THE INTEGRATION OF INFORMATION AND COMMUNICATION TECHNOLOGY FOR TEACHING AND LEARNING AT GHANAIAN COLLEGES OF EDUCATION: ICT TUTORS' PERCEPTION

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Abstract
ICT is used more at the workplace than in the classroom mainly due to the lack of its extensive integrated into the curriculum by teachers. With the increasing use of ICT in our society, teachers must be at the forefront of it use in order to train their students in its proper use. Ghana's Colleges of Education (COEs) are the first place where ICT education should begin since they are responsible for the training of teachers in the country. The main objective of the study is to evaluate the extent of ICT integration in Ghana's COEs. This study, based on the UNESCO's literature on ICT integration in education and teachers' adoption of ICT, examines the perception of ICT tutors in COEs on the goal to strengthen ICT curriculum in COEs. It also examines their perception of the capability of their students to competently teach ICT studies at the Basic levels in Ghana's education system. Results from the study show that tutors are of the view that ICT integration for teaching and learning are at the beginning stages with respect to Anderson's ICT in Education model. They also are of the view that an elective ICT course should be introduced to train teacher-trainees who will specialise in ICT teaching at our basic level. Finally the study made recommendations to address these challenges.
Keywords: ICT integration education, ICT integration, ICT adoption, ICT curriculum, COEs

Introduction
These days, there is not a single day that one will not hear the term Information and Communication Technology (ICT). In advanced economies ICT has become one of the essential foundations of their society while in Sub-Saharan Africa; it will very soon be the building block in our societies. Thus mastering of ICT's basic skills and concepts is an important and mandatory part of the education system. Tracing the genesis of ICT, Anderson (2010) said:

> When the first computers made their entry into schools in the late 1970s, we used to speak about computers in education. With computers came printers, floppy disk drives, scanners and the first digital cameras. We began to use the term IT, or Information Technology, to describe computers and these various peripheral devices. Then the

internet arrived together with computer networks, the World Wide Web, email and search engines. A new term entered the language – ICT. The term ICT, short for Information and Communication Technologies, embraces the many technologies that enable us to receive information and communicate or exchange information with others. ICT encompass all the technologies by means of which we can detect these signals, interpret them and exchange information with others. The term ICT is plural, referring to a great many technologies. To sum up, ICT is an all encompassing term that includes the full gamut of electronic tools by means of which we gather, record and store information, and by means of which we exchange and distribute information to others. (p.4)

Also, United Nations Educational, Scientific and Cultural Organization (UNESCO, 2010) defines ICT as the forms of technology that are used to transmit, process, store, create, display, share or exchange information by electronic means. This broad definition of ICT includes such technologies as radio, television, video, DVD, telephone (both fixed line and mobile phones), satellite systems, and computer and network hardware and software, as well as the equipment and services associated with these technologies, such as videoconferencing, e-mail and blogs. The list of technologies that ICT encompasses is been updated daily as new technologies are invented or designed. Thus we can say ICT is a generic term that refers to technologies, which are being used for collecting, storing, editing and communicating of information in various forms from one user to another.

The lack of use of ICT in teaching and learning is the responsibility of teachers simply because they implement the curriculum. But most teachers do not use ICT in their teaching not because there is lack of access to it, but also because they are neither skilled nor confident in its usage. Many teachers report that they have not had adequate training to prepare themselves to use technology effectively in teaching and learning (Jung, 2005). This assertion is supported by a survey by the European Commission featuring 190,000 responses from 27 European countries that many teachers are ill-equipped to teach students IT-related subjects. The study concluded that access to skilled and confident ICT teachers is more important than being able to use the latest equipment (Taylor, 2013). In addition to the development of the necessary skills that will enable the teacher-trainees to use ICT by themselves for research, lesson planning, there is several new teaching and learning models or principles that were developed to enhance effective teaching and learning with ICT. The teacher-trainee ought to be trained to acquire ICT literacy skills and pedagogical skills.

Living in a digital world and teaching students who are digital natives, it is important that our teacher-trainees are encouraged or mandated when necessary to incorporate ICT in their teaching of class lessons. This is not done as indicated by Taylor (2013), which states "20 per cent of secondary-level students in Europe claimed to have never (or almost never) used a computer in their school lessons." This result is after millions of Euros were invested in ICT infrastructure for the education sectors in those countries. The situation was worse in Ghana thus the first thing must happen is that teacher-trainees must be taught to acquire the ICT skills that would enable them to live in a world becoming digital and also teach with digital technology to digital natives. For this to be accomplished there is the need to investigate the kind of ICT infrastructure, curriculum, and training the teacher-trainees receive at the Colleges of Education, which is the focus of this study.

ICT is invading every aspect of our society at an astronomical rate. In fact there is not a single area in human endeavor that ICT has not been utilized. Despite this, the use of ICT in the Education sector is confronted with enormous challenges including inadequate infrastructure in schools, lack of use it in teaching and learning, and high cost of maintenance and replacement. This should not be the case especially in the century where knowledge is expanding without bounds. Teaching is one of the most challenging professions since there are a lot of technologies for accessing information and knowledge at the disposal of students thus the teacher has be constantly updating their knowledge so as the direct their students to successfully navigate this ocean of information, which is overwhelming and confusing. But it is known that ICT is used more in work environments than at schools mainly because it is not extensively integrated in the curriculum by education planners. With the increasingly use of ICT in our society, teachers must be at the forefront of its use in order to train their students in the proper use of technology. The effective integration of ICT in the learning process yields the following: increases student motivation for learning, improves communication of learning goals, facilitates higher-order thinking skills, builds valuable skills that students will use in college and in the workplace, expands students' understanding from novice to mastery among others (Melville, 2005). To enjoy the benefits of ICT in teaching and learning depends to a large extent on teacher's familiarity and ability to use it in the classroom settings. This is or can be possible when the ICT curriculum of teacher education is both rich in theory and practice.

Putting things in perspective is very important, but that does not downplay the need to integrate ICT. ICT in Education or ICT for education (ICT4E) has many components that should be emphasized. Citing literature (SER, 1998; Moonen and Kommers, 1995; Pilot, 1998; Jager & Lokman, 1999) classified the functions of the use of ICT in education into four areas:

1. ICT as object. It refers to learning about ICT. Mostly organised in a specific course. What is being learned depends on the type of education and the level of the students. Education prepares students for the use of ICT in education, future occupation and social life.
2. ICT as an 'assisting tool'. ICT is used as a tool, for example while making assignments, collecting data and documentation, communicating and conducting research. Typically, ICT is used independently from the subject matter.
3. ICT as a medium for teaching and learning. This refers to ICT as a tool for teaching and learning itself, the medium through which teachers can teach and learners can learn. It appears in many different forms, such as drill and practice exercises, in simulations and educational networks.
4. ICT as a tool for organisation and management in schools.

When accessing the integration and adoption of ICT4E especially for COEs, none of these roles should be ignored, so a holistic view is presented.

Ghanaian Colleges of Education (COEs) are the first place where ICT education should begin since they are responsible for the training of teachers. Though the COEs are tertiary institutions in comparing them to other tertiary institutions, like universities and polytechnics, they are far behind in many things including ICT infrastructure. Improvement in this area is critically needed, which succinctly was stated by the Forum for Education Reform (FFER). In order to

improve the quality of the 38 Colleges of Education in Ghana, the FFER listed improving the facilities, updating the quality of instruction, infusing technology, and updating the teaching methods and models, amongst others (Nyavor, 2013). Though ICT is a core subject at the COEs, do they have the necessary resources especially infrastructure to teach the trainee teachers? Making ICT studies core in COEs is a good thing, which is not always apparent in every country as alluded in Jung (2005) who stated "across the Europeans countries surveyed, teacher training in ICT is rarely compulsory, meaning many teachers have to use their spare time to develop these skills." But are our teacher-trainees well skilled to teach ICT subjects? Again is ICT integrated into the overall training of the teacher-trainees in a manner that they use it effectively in either their internship or actual teaching position? Answers to these questions and many others need to be ascertained in order for Ghanaian society to be assured of our preparedness to participate fully and actively in the knowledge economy.

Statement of the Problem
ICT plays an important role in today's literacy and global development thus more and more emphasis is being placed on the education sector of nations to contribute efficiently in meeting global challenges by making our students ICT literate and competent. The use of ICT in teaching and learning is paramount for life in the twenty-first century and beyond. Schools are the best place for ICT education and/or training and for this to happen, the role of the teacher is key. This brings us to COEs where professional teachers for the basic level of our educational system are trained. The problem for this study is: what is the extent of ICT infrastructural provision and integration at Ghana's Colleges of Education?

This article is our attempt in answering this big question. In order to do this, we divided the main question into sub-questions. Specifically we will provide answers to the following questions:

- What kind of ICT infrastructure is in place at Ghana's COEs?
- How adequate is the ICT infrastructure at these institutions to train the teacher trainees to teach ICT courses at the basic schools in Ghana?
- At what stage of ICT integration are these colleges in respect to Anderson's Model?

The introduction of ICT studies at both basic and secondary levels of education in Ghana by the Ghana Government in 2004 places a challenge on the Colleges of Education to adequately prepare our teacher-trainees to teach this subject everywhere they find themselves teaching. An inventory of the infrastructure and materials to teach this subject is necessary thus the study. From the literature review, we discovered that limited research was conducted on the ICT infrastructure of Ghana's COEs and how the ICT tutors rate its integration. This study investigates the needs of using ICT in teaching at COEs in Ghana from the perspective of ICT tutors. Since the ICT tutors are both educators and technologists they are most qualified to assess the extent of ICT integration at the COEs and whether the teacher-trainees they have taught per the existing syllabus can teach ICT at the basic schools.

Literature Review
It is established that access to ICT infrastructure and tools is cyclically related to its use. It is cyclical in the sense that when management of tertiary institutions build ICT infrastructure and provide ICT tools for educational purposes both staff (tutors and administrators) and students

will certainly make use it and this will require constant updating and therefore retraining. As these ICT facilities are being used there will be the demand for its expansion and the cycle is perpetual. That is why Brown & Czerniewicz (2007) said "as access issues are resolved, use opens up more access issues: as use is explored, more and different kinds of access are needed…ad infinitum" (p. 731). The outcomes of the observation that ICT infrastructure will be utilized are: first better access is mandatory to accommodate higher frequency in its use, i.e. those students with inadequate access to a range of resources make very infrequent use of ICTs for learning; while those with adequate or good access make frequent use. In addition, we see that the majority of students with high access also have a more varied use of ICTs for learning. No matter what the level of access 98% of students use ICTs for learning in some way (p. 743). According to Becta (2003, p. 10), five factors influence the likelihood that good ICT learning opportunities will develop in schools: ICT resourcing, ICT leadership, ICT teaching, school leadership, and general teaching. It is worth noting that the first on the list of the five factors is ICT resourcing, which must in place for the others to be utilized. Pelgrum (2001) classified barriers to integration of ICT into education into two kinds of conditions: material and non-material. The material conditions may be the insufficient number of computers or copies of software or consistent access to electricity or Internet. The non-material obstacles include teachers' insufficient ICT knowledge and skills, the difficulty of integrating ICT in instruction, and insufficient teacher time. According to Lee & Im (2006), the extensive use of blended learning in Korea is due to the prevalence of Internet access and well-planned and well-supported infrastructure (p. 281).

Anderson (2010) presented a model that represents the four stages of ICT integration in schools: Emerging, Applying, Infusing and Transforming. This model is used use to measure the level of ICT integration in education at all levels of an education system. The model is shown in Figure 1 and the corresponding characteristics from which the respondents were asked to select the stage of ICT integration their college has attained is shown in Table 1.

Figure 1: Stages that schools typically pass through in adoption and use of ICT
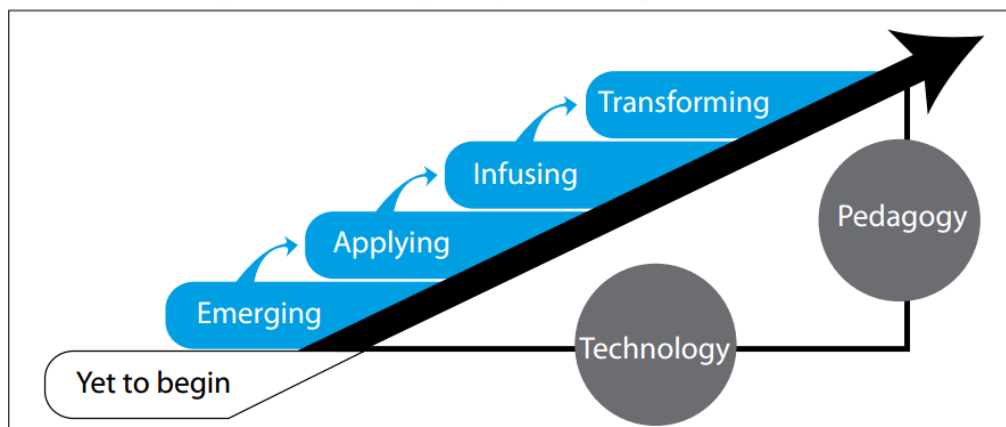
Source: Anderson(2010).

Table 1 The Characteristics of Stages of Adoption and Use of ICT in Education

Stage	Characteristics
Emerging	• Focuses on learning basic ICT skills and identifying ICT components.

Applying	• The emphasis is on learning to use a range of tools and applications, and becoming aware of the potential of ICT in their future teaching. • Teachers and learners become aware of ICT tools, how they function, and how they are used. • The curriculum has been adapted in order to increase the use of ICT in different subject areas, applying specific software tools in teaching.
Infusing	• Almost all classrooms are equipped with computers; as are school offices and the library, and schools have Internet connections. • Teachers are integrating ICT in all aspects of their professional lives to improve their own learning as well as the learning of their students
Transforming	• ICT are fully integrated in all regular classroom learning activities • ICT is used to rethink and renew institutional organization in creative ways • ICT are a regular part of the daily life of the institution • ICT become an integral, though invisible part of daily personal productivity and professional practice. (Anderson, 2010)

Methodology
This study was a pilot study to provide an overview of the nature of the ICT infrastructure used to support teaching ICT at the COEs when one of the authors was appointed the Chief Examiner for Basic Education (BEd) sandwich programme initiated by the Institute of Education, University of Cape Coast for the post diploma teachers. Of the forty-one COEs in Ghana (38 public and 3 private), twelve were selected as study centres for the said programme, which was the population of interest. These twelve COEs were selected and one ICT tutor from each COE was randomly selected for the survey. Due to the distance and dispersed locations of the COEs from UCC, the respondents chose the form in which the questionnaire was distributed; paper-based or online-based. Ten of the questionnaires were distributed in electronic form (via http://www.esurveyspro.com/) while five in paper form.

Findings and Discussion
In all 12 ICT tutors from 12 different COEs responded to the entire survey questionnaire. The findings focus on the following areas: ICT competence and training, frequency of ICT use and access of ICT resources, ICT use for teaching, administration, professional development and personal use; and the influence of ICT on students' learning.

Background Data

Table 2: Background Data of Colleges

College Name	Students' Population	Students' Gender	Number of ICT Instructors	Number of ICT Technicians	Number of PCs Available for student

Akrokerri COE	900	Mixed	3	2	20
Atebubu COE	500	Mixed	2	0	40
Brekum COE	900	Mixed	3	0	40
Enchi COE	510	Mixed	2	0	25
Foso COE	900	Mixed	3	0	56
Komenda COE	720	Mixed	2	1	30
OLA COE	850	Female	3	1	85
St John Boscos COE	840	Mixed	4	0	45
St. Joseph COE	820	Mixed	2	0	40
St. Louis COE	832	Female	3	0	40
Tamale COE	876	Mixed	2	0	70
Wiawso COE	720	Mixed	2	1	20

Table 2 provides background information on the participating COEs. The student-tutor ratio ranged from 210:1 to 510: 1 for St John Bosco and Tamale respectively with an average of 318:1. This ratio alone has a negative impact in the teaching of a technical course like ICT or Computer studies. The ratio of students to instructional computers ranged from 10:1 to 45:1 for OLA and Akrokerri respectively with an average of 23:1. This is also on the high side as compare with that of 3:1 in public schools in USA (Warschauer, 2010). This is a clear indication of digital divide. The high student-instructional computers ratio will affect hands-on training of the teacher-trainee that will eventually hamper his/her use of ICT in teaching upon graduation. Table 2 also shows that not all COE have employed full-time ICT technicians to maintain the computers meant for students ICT training. For those COE without ICT technicians the indication is either the ICT tutors have additional responsibilities of the maintenance of the computers or a private ICT technician does the job whenever the need arises. In the former, ICT tutors are over-burdened, which may result in reduced quality of supervision and research while in the latter case, repairing PCs by outsiders may delay practical session time since usually they respond late to repairs/maintenance due to late payment of previous work done.

Internet Connectivity

Table 3: Does your College have Internet Connectivity?

Internet connectivity	Frequency	Percentage
Yes	10	87
No	2	13
Total	12	100

From Table 3, 10(87%), of the COEs have Internet connectivity, which is a good thing since no educational organization can do without Internet. That is why it worrisome to observe that 2(13%) of COEs do not have Internet connectivity thus their stakeholders-tutors, administrators and teacher-trainees-are deprived of the rich resources of information on the Internet.

Table 4: Bandwidth of Internet Connectivity

Bandwidth	Frequency	Percentage
Unknown	5	40
52kbps	1	7
10mbps	2	13
50mbps	1	7
54mbps	2	13
100mbps	1	7
1024mbps	2	13
Total	12	100

From Table 4, 5(40%) of the respondents have their questionnaire blank on this matter. Comparing the amount being paid by the COEs for stated bandwidth with the $18,000.00 that the University of Cape Coast is paying to Vodafone Ghana for our dedicated 45 mbps, these bandwidths are shared and not dedicated. Shared bandwidth implies that users apart from the COEs use the same bandwidth thus data transfer/speed may differ depending on the number. Now that most students are using video streaming for educational purposes, COEs subscription of shared bandwidth will make their Internet to be unstable and slow. Looking at the financial position of the COEs, all the 41 COEs in Ghana cannot afford the amount being paid by University of Cape Coast for their 45 mbps dedicated. With GARNET (Ghana Academic and Research Network) successful deal with MainOneGh Ltd to sell dedicated DS-3 and STM-1 for $7000.00 and $15,500.00 respectively, the COEs should join GARNET to enjoy the said deal.

Table 5: Places with Internet Connectivity

Areas	Yes	No	Total
Classroom	2(13%)	10(87%)	12(100%)
Computer Lab	7(60%)	5(40%)	12(100%)
Staff Offices	1(7%)	11(93%)	12(100%)
Students' hall	0	12(100%)	12(100%)
Anywhere on campus	2(13%)	10(87%)	12(100%)

Table 5 shows areas on campus where Internet could access by both tutors and students. Majority i.e. 7(60%) of the respondent said Internet is accessible at the computer laboratory, where the computers stated in Table 1 are mainly located. Once the computer laboratory is locked both students and tutors cannot access the Internet unless they have their own private modems. In 2(13%) of the colleges, St. Louis and Wiawso, Internet is accessible in the classroom while another 2(13%) colleges, Brekum and St John Boscos, have Internet connectivity anywhere on campus. Lastly only Brekum has accessibility in the staff common room. We could deduce from Table 5 that Internet connectivity is not widespread in the participating colleges.

The Use of Web Services

Table 6: Does your College have a Website?

Response	Frequency	Percentage (%)
Yes	6	50.0
No	6	50.0
Total	12	100.0

Table 6 shows that 50% of the respondents said their colleges do not have websites. The colleges that have websites are Atebubu College of Education (www.atecoe.edu.gh), Brekum College of Education(www.betco.edu.gh), Komenda College of Education (www.kmenco.com), OLA College of Education (www.ola.edu.gh), Tamale College of Education (www.tatco.edu.com), and Wiawso College of Education (www.watico.edu.gh). Tertiary institutions such COEs ought to have websites to enhance communication with the world especially for current and prospective students. Websites are one of the avenues provided for organisations in the twenty-first century to share information with the world. Pieces of information such as emails and phone numbers of schedule officers, staff research profiles, admission list, and others should be placed on the website. Owning and operating websites is not easy especially considering the precarious financial position of the COEs that depend solely on funding from the Ghana Government nevertheless it is a worthwhile venture. Management of COEs that cannot afford paid hosting should explore free hosting sites for a start such as Google Apps Education.

Two of the COEs, OLA and St. Joseph, also have Wikipedia pages. Majority (80%) do have email accounts though through free email service providers are most often used including Yahoo (60%) and Gmail (40%). Out the 12 COEs, 4(33%) reported that their institutions are on Google Map; these include Brekum, OLA, St. Joseph, and St. Louis College.

Learning Management System (LMS) also known, as Virtual Learning Environment (VLE) is a platform that tutors can upload their course materials, tutors-students/students-students interaction can take place using the discussion forum. Finally, students can take online quizzes and upload assignments on this platform. On the issue of the use of LMS to augment teaching and learning, it was found, unfortunately, that none of the COEs surveyed have such platform. Now that Africa Virtual University (AVU) and its partner universities across Africa are offering online degree in Basic Education via such platform, teacher-trainees should be introduced to this technology. Once this is established, teacher-trainees will have the necessary exposure to enrol in the much flexible AVU programmes if they so wished without any difficulties. With knowledge doubling every two years and the need for lifelong learning, coupled with the difficulty of teachers leaving the classroom for in-service training, sooner than later organisations like Ghana Education Service (GES) will depend on LMS as the platform for offering in-service training.

ICT Practical Skill Training
Since a critical aspect of computer literacy is the ability to know how to use the computer practically to enhance the work of the end-user, Table 7 then depicted the contact hours for teaching the practical component of the computer studies. In this table, 58% of respondents indicated their teacher-trainees use the computer for practical purpose occasionally, while 42% have a fixed period of three hours per week. Since computer literacy is not knowing about the terminologies and concept only but also how to use the computer, it important that all COEs

have a fixed period for hands-on training of window environment such Microsoft Windows and Productivity software such as Microsoft Office.

Table 7 How Often do Your Students have Computer Access for Practical Sessions?

Responses	Frequency	Percentage (%)
Three hours in week	5	42
Occasionally	7	58
Total	12	100

The Use of ICT in Teaching and Learning

Among the twenty-first century skills that both teachers and students acquire are collaboration, problem-solving, and creative thinking. Thus learning environments should include activities that will enable students to have such skills and once this is accomplished, students are on their way to becoming effective citizens and members of the workforce. ICT can be used to achieve these skills quickly, easily and cheaply. When respondents were asked whether ICT is used to inculcate these skills into our teacher-trainees, 9 respondents (73%) said ICT is not used at the COEs for such skill training while the remaining 3(37%) said they had no idea. Apart from the teaching of ICT-related courses, most tutors at the COEs do not use technology in teaching other courses. Table 7 agrees to this assertion.

Table 8 Courses and Technology used in Teaching

Courses Technology	PC	Projectors	Internet	YouTube
Computer studies-Theory	10(87%)	2(20%)	2(20%)	2(20%)
Computer studies-Practical	12(100%)	0	3(27%)	2(20%)
Other courses	3(27%)	1(7%)	1(7%)	0

Table 8 depicts the various technologies used for teaching computer studies and other courses at the COEs. The course Computer studies introduces information and communication technology (ICT) to the teacher-trainees. It is refreshing to know that 20% and 27% of the respondents use Internet and especially YouTube to enhance the teaching and learning of computer studies theory and practical respectively. The importance of YouTube for providing videos teaching and learning cannot be over-emphasised. Some people may find it difficult to comprehend how one can teach in this century without projectors but that is the reality on the ground even at the tertiary level such as a COE. Only 20% of the respondents used projectors for teaching the theory of computer studies. The practical component of the computer studies, which is Microsoft Office or its equivalent, was encouraging in that all the respondents indicated the use of personal computers (PCs). On the question of using projectors to teach Microsoft Office, it is surprising to observe that none of the COEs use the said tool. The result of this is that tutors have to spend a lot of time explaining whenever they teach difficult skills couple with the fact that they have to move from one student group to the other to supervise whether or not they are doing the right thing. Finally, we can observe that technology is used in the teaching of other courses though not at all COEs. Though the use of technology in teaching varies from curriculum to

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curriculum, place to place, and class to class (Becta, 2003), relatively less technology is used in teaching non ICT-related courses as shown in Table 8.

In a digitalized world that recognizes that role of ICT in learning, educational institutions should create situations that enable their students to have holistic experiences with ICT in learning. Ledesma (as cited in Anderson, 2010, p. 21) stated that the Ministry of Education of New Zealand identified three stages of ICT in learning namely, learning about ICT, learning with ICT, and learning through ICT. This full cycle exposure to ICT for learning is important in a world controlled by ICT as an indication that schools are reflecting the realities on the ground (Anderson, 2010). This is so since the education sector lags behind home and others sectors of the human endeavour in the use of ICT (Kraus, 2010). When asked what stage of ICT for learning the teacher-trainees have attained through the activities of the COEs, all the respondents were of the opinion that their students are at the stage of learning about ICT for either ICT or non ICT-related course at only the enrichment level of activities and not as part of everyday learning.

Stages of ICT Integration in Education
In order to ascertain the stage of ICT integration at the COEs as base on the characteristics specified in table 1, the respondents' choice is shown in Table 9. It can be observed that 92% of the respondents overwhelmingly said their college is at an emerging stage except OLA that opted for Applying stage.

Table 9 Perceived Stages of ICT Integration at the COEs

Stage	Frequency	Percentage (%)
Emerging	11	92
Applying	1	8
Infusing	0	0
Transforming	0	0
Total	12	100

In looking at the existing ICT infrastructure at the COEs coupled with the characteristics of the four stages of ICT integration in education listed in Table 1, the COEs are indeed at the emerging stage. The respondents were further asked to express their view on the scale of strongly agreed to strongly disagreed on the following statements:

- ST 1: ICT has transformed the teaching practices in our college.
- ST 2: ICT has been fully integrated into the curriculum across all subject areas in our college.
- ST 3: The curriculum of our college has been restructured with ICT to meet the challenges of the digital world in order to realize our students' full potential.
- ST 4: Instructors in my college have the capability to use ICT effectively in their teaching
- ST 5: It is critical for educational institutions to prepare students to work and live in the emerging digital world with ICT skills.

With a composite mean of 4.165, majority of the respondents 10(83%) 12(100%), and 11(91%) respectively did not agreed to the statements ST1, ST 2 and ST 3 as shown in table 10.

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Table 10 Mean and Standard Deviation of Perceived View of ICT Integration at the COEs

STATEMENTS	SA	A	I	D	SD	MEAN	ST DEV
ST 1	2(17%)	0	0	6(50%)	4(33%)	3.83	1.4
ST 2	0	0	0	6(50%)	6(50%)	4.50	0.50
ST 3	0	1(8%)	0	7(58%)	4(33%)	4.17	0.84
COMPOSITE MEAN						4.165	

Means were computed on a scale that range from 1 – 5 where 1= strongly agreed, 2 = agreed, 3= indifference, 4= disagreed and 5= strongly disagreed

Table 11 Mean and Standard Deviation Other ICT Integration Issues in Education

STATEMENTS	SA	A	I	D	SD	MEAN	ST DEV
ST 4	4(34%)	6(50%)	0	0	2(17%)	2.17	1.4
ST 5	2(17%)	4(33%)	0	5(42%)	1(8%)	2.75	1.36

Table 11, shows the importance of preparing teacher-trainees with ICT skills for teaching and whether their tutors are capable of teaching with ICT themselves. On the issue of preparing teacher-trainees with the requisite ICT skills for teaching in a digitalized world, majority of the respondents, 10(84%) were in agreement with Statement 4 (ST 4) as shown in Table 11. Finally, there was a split, 6(50%) in favour and 6(50%) against, on the issue of the tutors' capability to teach with ICT, Statement 5 (ST 5) as shown in Table 11. There are many reasons for the stalemate, ranging from lack of training, motivation and ICT equipment among others.

Table 12 Awareness of the Existence of National ICT Capacity Standards for Teachers

Response	Frequency	Percentage
Yes	5	40
No	7	60
Total	12	100

As indicated in Table 12, majority of the respondents (60%) were not aware of the existence of National ICT Capacity Standards for Teachers. The UNESCO published ICT Competency Standards for Teachers (Policy Framework, Competency Standards Modules, and Implementation Guidelines) in 2008. It is time for Ghana to develop one to measure ICT Competency Standards for Ghana's teachers, tutors, and lecturers at all levels of the education system and fill the gaps with in-service training. There 10(84%) of respondents who viewed that ICT Competency Standards should be included in the curriculum of the COEs.

Conclusion
This study aimed to determine the kind of ICT infrastructure that exists in the Colleges of Education in Ghana and find out the stage of ICT integration at those colleges with respect to Anderson's Model. Finally, it sought to find out the adequacy of the ICT infrastructure used to teach the teacher trainees. From the discourse in the preceding pages, the following observations were made:

- There is inadequate ICT infrastructure at the COEs. This is poor in comparison to the other Tertiary institutions in Ghana such as the Universities and Polytechnics.
- Very low ratio of ICT tutor to student with an average of 1:318
- Moderate student to PC ratio with an average of 23:1
- Most COEs do not have ICT Technicians who are responsible for maintenance of the ICT equipment
- Internet connectivity is slow and limited mainly to the computer laboratories
- Lack of adequate practical ICT skill training for teacher-trainees
- ICT not fully integrate in the teaching of all curriculums at the COEs
- Lack of the knowledge among tutors of the UNESCO's ICT Competency Standards for Teachers and lack of the existence of it corresponding nation ICT Competency Standards for Teachers

These conditions will ultimately result in low integration of ICT in COEs thus eventually impeding on technology integration at the basic schools in Ghana since the graduate teachers may have little or no exposure to ICT practical at the pre-service level. This is in line with Albirini (2006). Teacher-trainees have a significant role to play in the sustained application of ICT in schools. Therefore, it is imperative that they are exposed to effective use of ICT in their training (Steketee, 2006). By integrating ICT as a learning resource during regular classes, tutors are exposing students to innovative ways of learning and in the case of the teacher-trainees also to innovative means of teaching with technology. Teacher training programs need to effectively train their prospective teachers in using different ICT materials for lessons and also to be able to direct and have learners effectively benefit from such materials (Osborne & Hennessy, 2003).

In Africa, Ghana is not doing badly in terms of the availability of a well-developed ICT infrastructure, but their educational sector is far behind the other sectors when it comes to ICT infrastructure. In this respect, the Government of Ghana should team up with well meaning NGOs and Internet Service Providers (ISPs) to provide Internet connectivity to the Colleges of Educations in Ghana and other educational institutions.

Recommendations
ICT is considered an essential part of the twenty-first century culture and it's infrastructure a fundamental element of infrastructure in a 21st Century economy. Thus integrating ICT in teaching and learning should be priority that ought to occupy the highest echelon among the strategies for improving the education sector, since by automatic extension education should be twenty-first century one. In order to achieve this goal, ICT infrastructure is unavoidable prerequisite. It is essential that ICT infrastructure is in place to enable people to access knowledge and gain the skills to compete successfully in this economy ("Welcome to Glasgow", 2013).The pervasiveness of ICT infrastructure such as the Internet presence helps people to become familiar with and take advantage of technology in education such as e-learning and blended learning (Lee & Im, 2006; p. 282). To accomplish this agenda in education, we discuss our recommendations in the ensuing paragraphs.

The first step to effective use of ICT in education is accessibility to the technology for all stakeholders in the industry for teaching, learning and administration. Investment in the area of

infrastructure should be made at the COEs in Ghana. That is adequate ICT laboratories should be provided, where the teacher-trainees are taught how to practically use the computer and its accompanying productivity applications.

The one laptop per policy which Ghana Government is pursuing though laudable needs to be augmented with a supplementary policy of one laptop for the teacher/teacher-trainee. This is because once the teacher/teacher-trainee is confident in using the device in education learning, then teaching would the natural extension. Lack of ownership of ICT leads to lack of confidence in using ICT that in turn is considered to be the contributing factor of lack of integrating ICT into teaching and learning.

Though overcoming the lack of ICT infrastructure does not, in itself, ensure ICT will be used successfully in teaching (Balanskat , Blamire, & Kefala, 2006) but it is a good start. Other factors teacher motivation, confidence, competency, training and policy must also be considered. Since ICT sector is ever changing and expanding, the teacher's knowledge and skills in ICT must be constantly updated to stay abreast with current trends in ICT integration in education. The 39 Colleges of Educations scattered all over the country should be well-equipped with ICT and these facilities used for the professional development of teacher-trainees and teachers in both ICT-content and ICT-pedagogy.

The COEs should be treated as the nerve centre of the whole computerization programme in our education system. This is logical as the COEs are the first place where ICT education should begin since they are responsible for the training of teachers in the country. This is because society expects teacher-trainees to help pupils later in schools with their ICT as part of their first formal learning in ICT. There is the need for critical investment in the COEs with the provision ICT infrastructure-computers, Internet among others, to aid the practical skill development of teacher trainees.

UNESCO published ICT Competency Standards for Teachers (Policy Framework, Competency Standards Modules, and Implementation Guidelines) in 2008 aimed at helping countries to develop their national teacher ICT competency policies and standards. Unfortunately, such national policy that indicates such an expectation of ICT standards for each teacher at each level of our education currently does not exist. A conference of Computer Science lecturers and ICT tutors at University and the COEs respectively should be organized with the main agenda of developing of ICT Competency Standard for Teachers.

Tutors of the COEs must be trained on new ways of teaching and learning in ICT enriched education so that they in turn incorporate such knowledge and skill into the curriculum for our teacher-trainees who will ultimately teach our digital kids. This was highlighted succinctly by Anderson (2010) who said "although ICT offer the potential for new ways of learning, this potential is often limited because teachers do not modify their teaching approaches sufficiently" thus integrating ICT into the curriculum of the COEs is very important to preparation of the next generation of teachers. As Ledesma (ibid) puts it, "New learning cultures need to be created to respond to the opportunities and challenges of the digital world".

The digital world needs new learning and teaching culture, which in turns need digital medium that is built on strong ICT infrastructure.

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