Educational Implication For Adopting Open-Ended Response Systems In Higher Education: The Scenario Of Wa Polytechnic, Ghana.

Nicholas A. Tetteh, Joseph Osei, Harry B. Essel

Abstract: Teaching and learning is fundamentally a two-way affair: the teacher transferring knowledge and the learner making meaning from the knowledge. Teaching becomes complete when the learner acquires the knowledge transferred and applies it appropriately to real life situations. However, in Ghana, teaching and learning has undergone a lot of alteration coupled with both negative and positive effects. In Wa Polytechnic, teaching and learning has seen little or no improvement, with regards to information and communication Technology (ICT), making it difficult for students to acquire 21st century skills and be part of the digitally connected ecosystem. Active classroom participation and engagement, information sharing, communication collaboration coupled with large class sizes have been a problem for teachers and students in Wa Polytechnic; hence, the need to conduct a study to identify productive solutions that enhance students' participation and engagement in the classroom. The study investigates the role of ICT in augmenting active participation and engagement of students in the classroom via open-ended response systems. The study was conducted using Educational Design Research (EDR) methods. A critical analysis was done by studying the responses of the respondents which identified three forms of students' classroom participation and engagement: verbal classroom participation, non-verbal classroom participation and after classroom teaching and learning activities. Smart phones, laptop, tablet, iPad and regular cellular phone were the predominant devices used by students for other purpose rather than teacher-led class activities. When students were made to actively participate in the classroom using the devices as open-ended response system, students' engagement and their ability to contribute during lectures appreciated comparatively. It was, however, evident that open-ended response system was effective tool to manage large class sizes as students who were timid could contribute creatively in class which altered their character of learning.

Index Terms: Information, Communication, Technology, Student-Response System, teaching, learning.

1 INTRODUCTION

Information and Communication Technologies (ICT) are expounded as "a diverse set of technological tools and resources used to communicate, create, disseminate, store, and manage information" (UNESCO, 1999, [1]). Student's participation in teaching and learning in the Wa Polytechnic has seen little or no improvement. Lecturers do almost all the talking with a handful of students contributing in class. Incongruously, majority of the students would rather make a phone call to lecturers or meet them face-to-face for clarity on lessons taught. According to M.K. Salifu, D. Sanker & A. Chemogoh (personal communication, September 3, 2014), timidity, nervousness, shyness, fear of being mocked and lack of expression makes it difficult for some of them to contribute in class. But Liu, Tao and Nee (2008) assert teachers being aware of other students are the most important for student activities in classroom [128]. The other student, according to Liu, Tao and Nee (2008) are those that need attention [128].

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But the question is, in what form can those students be attended to? Takao, Takahashi and Kitamura, (2009) unfold that one attractive tool for communication and interpersonal relations that can help in teaching and learning is digital technologies such a mobile devices [503]. They further stated that in the current dispensation some students and lecturers seems depressed, lost and isolated in class without their mobile devices; hence, this makes their learning activities bizarre. To buttress this statement empirically, Eteokleous and Ktoridou (2009) opine that the use of digital technologies to enhance student learning increases students' attention to school work and participation in learning activities, which augments motivation and the learning experience [38]. In this emerging technological world where people around the globe are more connected to each other than ever through the use of digital technology (Clough, Jones, MacAndrew and Scanlon, 2007), students' challenges as aforementioned should be a thing of the past [360]. Campbell (2006) advocates that participants in the classroom, which include the lecturer (instructor) and the student (learner), should find a way of using the digital technologies to support classroom contact sessions [282]. However, in this era of globalization and technological revolution, teaching and learning is considered as a first step for every human activity. It plays a vital role in the development of human capital and it is linked with an individual's well-being and opportunities for better living (Battle & Lewis, 2002, [33], [34], [35]). It ensures the acquisition of knowledge and skills that enable individuals to increase their productivity and improve their quality of life. But the media in which teaching and learning take place reflect to some extent the level of knowledge learners can acquire (Saxton, 2000 [8]). Looking at the wider context of ICT and mobile learning, mobile devices are responsible for the new forms of art, employment, language, and commerce as well as teaching and learning. They are part of every transformation of discourses and knowledge (Ally, 2009 [10]). Saxton (2000) and Ally (2009) assertion gives the impetus that students of

Wa Polytechnic must be given the opportunity to explore the miscellany of Information and Communication Technology (ICT) especially in class [8], [10], to facilitate the process of teaching and learning as it is concerned with the exploitation and development of knowledge (Toro & Joshi, 2013, [63]). According to Oye, Iahad & Ab.Rahim (2012) the use of ICT in this global era is inevitable and digital literacy skills are very necessary in participatory information sharing and lifelong learning improvement [3]. These statements debatably open diverse ways we can leverage digital technologies to promote transfer and retention of knowledge in the process of teaching and learning; nonetheless, open-ended response systems can be leveraged to enhance classroom interactivity (Starkweather and Stowers, 2009, [187], [188]). In this study, the researcher seeks to explore open-ended response systems; a digital system of aiding interactivity teaching and learning. An article titled "Open-ended response system" in EDUCAUSE (2011) explicates open-ended response systems as "an electronic service or application that lets students enter text response during a lecture or class discussion" [1]. This system of teaching and learning provide students the opportunity to enter their comments on devices such as mobile phones, tablets, netbooks, or laptops that use a Wi-Fi or a mobile network connection (Ally, 2009), that links to the response service [10]. The frequent use of open-ended response systems for classroom interaction is assumed to enhance the digital literacy skills of both instructors and learners at Wa Polytechnic. However, behaviorism and gestalt theory identified by Chin (2004) to be the most effective way to foster teaching and learning was leveraged for this study.

2 OBJECTIVES OF THE STUDY

The fundamental objectives of this study is to:

1. Conduct a needs assessment on the instructors and students to identify the availability of smart devices; and other technical infrastructure that can support open-ended response systems at the Wa polytechnic.
2. Examine the stimuluses of Open-Ended Students' Response System in the classroom and how it alters the formative learning experience of students at the Wa Polytechnic.
3. Find out whether or not it can improve students' participation in teaching and learning.

3 METHODOLOGY

The study adopted educational design research (EDR) and action research methods. The study focused primarily on the lecturers and the students at Wa Polytechnic bearing in mind how technology can be integrated into classroom teaching and learning to enhance learning outcome. According to Educause Learning Initiative (ELI, 2011), EDR addresses educational problems in real-world - not laboratory - settings. EDR was primarily used to develop knowledge and solution on how to effectively integrate traditional classroom content with open-ended response systems [1]. The identified problem was observed using the three main phases of EDR: analysis, design, and evaluation (ELI, 2011). In the analysis, researchers discussed among themselves and had an opened discussion with section of students to learn about the root causes of the problem [1]. During design, a creative, multidisciplinary team made up of the researchers reviewed the theoretical knowledge relevant to the problem; brainstorms innovative solutions; considers various options; and creates designs to try in real educational settings using available ICT gadgets from both the researchers and students end. Once a prototype solution is developed, evaluation takes place to test and revise both the design and the ideas and assumptions on which it is built [1]. Sampling techniques including purposive, convenience and proportional stratified sampling (70% equalization level) techniques were used to select programme courses, lecturers and students for the study. Three hundred and fifty (350) questionnaire were administered to the students' respondents from the four selected programme courses to validate the intervention. The researchers retrieved 293 questionnaire which were used for the assembling, analysis and interpretation of the study. It must also be stated that the researchers were the lead instructors for the study. The practical analysis of data to verify the objectives of the research and other variables linked towards the use of technology in the academia, towards the acceptance and use of ICT for teaching and learning.

4 PRESENTATION AND DISCUSSION OF FINDINGS

Data was analyzed using Microsoft Excel Spreadsheet. The data analyzed were divided into sections. Section A dealt with respondents' demographic data; Section B focused on the factors preventing student's participation in class activities; Section C discussed how the study was conducted; Section D looked at the improvement after the research; and Section E focused on the challenges encountered in the research.

4.1 Section A: Demography of Respondents for the study

Respondents were made up of first and second year Higher National Diploma (HND) students from four programme courses all within the Arts and Humanities in Wa Polytechnic. Second year students were sampled since they have productively gone through first year introduction to Information and Communication Technology (ICT). First years were also selected since they are reading a course: Introduction to Computer Literacy for that semester; hence, it is presumed that all the respondents possess fundamental ICT proficiencies. Data were sampled from both male and female respondents.

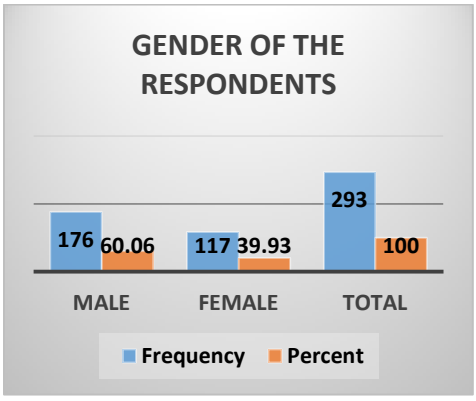

Fig.1. *Shows a bar chart representation of frequency and percentage of the overall gender*

***Table 1**: Sample gender and class distribution*

Variable	Gender and course demography of respondents				
Gender	**Course A**	**Course B**	**Course C**	**Course D**	**Total**
Male	43	51	47	35	176(60.07%)
Female	35	24	31	27	117(39.93%)
Total	**78**	**75**	**78**	**62**	**293 (100%)**

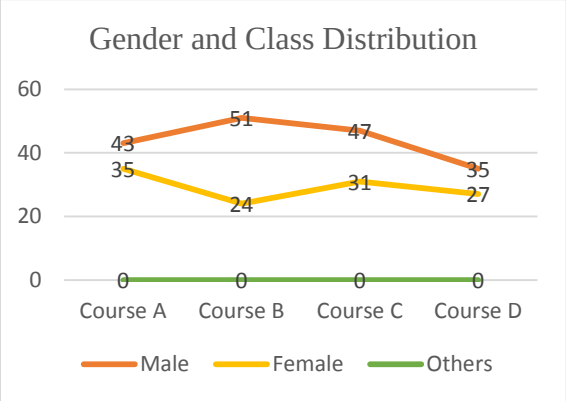

***Fig.2.** Shows a bar chart representation of frequency and percentage of the overall gender*

Fig.1. shows the overall gender representation of the respondents for the study. The male respondents subjugated the research with 60.06% and the female contributed 39.93% of the study. Table 1 and fig. 2 shows the sample gender and class distribution. The data, however, emphasize male dominance in the Ghana higher education system. Gender as a research variable also assisted the researchers to establish whether there were disparities between sexes with concerns to the implementation of ICT to corroborate instructional delivery.

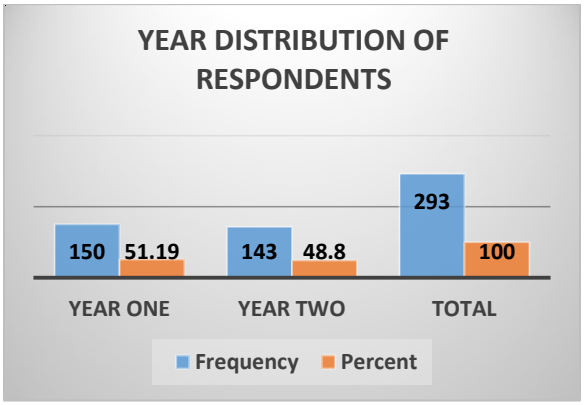

***Fig.3.** Year of respondents*

The researchers used two separate year categories of respondents. 150 respondents were selected purposively from first year and 143 selected from second year. The first year respondents were in the majority with the percentage of 51.19 to 48.80 compared to the second years. This implies that the study was mostly participated by the first years. Fig.3. throws more light on the respondents in terms of percentage and frequency.

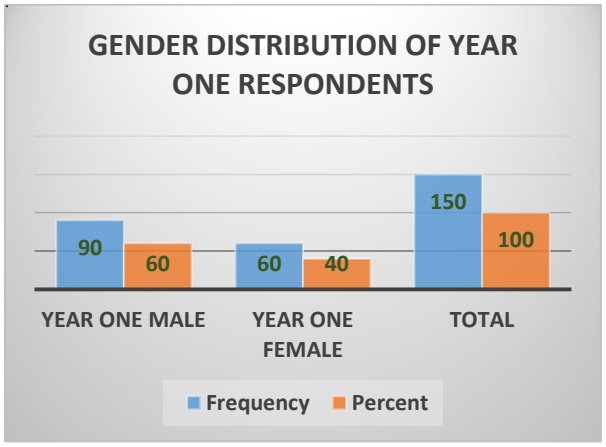

***Fig.4.** Year One gender distribution*

Fig.4. shows the gender distribution among the first years. It highlighted 60% male and 40% female. The male respondents were more than the female respondents among the first years.

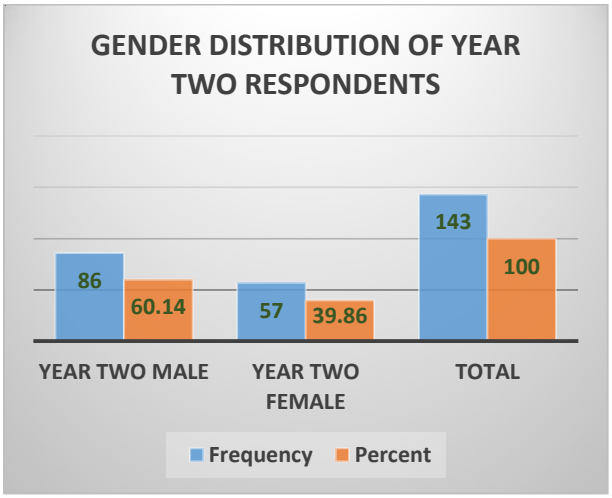

***Fig.5.** Year One gender distribution*

Similarly fig.5. exhibits the gender distribution among the second years. It highlighted 60.14% male and 39.86% female. Observedly in both years the males dominated the research.

Section B: Factors preventing student's participation in class activities

***Table 2**: Active participation of students in the classroom*

Variable	Class Participation		
Gender	**Yes**	**No**	**Total**
Male	15	161	176(60.07%)
Female	27	90	117(39.93%)
Total	**42**	**251**	**293 (100%)**

There was the need for the researchers to observe and establish how active students were during teaching and learning. Conversely, it was exposed that students' participation during lectures was off-the-cuff which makes the introduction of the open-ended response system intervention timely. The questionnaire administered to the respondents also substantiated the observation made by the researchers.

Table 2 shows that lesser number of students participate actively during teaching and learning. Out of the 293 respondents 42 representing 14.3% participated recurrently in class while 85.7% remain passive observers. The data also revealed that female participation in class - before the intervention - was higher than their male counterparts.

***Table 3**: Factors hindering student's contribution in class*

Variables	Gender		
	Male	Female	Total
Participation Hindrances			
Timidity	74	57	131(44.70%)
Peer Mockery	81	33	114 (38.90%)
Deficient of Expression	16	11	27 (9.21%)
Others	5	16	21(7.16%)
Total	**176**	**117**	**293 (100%)**

Further probe into the sedentariness of students in the classroom exposed timidity, fear of being mocked, lack of expression and others (nervousness, shyness,) as the major factors that hamper active participation during lectures. Other factors included unapproachable attitude and lackluster lecturing by lecturers, and inauspicious environmental conditions instantiated by large class size at the polytechnic (Table 3). In addition, students' inattentiveness in the classroom as they engage their mobile devices do not make them participate actively. The findings in table 3 gave the researchers the impetus to integrate ICT into teaching and learning to aid students participate actively in the classroom to optimize learning outcomes.

Section C: How the study was conducted

Lessons were conducted in real-time at lecture theatres. These lessons included Metal Design and Fabrication, Management Information Systems, African Studies and Basic Design. First Semester 2014/2015 Academic Year which consisted of 16 weeks; 12 weeks for teaching and learning, 2 weeks for student's revision and 2 weeks for examinations was used. 9 weeks were used for the study. Each subject relatedly recorded 13-18 meeting times in the study. The most being Management Information Systems; 18 times with the least being Basic Design; 13 times. Students were permitted to use their ICT gadgets for a class of two hours. Students had options for contributing. The researchers gave text message, WhatsApp, twitter, e-mail and others as the options for the respondents. Lecturers activated their ICT gadgets to receive the contributions from the respondents. Lecturers though using verbal talk, checked their ICT gargets to pick questions and contributions for further explanation to the class to aid teaching and learning.

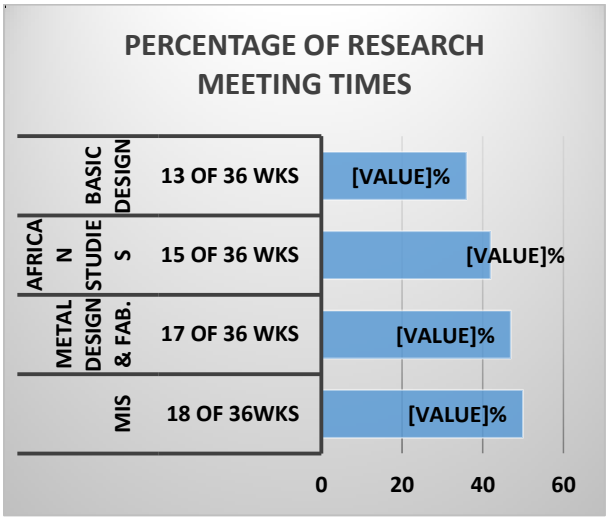

***Fig. 6.** Percentage of research meeting times*

Indications from fig.6. informed that Management Information Systems received the most lecturer and students interaction using ICT gadgets representing 50 % of the number of weeks in the semester in the study. The second subject to receive most interaction is Metal Design and Fabrication representing 47%. This was followed by African Studies 42% and lastly Basic Design representing 36%. The details in fig. 6 supports the argument of Leedy and Ormrod (2005) who assert that for quality research, at least, thirty percent (30%) of the total category for study, is a fair representation for an acceptable accuracy of results. All subjects used represented above 30% of the total meeting times [199].

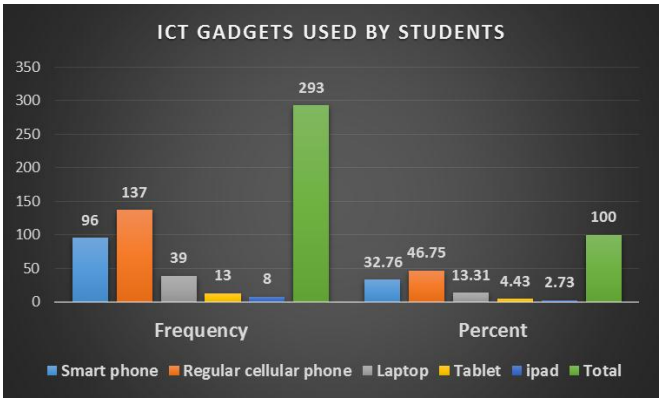

***Fig.7.** Types of ICT gadgets used by respondents*

The study identified smart phones, regular cellular phones, laptop, tablet and iPad as the ICT gadgets used in the research. The least ICT gadget used was the iPad making up 2.73%. Afterwards was tablet representing 4.43%. The laptop was the third most used ICT gadget representing 13.31%. The phones used were grouped into two: the smart phones making 32.76% and the regular cellular phone making 46.75% of the ICT gadgets used by the respondents for the research. Fig.7. gives percentage and frequency description of the ICT gadgets used by respondents.

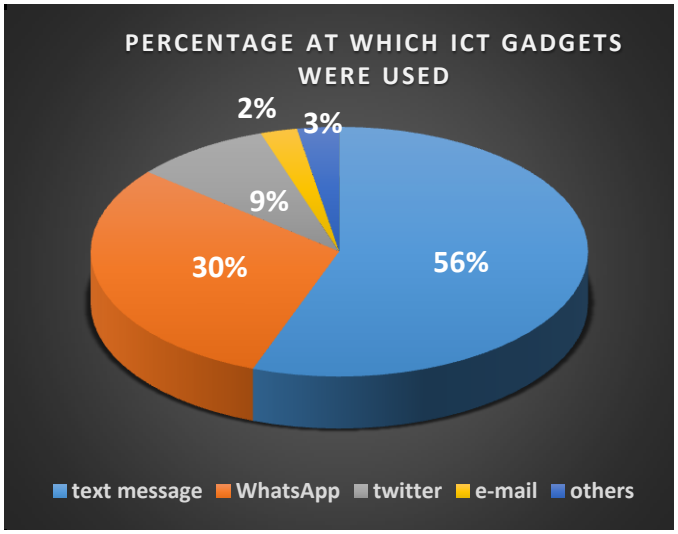

Fig. 8. *Percentage of use of ICT gadgets by respondents*

Fig.8. displays how the electronic media platforms were used in the research. With the frequency of 163 respondents, text messaging recorded the highest medium used in the research representing 55.63%. This was followed by WhatsApp representing 30.37% with the frequency of 89. Twitter became third with 8.87% haven the frequency of 26 respondents. E-mail placed last with the frequency 7 respondents representing 2.38% while others took the fourth position in the research with the frequency 8 representing 2.73%. It must be noted that the respondents were more familiar with text messages than any of the media platforms.

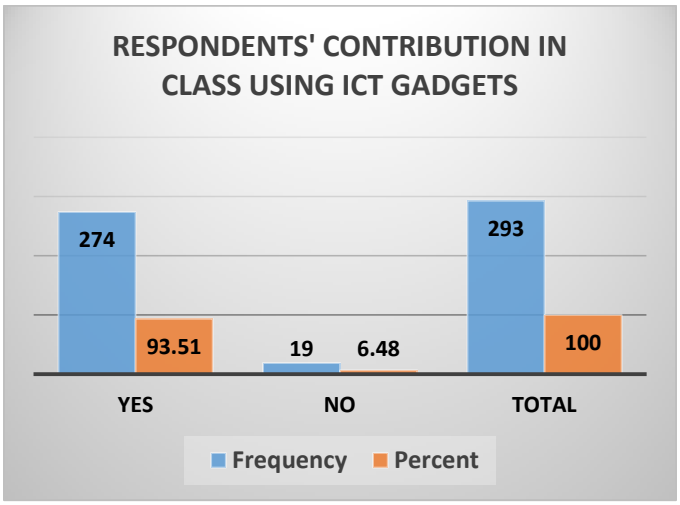

Fig.9. *Contribution level by respondents using ICT gadgets*

Fig. 9. captured the responds from respondents after the use of ICT gadgets in the research. 93.51% of the responds were able to contribute in class discourse with 6.48% of the remaining respondents not being able to contribute in class. This data shows that almost all respondents participated.

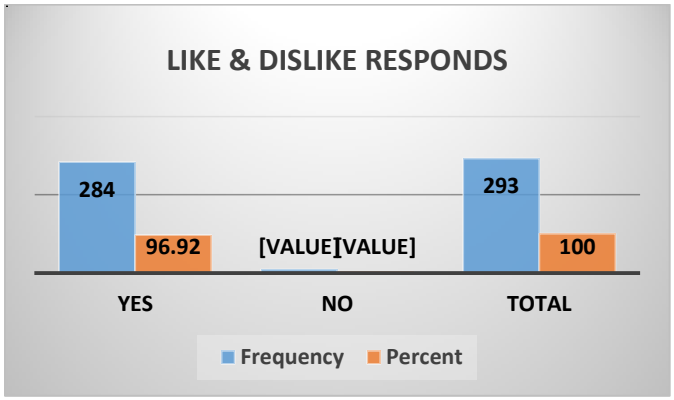

Fig.10. *Like and dislike of the use of ICT gadgets by respondents*

According to fig.10, contrary to 6.48% who did not participate in the use of ICT gadgets in class, the research also recorded 3.07% of the respondents who did not like or enjoy the use of ICT gadgets in the class discourse. Meaning, some of those who did not participate enjoyed the use of ICT gadgets in class. 284 out of 293 of the respondents representing 96.92% liked the use of ICT gadgets in class.

Section D: Improvement after the research

Lecturers write topics for discussion on white boards for students to brainstorm and contribute. Lecturers make their contact available to the class. Phone number, Facebook, e-mail, twitter, and link in. Without projectors students start submission to the contacts of the lecturers. While submission is on-going lecturers verbally explain the submissions and questions posed. Students also make verbal submission particularly those without ICT gadgets. A class with only 15 students contributing, saw 92 contributions from students of which 71 were through ICT gargets out of 178 students for MIS. African Studies recorded 84 class contributions as compared to the 12 previously in which 56 were through ICT gadgets out of 127 class size. Metal Design showed 13 out of 14 contributions from 5 out of 14 contributions previously with only two being non ICT gadgets contribution. Basic Design class also recorded 11 students class contribution out of 14 students of which 8 contributions were by way of ICT gadgets.

Section E: Challenges encountered in the research

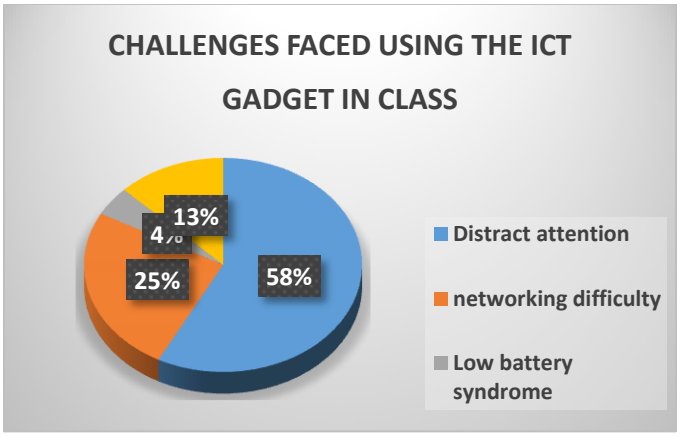

Fig. 11. *Challenges encounter using the ICT gadget in class contribution*

The research faced numerous challenges some of which were purely technical and others non-technical. Telecommunication Network problem was one major factor and this contributed 25% of the challenges. Low battery of the ICT gadgets was another challenge which contributed 4% of the difficulties faced by the researchers. 58% of the challenges were the distraction of attention by gadget sounds, call receiving, video or interactive messages from elsewhere rather than class topic discussions. Lack of technical know-how in the use of ICT gadgets made-up of 13% of the challenges as showed in fig. 11.

5 DISCUSSION OF FINDINGS

The research was based on three main objectives. The first objective was to identify the means that can make Open-Ended Response Systems applicable. In this direction the researchers were to find means and ways that can be used to make open-ended response systems work to support student's class participation. In fig.7. were the identified means by which open-ended response systems can be applicable to help students. Students used smart phones, laptop, tablet, iPad and regular cellular phones in this study. Regular cellular phones were used to send text messages to lecturers in classroom situation to contribute and also to call for explanations from teachers for better understanding of taught courses. Like-wise all the other devices ascertained. The second objective was to examine the extent to which Open-Ended Response Systems can improve students' participation in teaching and learning. The study exposed (1) verbal classroom participation, (2) nonverbal classroom participation and (3) after classroom teaching and learning activities. Teachers and students were at liberty to ask as many questions as possible of which answers were given accordingly all through the aforementioned exposure. Identification of class participants were either hidden or made known depending on the medium used by students in class. When a student verbally talks, his or her identity is immediately known but when any of the ICT gadget is used his or her identity is hidden which majority preferred. Significant enough, though the research was classroom oriented, students found it interesting to ask questions after class and lecturers were there to deliver responses. Indeed this teaching and learning medium gave most of the students the opportunity to learn with clarity even in their homes or private locations. As shown in fig.8. platforms used by students to participate in class were numerous. The research ascertains text messaging, WhatsApping, tweeting, e-mailing and others which include face-booking, Link-in as the platforms used by students to participate in the classroom teaching and learning activities. ICT gadgets employed in the research included smart phones, regular cellular phone, laptop, tablet and ipad as elaborated in fig.7. Find out whether or not it can improve students' participation in teaching and learning. Out of 293 participants almost all participated in class discourse making 93.51%. This is clearly stated in fig.9. Individual brilliance was displayed as fig.7 is showing. 32.76% smart phone users who could use their phone to research and ask questions through text messaging and WhatsApp. MIS recorded 92 students contributions from 15 students' contribution of which 71 were through ICT gadgets out of 178 students in class. African Studies recorded 84 class contributions as compared to the 12 previously in which 56 were through ICT gargets out of 127 class size. Metal Design showed 13 out of 14 contributions from 5 out of 14 contributions previously with only two being non ICT gadget contribution. Basic Design class also recorded 11 students class contributions out of 14 students of which 8 contributions were by way of ICT gadgets. Subjects such as MIS, Metal design and fabrication, African Studies has seen significant improvement in class participation which the researchers believe it will translate to good assessment performance.

6 CONCLUSIONS

The paper mainly focuses on the feasibility of the use of personal phones and tablets vis-a-vis teachers who used ICT gadget to transfer and acquire knowledge. Given that ICT has made teaching and learning accessible everywhere, it is important to understand how this phenomena play out in Wa Polytechnic. The factors that turn out of the research included adequate satisfaction of students who could not have contributed having their share of the participation in class. After class teaching and learning, records of teachers and students were kept on memory cards for revision by both. All these factors gave students much knowledge based on the subject taught by the teachers. It also widened the accessibility of the teachers. On the other hand lessons are sometimes distracted by call receiving, late delivering of messages due to communication network issues and non-related questions from students. The result shows that the behavioral intention to accept and use ICT by lecturers in Wa Polytechnic is a function of various concepts including the understanding of open-ended response systems and it is not difficult to use. The study confirms most students are influenced by new things as such constructive influencing the behavioral intention of them to actively participate in class lesson. The study also certifies that some of the students are still having challenges as to blending the use of ICT with the face-to-face teaching and learning. Also lecturers or teachers personal contacts are at the mercy of students of which some were communicating issues that have nothing to do with subject areas.

7 RECOMMENDATIONS

A. Dadzie (Personal Communication, March 12, 2014) indicates that the telecommunication mast installed in Wa township is on low grounds as that of the Wa Polytechnic campus is on high grounds; as such the interference in the network service. It is recommended that the institution should liaise with the telecommunication networks to install one major mast on campus to augment the situation. Battery quality of gadgets was also a challenge. Most students will run out of battery and that ends the class discussions for them. Charging of batteries to the fullest is one major thing students who would want this study sustained can do to help it. Most of the students need more tutorials on the use of some of the gadgets since some of them could not use WhatsApp application although they have it on their phones. Others are not able to use their twitters, Facebook and e-mail due to technical-know how. Teachers were not left out here since some could not access the information due to lack of the application on their phone or lack of technical know-how. Money to buy credit or recharge cards to use gadgets also stood tall in the challenges. Students were supported with credits by the researchers to be able to contribute in class as well as outside class teaching and learning.

8 ACKNOWLEDGMENTS

The authors would like to thank the management of Wa Polytechnic, Business School and School of Applied Art Design and General Studies of Wa Polytechnic, all students who participated and the entire community of Wa Polytechnic.

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