs (year two and year three undergraduate and first year postgraduate) across the six colleges of the University. The Colleges are Science, Agriculture and Natural Resources, Architecture, Health and Allied Sciences, Arts and Social Sciences and Engineering. Since some Colleges have more departments than others, probability –proportion-to-size sampling approach was used to select the programs. Students were engaged through focus group discussions in their various lecture halls whereas staff were engaged individually in their offices. The principal survey questions are as follows:

1. Could you please tell us which resources, both human and infrastructural, the university/college/department has at present for e -learning?

2. Does the university/college/department in your opinion have sufficient resources, both human and infrastructural, for e-learning?

3. Are you using e-learning in any of your teaching activities? If yes, please elaborate on your experiences.

4. Have you been using or are you at present using e-learning in any of your study activities? If yes, please elaborate on your experiences- please, include institutional and teacher support for such activities. If no, would you like to be able to have access to e-learning opportunities in the future?

5. If you are teaching yourself: Are you using e-learning in any of your own teaching activities? If yes, please elaborate on your experiences.

The above, questions 1 and 2 were given to all participants while questions 3, 4 and 5 were limited to teachers, students and IT experts respectively.

Methodology of data analysis

The data analyses in this study were performed with a range of presentation tools and statistical methods. First, graphical procedures including clustered and stacked bar charts were employed to explore patterns in the responses of survey participants.

Statistical test of proportion was also used to determine whether the proportion of participants who were utilizing e-learning in their teaching and learning activities differ significantly from 50%. Furthermore, count regression analyses were employed to determine the simultaneous effect that college of study and level of study have on the use of e-learning. Specifically, the Poisson Regression Model and the Negative Binomial Regression Model were employed. When applying these models, data was first aggregated into counts at the levels of college and year of study based on the responses from students regarding the use of e-learning. The counts of utilization or exposure to e-learning was specified as the outcome variable while college and level of study were treated as covariates. College of Science and year 2 undergraduate were used as categories at baseline (reference level) for the college and year of study variables respectively. The Poisson Model assumes that data is equidispersed (Mouatassim and Ezzahid, 2012). However, the negative binomial model is used when the equidispersion assumption is violated (Zeileis, *et al.,* 2008). Data preparation and graphical procedures were computationally handled in Ms Excel. Also, the test of proportions was performed with MINITAB and the count regression models were executed using R.

RESULTS

The categories of survey participants considered in this study are presented in Table 1. In total, 1,145 participants were surveyed for the study with majority being students (89.1%) from various colleges of KNUST (Table 1). The IT experts were fewer, occupying 1.0% of the entire sample. Also, 3.8% and 6.1% of the participants were educational managers and teachers respectively (Table 1).

Available resources for E-Learning

To elicit information regarding the available e-learning resources at KNUST, survey participants were asked to indicate the resources, both human and infrastructural that the university has at present for e-learning. In respect to this question the responses below were given by survey respondents in order of preference.

- Projector
- ICT lab
- Electronic library and e-learning center
- Wifi enabled lecture theatre
- Computer laboratory
- Printers
- Internet facility
- IT technical staff
- Laboratories with old machines
- Desktop computers
- Lecturers with ICT skills
- Workshop
- Public Address system
- Inaccessible computers

Survey participants were asked whether the university has sufficient human and infrastructural resources for e-learning. Only few respondents in the four participating groups indicated that the university has sufficient resources for e-learning. Explicitly, a proportion of 9.1% of the IT experts responded yes. Among the educational managers, the proportion of 11.4% reported that the university has sufficient resources for e-learning with 88.6% who think otherwise. Correspondingly, among the teaching (5.7%) and student (1.7%), just few were in support that the university has sufficient resources for e-learning, see Fig. 1. The participants also reported that the e-learning environments of the university are surrounded by several challenges including frequent power outages, small capacity of e-library and ICT labs, low bandwidth connectivity, low memory speed computers and lack of contemporary technologies.

Extent of utilization of E-learning

To understand the extent of exploitation of e-learning in the University, survey participants

Table 1: Frequency distribution of survey participants

Survey Participants	Frequency (n)	Percent
IT Experts	11	1.0
Educational Managers	44	3.8
Teachers	70	6.1
Students	1020	89.1
Total	**1145**	**100.0**

Source: Field Survey

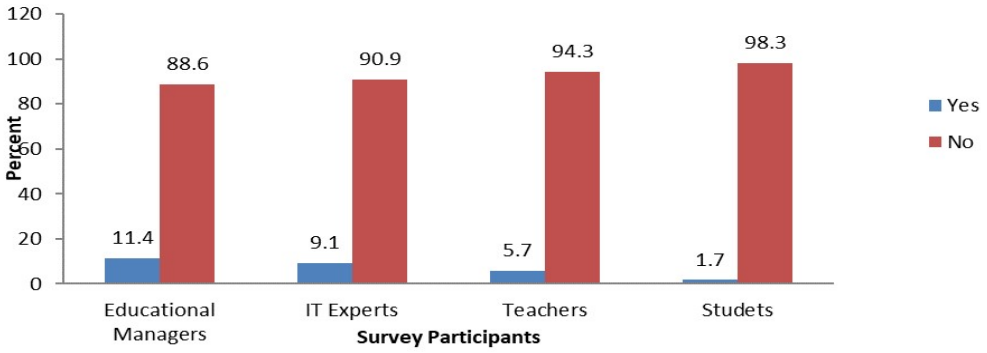

Fig. 1: Outlook of sufficient resources for e-learning

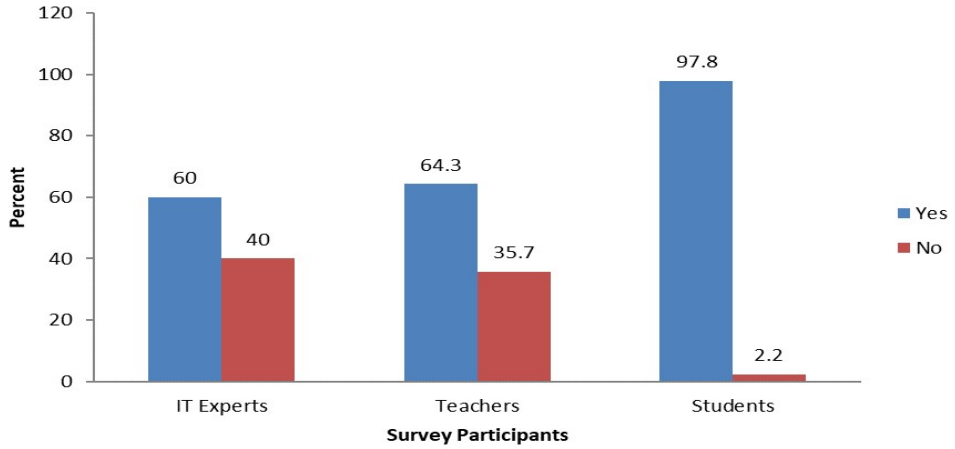

Fig. 2: Utilization of e-learning among participants

were asked to indicate whether they have been exposed to or utilized e-learning in their teaching and learning activities. This question was limited to the IT experts, teaching and student participants. Among the IT experts, 60.0% responded that they employ e-learning in their teaching and learning activities (Fig. 2).

With a corresponding p-value of 0.754 given by Table 2, the proportion of IT experts who make use of e-learning in their teaching and learning activities is not significantly different from

Table 2: Test of Proportion of e-Learning utilization among participants

Survey Participants	Sample Proportion (%)	95% Confidence Interval		P-Value
IT Experts	60.0	26.3	87.8	0.754
Teachers	64.3	51.9	75.4	0.022
Students	97.8	96.6	98.6	0.000

p-value based on one-tailed test

50.0%. Nonetheless, among the teaching participants, a significant proportion (sample proportion=64.3%; p-value=0.022), more than 50.0% indicated that they exploit e-learning in their teaching and learning activities. On the whole, 97.8% of the student participants indicated that they use e-learning. The participants provided the following as some of their experiences of e-learning within the university:

- Using projectors for projecting lectures, assignment, project and seminar presentations
- Public address system for lecture delivery
- Using laptops and personal computers to read
- Submission of assignments via emails
- Delivery of course materials through emails
- Typing and printing of assignments
- Searching and downloading research articles, books and other informative materials online
- Downloading video lectures online

The teaching participants reported that they use public address system when teaching large classes. The use of projectors in teaching was reported to be frequent and mostly combined with the utilization of writing on the marker boards. Moreover, assignments, projects and seminar presentations through the use of projectors are common practices. The teaching participants elaborated that the delivery of course materials via emails rarely occurs and mostly does not engage entire class except the teacher and course/ class representatives. This is subsequently followed by the class representative delivering the materials to their mates. Where it involves all students, the class uses a common email. However, online delivery and submission of assignments through emails are very common. The IT and teaching participants detailed that they collaborate with their peers within and outside the university through emails. The IT experts indicated that the e-library provide access to online journals and books and it can be accessed by students and staff on individual and group basis. The teacher and student participants confirmed that they use the e-library, while a few reported that they rarely use the facility. The students noted that they usually download and use online video lectures to complement the notes they take in class. Moreover, downloading and reading from portable document format (PDF), and Microsoft technologies mostly word documents and power points were frequent.

In spite of these, the e-learning environment of the university is facing some challenges. As outlined by the teacher and student participants such challenges include:

Teacher and staff participants:

- Erratic power supply,
- Limited access to internet and e-study space
- Infrequent e-learning training/ workshop for students and teaching staff

- Absence of some contemporary e-learning tools and technologies such as interactive whiteboards, video and audio conferencing platforms.

The teacher and student participants suggested that they would like to have access to well enhanced e-learning platforms and other e-learning opportunities which are not presently available within the University, such as:

Student participants:

- Create a blog for information and a platform to meet lecturers online
- Lecturers/teachers prepare video lectures and made available to students
- Improve internet connections and make it accessible everywhere
- Extend free internet connectivity to students residing off campus
- Provide electric plants to supply constant electricity
- Renovate all college and department computer labs, stocking them with working computers.
- Make course outlines available to students online

Teacher participants:

- Create virtual classrooms
- Provide electric plants to supply constant electricity
- Provide/supply diagram answer simulators
- Train lecturers/teachers on e-learning
- Provide electronic distance learning
- Create more centres furnished with computers and fast internet access that can be accessible to students.

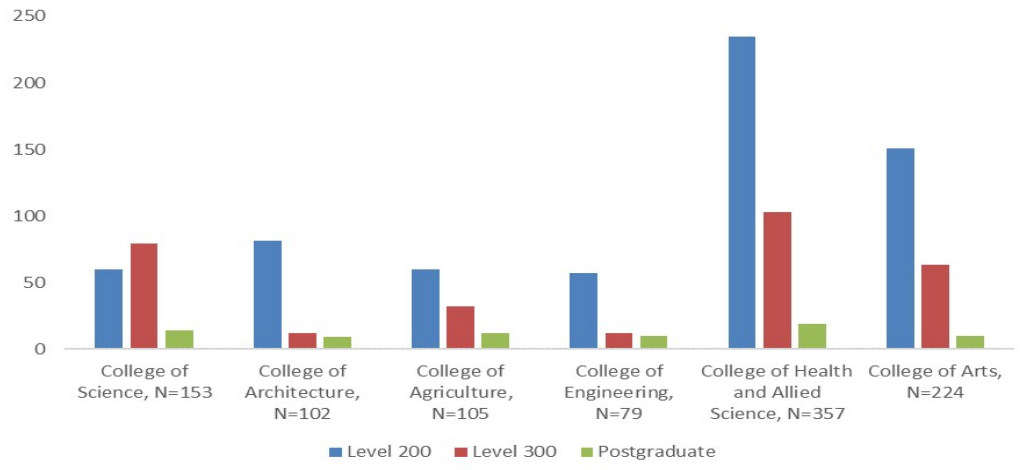

Fig. 3: Frequency distribution of student participants stratified by College and level of study (N denotes the number of students from each College)

Majority of these participants (Fig.3) were from College of Health and Allied Science (N=357, 35%), followed by College of Arts (N=224, 22.0%). College of Engineering had the lowest sample (N-79, 7.7%). In each college most of the students were drawn from level 200 excepts College of Science, where majority of them were chosen from level 300.

From Fig. 4, utilization is extremely high in students from College of Agriculture, followed by College of Engineering. These participants were largely level 200 students from all colleges. The figures seem to suggest that college and level of study are good candidates for predicting the number of students who utilize e-learning within the University. Moreover, the interaction between college and level of study could be a useful variable accounting for the use of e-learning among students. Negative Binomial (NB) regression analysis were performed to assess the assumption that the college and level of study as well as their interactions are predictors of the number of students who utilize e-learning within the University.

Table 3 shows the fit statistics of these models. Considering the Poisson Model the dispersion parameter is larger than 1. This depicts the presence of over-dispersion in the data hence, suggesting that the Poisson model is inappropriate. However, within the context of the negative binomial model, the dispersion parameter is approximately 1, indicating that this model provides an adequate fit for the data. Inclusion of the interaction term to the negative binomial model extensively deflated the degrees of freedom for the residual deviance to zero due to problems of over-fitting. Comparing the models based on the values of the Akaike's Information Criterion (AIC) the negative binomial model with interaction term appeared to be much relevant. However, this model has been linked to over-fitting, therefore making negative binomial model without the interaction term more reliable. In the analyses presented below, the negative binomial specification without interaction term was used (Table 4). For the factors, college and level of study, College of Science and level 200 were used as the reference categories respectively.

When controlling for level of study, College of Agriculture recorded the highest rate of e-learning utilization (RR=1.75; 95% CI=0.27-16.59) compared with College of Science. Specifically, student participants of College of Agriculture utilize e-learning in their study (75%) more than students of College of Science. Also, student participants of College of Engineering

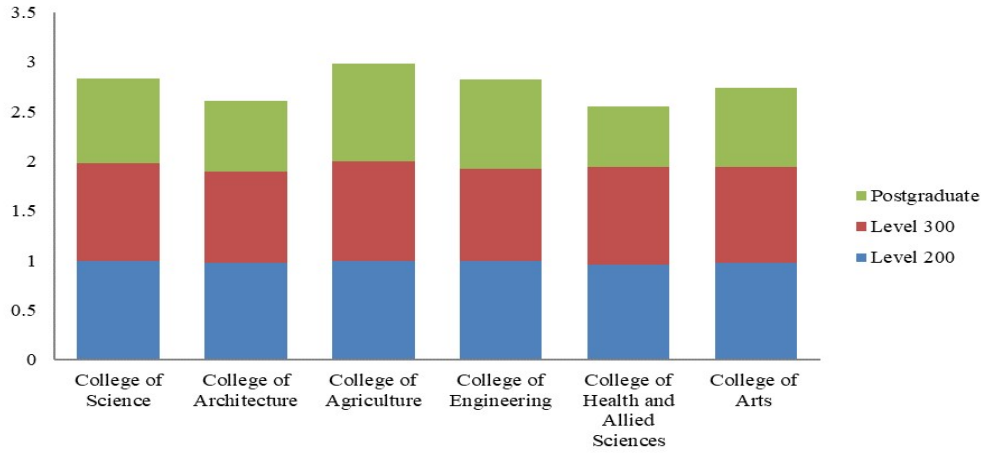

Fig. 4: Proportion of students utilizing e-learning grouped by College and level of study

Table 3: Fit statistics of poisson and NB models for the number of students using e-learning

Statistics	Poisson model	Negative Binomial Model	Negative Binomial Model with Interaction term
Residual Deviance	191.3	14.75	0.00
DF	10	10	0
Dispersion parameter (Residual dev./DF)	19.1	1.48	
AIC	275.2	155.0	105

Table 4: Negative binomial regression estimates of rate ratios for utilization of e-learning

Variables	Rate Ratios (RR)	Standard Error	Z value	95% CI for Ratio Rate		p-value
Intercept	263.28	0.70	7.97	55.46	1958	0.000***
College of Science						
College of Architecture	0.14	0.91	-2.18	0.02	1.06	0.030*
College of Agriculture	1.75	0.86	-0.33	0.27	6.59	0.738
College of Engineering	1.63	0.85	0.66	0.11	5.53	0.513
College of Health and Allied Sciences	0.05	0.97	-3.04	0.01	0.44	0.002**
College of Arts	0.30	0.88	-1.35	0.05	1.87	0.176
Level 200						
Level 300	0.22	0.60	-2.54	0.04	0.94	0.011*
Postgraduate	0.01	0.69	-6.07	0.00	0.08	0.000***

(Reference categories: College of Science, Level 200)

who use e-learning were 63% more than those of College of Science. However, exploitation by students of College of Architecture was low: 86% less than students of College of Science. College of Arts (RR=0.30), and College of Health and Allied Sciences (RR=0.05) recorded fewer number of students who utilize e-learning. College of Architecture (p-value=0.030) and College of Health and Allied Sciences (p-value=0.002) were statistically significant.

Compared to level 200, the rate of e-learning exploitation among level 300 students and postgraduate students were low when the effect of the College factor was controlled. The rate of e-learning utilization among level 300 student participants was 78% less than level 200. The postgraduate student participants who integrated e-learning into their study were 99% less than students who use e-learning in level 200. Both level 300 and postgraduate level were significantly associated with low rate of e-learning utilization.

DISCUSSION

The present study examined issues surrounding e-learning, focusing on utilization and experiences among teachers, IT experts and students of KNUST in Ghana. The study further investigated the available e-learning resources and needs concerning e-learning infrastructure. A cross sectional survey data from the KNUST-based BSU phase two project was used for

the analysis. The results show that KNUST has both human and infrastructural resources for e-learning. These resources include LCD, public address system, ICT lab, e-library, e-learning center, Wi-Fi enabled lecture theatres, printers, lecturers with ICT skills, internet facilities, IT technical staff, desktop computers, workshop, and projectors. These results complement the existing studies on the e-learning environments of KNUST (Agyekum, *et al*., 2014; Marfo and Okine, 2011).

Nonetheless, our findings indicate that a proportion of the infrastructural resources was outdated and inaccessible, citing low bandwidth connectivity, frequent power outages, old fashioned and low memory speed computers and small capacity of e-library and ICT labs. These results are consistent with the growing literature on the challenges pertaining to the adoption and growth of e-learning in higher education institutions (Al-adwan, and Smedley, 2012; Fares, 2007; Rajesh, 2003; Heeks, 2002; Dhanarajan, 2001). Furthermore, the survey participating groups coherently agreed that the resources presently available for e-learning within the university are insufficient. It has been found that poor or insufficient infrastructural resources can lead to disagreeable experiences that can cause more damage than good to teachers, students and the learning experience (Naidu, 2006). Our study therefore, highlights the need to tailor interventions to address these issues to prevent any subsequent harm to the learning environment of the university.

While the extent of utilization of e-learning is low among university teachers (32%) and students (35%) in Kenya (Makokha, and Mutisya, 2016), on the contrary, we found that utilization is high among student (97.8%; 95% CI: 96.6%-98.6%; p-value: <0.001) and teaching (64.3%; 95% CI: 51.9%-75.9%; p-value=0.022) participants of our study. The rate of utilization among IT experts was 60.0% (95% CI: 26.3-87.8; p-value=0.754). The use of statistical test of proportions make it possible to generalize these results to the teaching, IT staff and student population of the university. Thus, the results provide evidence that more that 50% of the teaching and student population of the university use e-learning. Nonetheless, among the population of the IT staff the exploitation of e-learning is not significantly more than 50%. Utilization among students from College of Agriculture was 75% more than those from College of Science. Similarly, the rate of exploitation of e-learning among student participants of College of Engineering was 63% more than students from College of Science. On the other hand, utilization among students from College of Architecture, College of Health and Allied Sciences, and College of Arts were 86%, 95%, and 70% respectively less than that of College of Science. The rate of utilization declined with increasing level of study. Thus, when compared to level 200, the rate of e-learning utilization among level 300 and postgraduate students were low. Specific e-learning experiences outlined by participants include: use of projectors in teaching, projecting assignments, projects/theses and seminar presentations, public address system for lecture delivery, use of laptops and personal computers for reading, and submission of assignments and course materials through emails. Others include typing and printing of assignments; searching and downloading research articles, books and other informative materials online, and downloading video lectures online.

CONCLUSION

KNUST has both human and infrastructural resources for e-learning. The extent of utilization was high in the participants. Utilization among students varied across Colleges and level of study. The e-learning experience of the university largely involves the use of physical tools including projectors and public-address systems in teaching and learning activities. Also the use of internet tools such as downloader for downloading books, research papers and video lectures are frequent activities among students. This study gives the present picture of the extent of acceptance, usage and how e-learning platforms are applied in teaching and learning activities within KNUST.

REFERENCES

Agyekum, K.A.P., Tchao, E.T. and Affum, E. (2014). Quality of Service Evaluation of a Deployed 3G Data Network for a Campus wide e-Learning Platform. *International Journal of Computer Applications*, *91(16):14-19*.

Al-adwan, A. and Smedley, J. (2012). Implementing e-learning in the Jordanian Higher Education System: Factors affecting impact. *International Journal of Education and Development using Information and Communication Technology*, *8(1):121-135*.

Al-Shboul, M., Rababah, O., Al-Saideh, M., Betawi, I. and Jabbar, S. (2013). A Vision to Improve E-Learning at The University of Jordan. *World Applied Sciences Journal, 21 (6): 902-914.*

Anberbir, T. (2015). Survey of the Use of e-Learning in Higher Education in Ethiopia. Retrieved on 12/01/2019 from https:// bit.ly/2wweoqm

Andersson, A. and Grönlund, Å. (2009). A conceptual framework for eLearning in developing countries: A critical review of research challenges. *The Electronic Journal on Information Systems in Developing Countries, 38 (8):1–16*.

Atsumbe, B. N., Raymond, E. and Duhu, E.B.E (2012). Availability and utilization of e-learning infrastructures in Federal University of Technology, Minna. *Journal of Education and Practice, 3(13*).

Dahms, M.L. and Zakaria, H. (2015). Institutional Capacities in E-learning and Problem Based Learning at Universities and University Colleges in Tanzania and Ghana. Department of Development and Planning, Aalborg University.

Dhanarajan, G. (2001). Distance Education: Promise, Performance and Potential, *Open Learning,* 16(1):61-68.

Ellis, R. A., Ginns, P. and Piggott, L. (2009). E-learning in higher education: some key aspects and their relationship to approaches to study. *Higher Education Research & Development*, *28*(3):303-318.

Fares, A. (2007). ICT Infrastructure, Applications, Society, and Education. Nairobi: Strathmore University. Retrieved 22/05/2015 from http://citeseerx.ist.psu.edu/viewdoc/ download? doi=10.1.1.135.9429&rep=rep1&type=pdf

Ghavifekr, S. and Mahmood H. (2017). Factors affecting use of e-learning platform (SPeCTRUM) among University students in Malaysia. *Education and Information Technologies*, 22:75-100.

Heeks, R. (2002). Information Systems and Developing Countries: Failure, Success and Local Improvisations; *The Information Society*, 18(2):101-112.

Hrastinski, S. (2008). Asynchronous and synchronous e-learning. *Educause Quarterly*, *31* (4), 51-55.

Khasawneh, M. (2015). Factors influencing e-learning utilization in Jordanian Universities-academic staff perspective. *Procedia- Social and Behavioural Sciences*, 210: 170-180.

Koller, V., Harvey, S. and Magnotta, M. (2001). Technology-Based Learning Strategies http:// www.doleta.gov/reports/papers/ tbl_paper_final.pdf

Larsen, S. and Rytkønen, M. (n.d). E-learning Appraisal Report: Kwame Nkrumah University of Science and Technology, College of Health Sciences, Ghana. Building Stronger Universities in Developing Countries.

MacKeogh, K.M. and Fox, S. (2008). Opening access to higher education to all? What motivates academic staff in traditional universities to adopt e-learning?

Makokha, G.L. and Mutisya, D. N. (2016). Status of e-learning in Public Universities in Kenya. *International Review of Research in Open and Distributed Learning*. 17(3).

Marfo, J.S. and Okine, R.K. (2011). Implementation of e-Learning in Ghanaian Tertiary Institutions (A Case Study of KNUST). Retrieved on 20/05/2015 at http:// ir.knust.edu.gh/handle/123456789/1433.

Ministry of Education New Zealand (2009). Retrieved on 18/05/2015 from http://

www.minedu.govt.nz/NZEducation/ Education Policies/Tertiary Education/ ELearning/WhatIsELearning.aspx

Moore, M. G. and Kearsley, G. (1996). Distance education - a systems view. Belmont, CA.: Wadsworth Publishing.

Moore, M. and Kearsley, G. (2011). Distance Education: A systematic view of online learning. Third Edition. Retrieved 01/06/2015 from https://www.cengagebrain.com.mx/content/moore20992_1111520992_02.01_chapter01.pdf

Mouatassim, Y. and Ezzahid, E. H. (2012). Poisson regression and Zero-inflated Poisson regression: application to private health insurance data. *European Actuarial Journal*. DOI 10.1007/s13385-012-0056-2

Naidu, S. (2006). E-learning: A guide of principles, procedures and practices. Commonwealth Educational Media Center for Asia, New Delhi.

Ochuko, I.G., Amakaino, U. J. D. and Chamberlain, K. I. P (2013). Utilization of e-learning technologies in business education institutional delivery in colleges of education in Delta State of Nigeria. *International Journal of Education and Research*, *1(10).*

Ong, C. S. and Lai, J. Y. (2006). Gender differences in perceptions and relationships among dominants of e-learning acceptance. *Computers in human behaviour*, *22*(5): 816-829.

Oye, N. D., Salleh, M., Iahad, N. A. (2011). Challenges of e-learing in Nigerian University Education based on the experience of developed countries. *International Journal of Managing Information Technology, 3(2):39-48*.

Oye, N.D., A. Iahad, N., Madar, M..J. and Ab. Rahim, N. (2012). The impact of E-learning on students performance in tertiary institutions. *International Journal of Computer Networks and Wireless Communications*, *2 (2):121-130.*

Pirani, J. A. (2004). Supporting E-learning in higher education. Retrieved 08/06/2015 from http://net.educause.edu/ir/library/pdf/ERS0303/ecm0303.pdf

Rajesh, M. (2003). A study of the problems associated with ICT adaptability in developing countries in the context of Distance Education. *The Turkish Online Journal of Distance Education*, *4(2).*

Rodgers, T. (2008). Student Engagement in the E-learning process and impact on their Grades:. *International Journal of Cyber Society and Education*, *1(2):143-156*.

Salim, H.M. (2005). E-Learning Critical Success Factors: An Exploratory Investigation of Student Perceptions. IRMA International Conference.

Sife, A.S., Lwoga, E.T. and Sanga, C. (2007). New technologies for teaching and learning: Challenges for higher learning institutions in developing countries. *International Journal of Education and Development using Information and Communication Technology*, *3 (2):57-67*.

Zeileis, A., Kleiber, C. and Jackman, S. (2008). Regression Models for Count Data in R. *Journal of Statistical Software*, *27(8).*