Factors Affecting Technology Integration in Colleges of Education

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Article Info	Abstract
	Learning technologies are gradually taking center stage in the education system of the various economies and are becoming a dominant tool for teaching and learning in the various higher institutions of learning. Various forms of learning technologies have evolved in this 21st century with the notion of improving content management, lesson presentation, teachers' portfolio building, curriculum design and management, assessment, teachers' competencies development, and reaching the learner beyond the traditional face-to-face model of teaching have increasingly become pervasive within various forms of learning environments. Institutions of higher education are increasingly turning to these technologies to resource and support their teaching and learning environments under distributed circumstances, face-to-face or blended. However, before the widespread deployment of these technologies, information regarding the effective implementation of these all-important learning technologies are very sparse. This study is geared towards gaining a better understanding of the factors that would influence the effective integration of these learning technologies into the teaching and learning in the various colleges of education in Ghana as well as the challenges they are likely to face. This research employed a mixed method. Among the factors likely to influence technology integration in the various colleges as discovered by this research are: tutors' attitudes toward new media, pedagogical knowledge, perceived ease of technological use, perceived usefulness of technological solutions, availability of technological resources, and motivation. Some of the challenges colleges are likely to face are lack of technological infrastructure, high cost of the internet coupled with low bandwidth, unstable power supply, lack of administrative support, curriculum overload, and lack of in-service training.

Introduction

For students to think critically, actively solve problems, and be digitally literate, teachers should create lessons that teach content knowledge and help students develop 21st-century skills while taking into account the TPACK model (Technology, Pedagogy, and Content Knowledge) (Amaniampong, Nantwi, and Birago 2019). Almost all improvement plans for education and educational reform programs appear to include training teachers in the educational uses of technology in the contemporary digital age (Adegbenro et al., 2015). Technologies for teaching and learning are used in conjunction to help teaching or learning and improve learning outcomes.

Computers, the Internet (websites, blogs, Web 2.0, Google+, Google Classroom, collaborative learning tools, EMIS, and emails), live broadcasting technologies (radio, television, and webcasting), recorded broadcasting technologies (podcasting, audio, and video players, and storage devices), and telephony (fixed or mobile, satellite, video-conferencing, etc.) are also included in this list of technological tools and resources (UNESCO, 2011). Learning technologies have advanced quickly in higher education, which is attributable to their ability to assist and innovate instruction as well as enhance various types of evaluations (Farrell & Rushby, 2016). According to Drent and Meelissen (2008), integrating teaching and learning technology into the classroom environment helps students grow in their ability to collaborate, communicate, and solve problems as well as search for and evaluate information. According to research, technologies can be used to enhance teaching quality by giving teachers opportunities for professional growth (Levin & Wadmany, 2008; Mends-Brew, 2012; Peters, 2009; Ruhizan, Norazah, Mohd, Faizal, & Jamil, 2014). In addition to these, technologies like Massive Open Online Courses (MOOCs) allow teachers to reorganize and produce content to suit their teaching methodologies as well as adaptable online education (Conole, 2013; Kay, Reimann, Diebold & Kummerfeld, 2013).

While opponents of the use of technology in education claim that there is no significant difference in understanding when technology is used in the educational system, proponents of its use argue that it will make training more accessible, reasonable, and viable (Abrahams, 2010). Despite exerting increasing effort to introduce these teaching and learning technologies into the advanced educational environment, successful organization, and reception are highly dependent on the arrangement of adequate resources (Pelgrum, 2001) and the ability to address individual, context-specific, and social factors within a given country. According to Karasavvidis and Kollias (2014), there hasn't been much of a change in teaching and learning throughout the past thirty years of research on the use of technology in the classroom. The designers provided two additional important justifications for the disappointment. First of all, classroom technology use has been proceeding slowly. Second, even though teachers love technology, it is often used in ways that support ordinary classroom activities rather than providing opportunities for developmental learning. According to earlier research (Zhao and Plain, 2003), institutional changes prompted by technology have also failed. Although studies show that specific uses of technology might affect students' learning, the relationship between technology and learning should be seen as multifaceted characteristics (Moeller and Reitzes, 2011). Coordination of technology in education enables staff to recognize individual differences in students' successes, gain a handle on teaching methods and abilities, and simultaneously improve student and staff flexibility in various learning modes (Massy and Zemsky, 1995).

Teachers will have a variety of personal challenges as they interestingly adopt modern technologies. These issues frequently relate to finances, infrastructure, training, administrative assistance, and the technical expertise required to effectively use technological resources, and support virtual learning environments (VLEs), (Sife, Lwoga, and Sanga, 2007). A variety of teaching technologies were identified by Sife et al. (2007), supporting both traditional classrooms and completely online instruction (Arabasz and Dough puncher, 2003). The use of Learning Technologies (LTs) in teaching and learning at the higher education level has increased throughout the most recent couple of exceedingly long times (Laurillard, 2013). In this study, the term "technology" refers to software (such as Microsoft Word, calculation sheets, data sets, PowerPoint, and virtual learning), hardware (such as computers, workstations, multimedia projectors, and intelligent whiteboards), as well as web applications (such as social

media sites like Facebook and Twitter and web search tools like Google and Wikipedia). There is a strong belief that these technologies will alter instruction and aid in classroom development by making lessons more important, captivating, and useful to the students and, as a result, fundamentally altering the nature of learning (Karasavvidis and Kollias, 2014). To support teaching and learning, foundations in advanced education are becoming increasingly interested in technology (Bebell, Russell, and O'Dwyer, 2004). As previously said, the technical, sociopolitical, attitudinal, and pedagogical concerns of educators have a significant impact on the successful adoption of technology in the classroom. According to (Al-Senaidi, Lin, & Poirot, 2009), it is crucial to take into account technical aspects like teacher competencies (Samarawickrema & Stacey, 2007), teachers' roles and pedagogical concerns (Kirkwood, 2015), organizational and financial support (Drent & Meelissen, 2008), and safety and privacy concerns (Mitzner et al., 2010) when integrating technology in the classroom. This highlights the necessity of having a full understanding of the variables influencing technology integration in Ghanaian educational institutions. There is general agreement in the literature that understanding specialized issues, instructors' abilities, educators' jobs, academic concerns, hierarchical and financial help, well-being, and security concerns are fundamental factors that either empower or impede technology adoption (Alazam, Bakar, Hamzah, and Asmiran, 2013; Bonsu, Duodu, JA, and Djang-Fordjour, 2013; Buabeng-Andoh, 2012; Peters, 2009). This kind of research also demonstrated that, even though technology can make teaching and learning more interesting, it still necessitates considerable input by teachers in the form of preparation, planning, and the development of appropriate resources.

Technology adoption is shown by Corridor and Khan (2003) as a consistent cycle that enables resistant users to successfully adopt and use technology for a particular purpose. They mentioned that customer participation in a series of decisions that are the outcome of a review of the advantages and drawbacks associated with the use of innovations in how technology reception occurs. Understanding the prerequisites for instructors to adopt modern technologies, such as the economical, socio-political, psychological, and intellectual ones, is fundamental in the field of advanced education (Fields, 2015; Shohel and Kirkwood, 2012). The competence of student teachers and our educational system could be improved by access to and use of ICT tools, but this opportunity is very unequal and unexplored. The prospects are not good because student teachers at educational colleges only have restricted access to the entire spectrum of ICT technologies. The student-to-computer ratio is currently 8:1, which has an impact on the quality of teaching and learning since students cannot gain the practical knowledge and skills required to prepare students to become teachers in the twenty-first century (Nantwi and Amaniampong, 2018). According to Alazam et al. (2013), there is a clear correlation between having technology usage skills and how much technology is used in the study hall. Additionally, numerous studies have drawn attention to the fact that the level of technical know-how and knowledge of students that improved technology can be implemented in the thin hall (Buntat, 2010; Paryono and Quito, 2010; Saud et al., 2010; Sukri, 2010). Further, Alazam et al. (2013) found that the lack of technical skills among instructors was caused by inadequate pre- and in-service preparation, which closed important doors to the effective use of technology in the classroom. According to several studies, barriers to accepting innovation include a shortage of PCs and access to them, a lack of progress in ICT infrastructure, the cost of acquiring ICT resources, and weak ICT skills (Bonsu et al., 2013). Insufficient foundation, lack of awareness, and social locations were identified as barriers to adoption in previous studies on the use of ICT tools in Ghanaian colleges (Amaniampong, Nantwi, and Birago 2019). Al-Senaidi, Lin, and Poirot

(2009) noted that obstacles to technology adoption in schools include a lack of hardware, institutional support, skepticism about the benefits of ICT, as well as a lack of time. According to Shohel and Kirkwood (2012), educators' inability to conduct thorough assessments of the integration of technology into the classroom can be attributed to their lack of discernment and susceptibility. Some staff members lack the time to successfully learn how to integrate technology into their daily classroom routines due to their workload of coursework, co-curricular activities, and obligations (Amanortsu, Dzandu, and Asabere, 2014). A fundamental problem for efficient technology integration in Ghanaian institutes of education is the examination of many aspects that may influence instructors' acceptance of learning technologies and the consequent integration into education. As developing countries like Ghana have made it a top priority, the effort to integrate ICT across all economic sectors did not ignore education. To ensure effective technological integration in education, the government and educational stakeholders have taken numerous actions and passed legislation. According to (Boakye & Banini, 2008), Ghanaian education stakeholders have been worried about how instructors and students utilize computers in classrooms and how their use promotes learning ever since the early 1990s. Due to Ghanaian professionals' limited skill sets, particularly in ICT, educational institutions realized in the middle of the 1990s that they could not compete for jobs on the international market (Nyarko, 2007). As a result, the World Links for Development (WorLD) program was launched in Ghana in 1997. This program was created to employ technology to give teachers and students access to a world of learning. The preprogrammed is designed to help teachers and students incorporate technology into their curricula, facilitate teacher-student collaboration on projects and distance learning, encourage computer and internet use for communication and research by most students, and create local educational content for the internet (Kwei, 2001). The political and governmental organizations have continued to make efforts to ensure effective technology integration in the various colleges and universities. The ICT for Accelerated Development (ICT4AD) program was launched by the government in 2000 under the direction of John Agyekum Kuffour. Its goal was to provide a framework for the use of ICT to transform the educational sector, enabling all Ghanaians to pursue quality life-long learning opportunities regardless of their geographic location and ensuring that educational authorities in Ghana launch projects to integrate ICT into Ghanaian education at the foundational level. In addition, the incorporation of ICT in all subject areas has received significant attention under Ghana's new educational reform, which was introduced in September 2007 (MOESS, 2007). In addition, the school system has added more computer labs, demonstrating the effectiveness of using technology to offer education (Yidana & Asiedu-Addo 2001). Additionally, ICT is now a required (core) topic in Ghana for all primary and secondary school students. Hardly, Ghana must utilize the information and technological era to bring about the needed innovation in teacher education initiatives to boost its relevance to the national development goal and global competitiveness Asare and Nti (2014). The overall framework of Ghana's teacher education system leaves very little or no room for instructors to successfully learn about and use technology in their daily lesson plans. Akyeampong (2003) pondered on numerous methods utilized to teach the topics of various subjects while writing in Ghana. He elaborated on how knowledge was transmitted in the (a) manner, where "tutors lectured their students" (p. 51). In student-centered teaching, "students engaged in discussions and debates on topical issues, with tutors acting as facilitators" (p. 51); in a question-and-answer strategy, "tutors mainly asked questions and used students' answers to further develop the lesson" (p. 52); and in a problem-based learning approach, "students worked in groups to solve problems" (p. The discovery learning process, brainstorming, individual technique, project method, and problem-solving method are other teaching

strategies that tutors employ when instructing aspiring teachers. In addition, tutors employed deductive and inductive procedures, field trips and educational visits, role-play demonstrations, and other simulation techniques in their instruction (Ghana Education Service, TED, 2004). The following techniques are also used to teach the students: drills, teacher-led discussions, case studies, and the expository teaching process. However, it has been discovered that "the dominant pedagogical stance remains one where trainees are largely regarded as 'empty vessels,' with little knowledge or experience of teaching" (Lewin & Stuart, 2003, p. 171). These draw attention to the fact that teachers and designers of curricula' attention spans are severely constrained in finding creative methods to integrate technology into the conventional classroom.

Before the current teacher education reforms went into effect in 2019, pre-service teachers for the basic school level were prepared using a dual mode in which both subject and methodological courses were taken throughout the program's allotted time. In this framework, aspiring teachers concurrently studied several topic courses and pedagogy courses. Additionally, the design of the program allowed for three different sorts of future educators: generalists, who are prepared to teach all topics at the primary level (grades 1 through 6); early childhood educators; and specialists, who are typically found at the JHS. No matter what kind of teacher was intended to be generated, the program design contained four elements. There are three of them: 1) several content courses relating to the subjects to be taught at the elementary school; 2) methodology courses to give aspiring teachers the instructional skills they need to handle a variety of topics in the basic school curriculum and at the grade level for which they have been prepared to teach; and 3) a practicum (teaching experience) that is divided into two phases. Prospective teachers are required to participate in peer teaching on their campuses for a semester as part of the first phase, often known as on-campus teaching practice. Peer teaching is carried out under the direction of subject-matter experts who work as tutors at the various CoE campuses. The idea behind this stage is to provide would-be teachers with the chance to teach in a comfortable setting and so increase their self-confidence as educators. Additionally, through the feedback they offer, the tutors can reinforce what has been taught in the various courses (i.e., content, methodology, psychology, and curriculum) while also allowing the ring teachers to develop/modify some professional competencies before teaching in elementary schools. The second phase, often known as field experience or off-campus teaching practice, gives aspiring teachers the chance to instruct in a real classroom with all of its difficulties. Tutors from the prospective teachers' college and seasoned educators from the placement schools supervise them throughout this time. When aspiring teachers go through this model of teacher development, it is hoped that they will gain a thorough understanding of the material in the various subject areas, become knowledgeable about methodology, and be able to skillfully combine their content knowledge and pedagogical knowledge for classroom instruction. The fourth requirement makes it necessary for aspiring teachers to enroll in literacy studies courses in subjects including English, information literacy, computing, and a Ghanaian language (usually determined by the College's location). This demonstrates how much focus is placed on content and pedagogy while technology continues to receive less attention. A simple example: All students majoring in general education who do not choose ICT as an optional in their first year only study computer literacy as a core topic for one semester. Even there, the information is restricted to a brief introduction to computer studies and does not consider how teacher candidates might effectively use technology intoner instruction.

The TPACK framework was developed by Mishra and Koehler (2006) with a primary focus on the fundamental

skills needed for teachers in the twenty-first century. They created a model based on three concepts: technology knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK). This has shown itself to be a fruitful strategy and has resolved most problems teachers encountered when developing their instructional design strategies. The TPACK framework, which distinguished between key areas of knowledge, describes how content—what is being taught—and pedagogy—how the instructor conveys that content—must serve as the cornerstones of any successful technological integration. This arrangement is crucial because, to improve students' experiences, the technology being used must both communicate the material and assist the pedagogy. According to the TPACK framework, it is best to train and direct students toward a deeper, more comprehensive grasp of the subject matter using a variety of technical tools (hardware, software, applications, and related information literacy activities). In the TPACK framework, the three types of knowledge—TK, PK, and CK—are thus joined and reconfigured in many ways. Finally, Technological Content Knowledge (TCK) depicts connections and convergences between innovation and learning objectives. Technological, Pedagogical Knowledge (TPK) portrays connections and communications between technological apparatuses and explicit academic practices, while Pedagogical Content Knowledge (PCK) depicts something similar between teaching practices and explicit learning goals. Then, these identified areas come together to form TPACK, which considers the links between the three areas and acknowledges that teachers are operating in this perplexing environment.
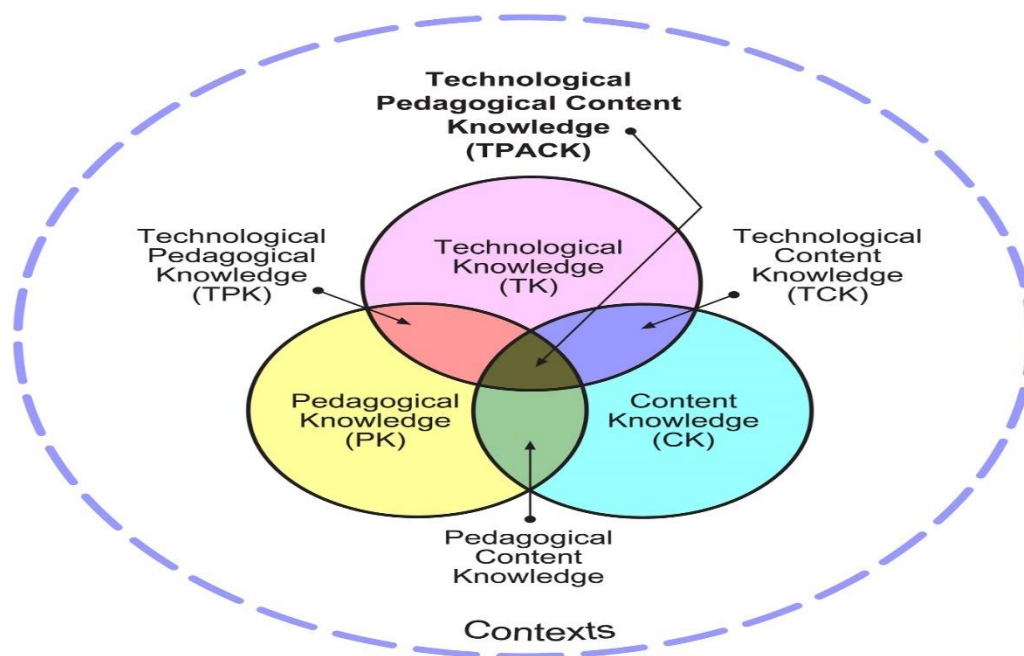
Figure 1.   TPACK model by Mishra and Koehler (2006)

It is therefore imperative to reconsider and rethink the various challenges and factors that affect effective technology integration in the various colleges of education as this has a profound effect on teachers' performance and international match-up abilities in this era of technology-driving society.

Purpose

The research is therefore intended to investigate the factors that affect technology integration in colleges of

education in Ghana and examine the challenges of technology usage in the classroom.

Method

Objectives

Based on the purpose stated above, the research seeks to achieve the following specific objectives:

1. To examine tutors' attitudes towards technology and its impact on technology integration
2. To assess the impact of curriculum structure and access to ICT infrastructure on technology integration

Research Questions

The research would therefore seek to address the following research questions

1. How does a tutor's attitude towards technology affect technology integration in colleges of education in Ghana?
2. What is the impact of curriculum structure and access to ICT tools on technology integration?

Research Design

The research will be conducted in the various colleges of education in the Ashanti region of Ghana. The research will employ a mixed method. Both qualitative and quantitative data will be collected from the selected teachers and students through interviews and questionnaires. In the mixed methods research design thus both quantitative and qualitative research methods will be used to explain and interpret data analytically and statistically. This research is divided into two phases: exploring teachers' characteristics and their readiness to integrate technology into their classroom activities through observation and interviews. For phase two, a questionnaire will be designed to identify, the administrator's role, the socio-culture background of learners, and its impact on technology integration and challenges encountered by tutors in their bid to integrate technology into teaching and learning in the various colleges of education. Based on the analysis of the result, suggestions and conclusions will be drawn by the researchers.

Study Group

Population in this context constitutes the tutors of the College of Education in the Ashanti region of Ghana. The population was defined in terms of content, gender, accessibility, and convenience. The content is defined in respect of the changing trend of the use of ICT tools/products and the subject of specialization of the selected colleges. There are three hundred and fifty (350) tutors in the six colleges of Education in the Ashanti region of Ghana with approximately 40% being females. The College also boasts tutors with diverse ethnic, cultural, and socio-economic backgrounds. These provided empirical data for finding credible answers to the research questions. Once it was challenging and unpractical to work with the entire population the researchers resorted to sampling.

The researchers opted for tutors in colleges of education within the Ashanti region who are teaching various courses in their respective colleges including ICT. In all, sixty tutors from the three colleges of education will be selected from the population with random sampling and convenient sampling techniques. The sampled population included forty (40) males and twenty (20) females including college principals and tutors. The findings from this sample will be generalized since the populace had similar characteristics. Each respondent serves as an entity and all the respondents will be regarded as the sample frame. Their specialties, in terms of content, methodology, and technology applications are relevant to the research. Random sampling technique is relied on where every unit of the sample has equal opportunities of being selected.

Data Collection Instruments

The collection of data is relevant to every research work. The data facilitate the testing and resolving research questions. There are many approaches and techniques necessary for acquiring data for this study. These approaches are the various research instruments, which will be used to gather, describe and quantify the data. Data collection instruments to be used by the researcher are questionnaires and observation methods.

Observation

Observation is one of the oldest methods of data collection. Observation means a method of data collection that employs vision as its main means of data collection. In this observational study, the researcher will collect data on the use of ICT tools by tutors and the challenges they face in the process of integrating technological tools into the teaching and learning process by watching them and listening and recording what they observe rather than asking questions. In general, the degree of the observer's involvement in the study varies from no participation to full participation. The researchers will adopt the non-participant observation techniques. In non-participant observation, observers study their subjects from outside the group without becoming a part of the environment of the observed.

Questionnaire

The questionnaire consists of a list of questions or statements relating to the aims of the study, and research questions to be verified and answered, to which the respondent will be required to answer by writing. In all, twenty-five (25) questions will be set for respondents to answer. The respondents will first be briefed about the need to be objective in their answers.

Administration of Instruments

The researcher will make an effort to distribute the questionnaire themselves since work of this magnitude requires direct collaboration with the participants. The respondents will first be informed and given copies of the questionnaire to answer after guidance from the researchers.

Data Collection Procedures

Since the mixed research method (qualitative and quantitative research method) is required for the study, Questionnaire, and observation are the main data collection instruments that will be used. The researcher will establish a friendly rapport with the respondents, and this proves extremely useful as it motivates the respondents to provide relevant data. The respondents will be guided to give candid opinions about the questions they are asked. The researcher directly observes the tutors to obtain information necessary for the study.

Data Analysis

The data collected will be put together and analyzed about the research questions and objectives using deductive methods, and descriptive and inferential statistics. Moreover, Interpretations will be made and conclusions drawn from which recommendations will be made.

Findings and Discussion

The positive attitude of teachers towards the acceptance of new media for teaching and learning and their belief in the positive impact technology can make in the classroom cannot be overemphasized. As indicated in Table 1, the majority of the respondent are of the view that new media improves learner motivation, is useful in the process of teaching and learning, and digital technologies have positively changed their lives (see Figure 2). Teachers in Ghana like to use digital technologies and they were neutral and (also ranked least) to the point that students should be prohibited from using cell phones in schools. Implying a universal acceptance of the use of mobile phones by students in schools. This goes on to point out the importance that tutors attach to the impact that mobile phones can make in the 21st-century classroom.

Table 1. Attitude towards Technology

Statement	SD	D	N	A	SA	Mean	Std Dev.	Ranking
I like to use digital technologies	0.00	0.00	8.62	53.00	37.38	4.3000	0.6189	2
Digital technologies have positively changed our lives	3.00	2.29	16.71	49.00	29.00	3.9833	0.9112	5
It is necessary to use digital technologies in the process of learning and teaching	3	2.00	10.01	50.99	34.00	4.1000	0.8963	3
Websites are useful for teaching and learning	0.14	3	9	64.86	23.00	4.0167	0.7700	4
Digital teaching aids are better than physical teaching aids in improving learning	9.00	2.00	28.01	50.99	10.00	3.6500	1.1472	10
The use of digital technologies	17.00	11.0	2.00	52.00	18.00	3.4333	1.3700	12

Statement	SD	D	N	A	SA	Mean	Std Dev.	Ranking
by the teacher has a positive impact on student learning		0						
The use of digital technologies by the teacher has a positive effect on student motivation	0.00	5.98	26.02	63	11/00	4.6667	0.6806	1
The use of digital technologies by the teacher has a positive effect on student involvement	5.00	6.00	13.96	51.04	24.00	3.8167	1.0332	7
The use of digital technologies by the teacher has a positive effect on student satisfaction	0.00	5.06	26.00	57.00	11.04	3.7500	0.7278	9
Students should be prohibited from using cell phones at school	16.92	43.08	16.00	21.93	2.07	2.5333	1.0965	13
Using new software is easy for me	8.00	6.62	14.00	60.00	11.38	3.6000	1.0609	11
Using a new website is easy for me	6.00	4.96	2.04	76.00	11.00	3.7833	0.9405	8
Using a new electronic device is easy for me	0..00	10.18	9.00	64.82	16.00	3.8833	0.8045	6

Table Index: D-Disagree, SD-Strongly Disagree, N-Neutral, A-Agree, SA-Strongly Agree
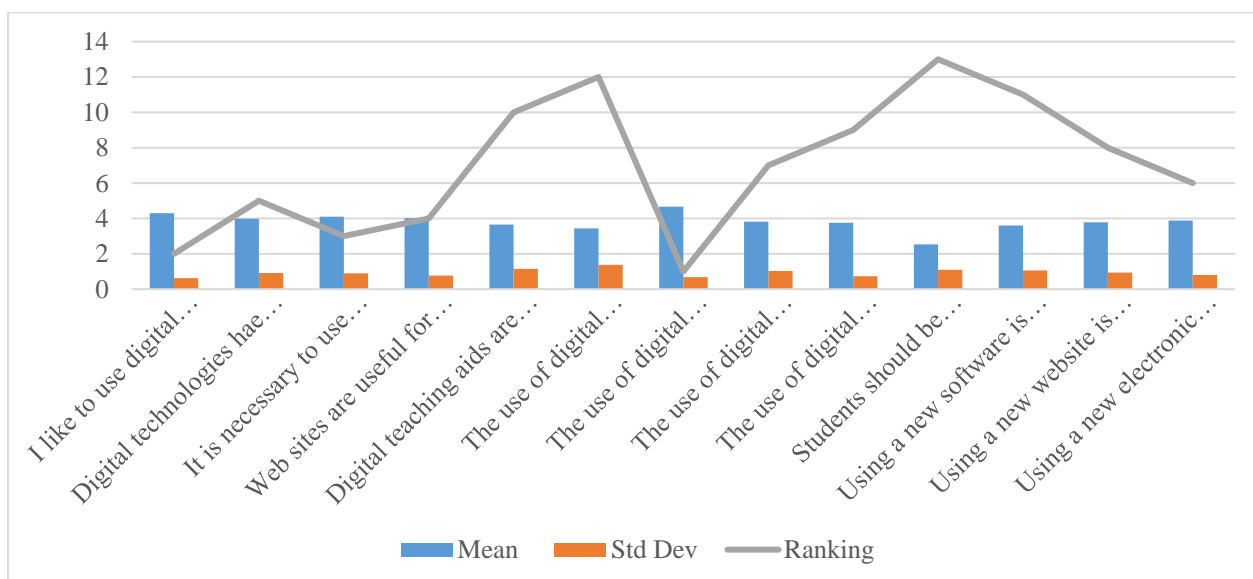

Figure 2. Attitude to New Media

The response for the various ICT tools for learning is very interesting, as major ICT tools available (ranked in descending order) are opening learning solutions (for example, MOOCs, OER), ICT tools for teaching and

learning a foreign language, Flipped learning, educational digital games, and digital storytelling (see Table 2 and Figure 3).

Table 2. ICT as a Tool for Supporting Learning

| Statement	Never	Rarely	Sometimes	Frequently	Very Frequently	Mean	Std Dev.	Ranking
Open learning solutions eg. MOOCs, OER	10.69	10.00	25.31	47.00	7.00	3.2667	1.1179	1
Flipped learning	16.00	22.33	34.67	21.95	5.05	2.7667	1.1255	3
Digital storytelling	20.32	35.00	26.00	18.58	0.00	2.4333	1.0146	5
Blockchain technology	74.22	10.0	3.00	11.88	1.00	1.5500	1.0958	8
Educational digital games	14.00	33.23	24.77	23.00	5.00	2.7333	1.1179	4
ICT tool for teaching and learning foreign languages	9.00	20.66	38.00	30.34	2.00	2.9333	0.9892	2
Special ICT tools to support teaching and learning for the deaf or blind or physically challenged people	52.08	5.92	28.00	11.00	3.00	2.1000	1.2582	7
Method to support the digitally excluded (eg. elderly, migrant)	42.00	24.00	15.94	18.06	0.00	2.1167	1.1512	6
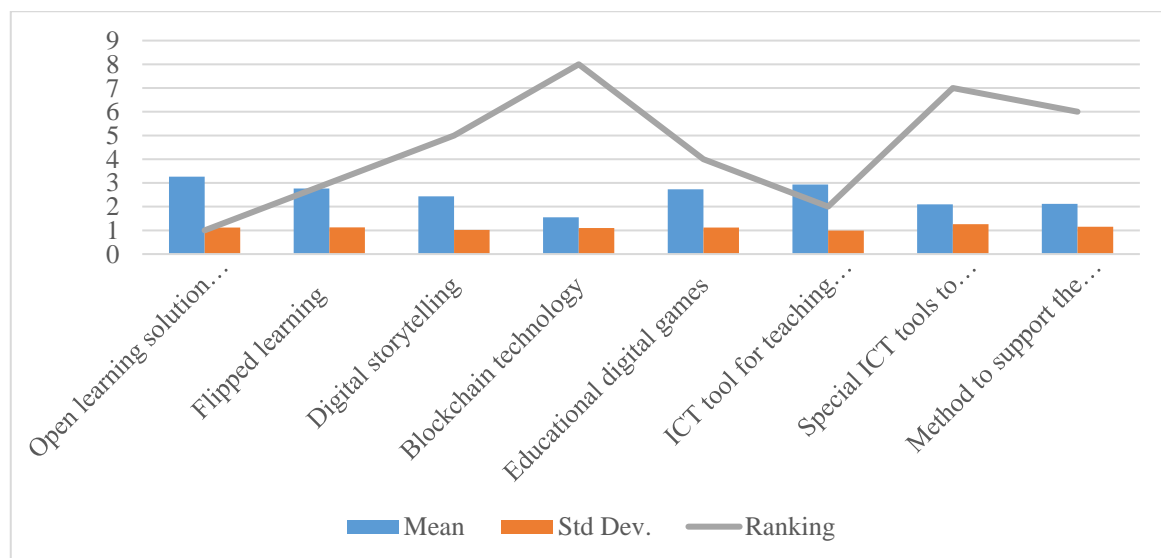
Figure 3. ICT Tools for Supporting Learning

As reflected in Table 5, the perception of teachers about the effectiveness of ICT solutions in education is very encouraging. From Table 5 and Figure 4, ICT tools for teaching and learning were perceived to be the most effective ICT solution. This was followed by educational games, open learning solutions (eg MOOCs and OER), flipped learning, and methods to support the digitally excluded (eg, elderly migrants).

Table 5. Perception of the Effectiveness of ICT Solutions in Education

| Statement	I do not know it	Very Poor	Poor	Acceptable	Good	Very Good	Mean	Std Dev	Ranking
Open learning solutions eg. MOOCs, OER repositories	7.00	6.00	5.00	40.00	34.82	7.18	4.1000	1.2447	3
Flipped learning	17.00	2.86	6.04	35.18	33.82	5.00	3.8000	1.4935	4
Digital storytelling	18.33	3.67	10	45.00	24.00	0.00	3.5167	1.3838	7
Blockchain technology	54.91	7.00	1.00	15.09	17.00	5.00	2.4667	1.8177	8
Educational digital games	8.00	3.35	4.65	33.00	40.00	1.00	4.2333	1.3067	2
ICT tool for teaching and learning foreign languages	8.59	1.00	2.41	41.00	35.92	12.08	4.2833	1.2635	1
Special ICT tools to support teaching and learning for the deaf	24.00	3.00	8.00	16.89	40.11	8.00	3.7167	1.7378	6
Method to support the digitally excluded (eg. elderly, migrant)	24.00	2.07	2.00	34.93	26.00	11.00	3.7500	1.7037	5
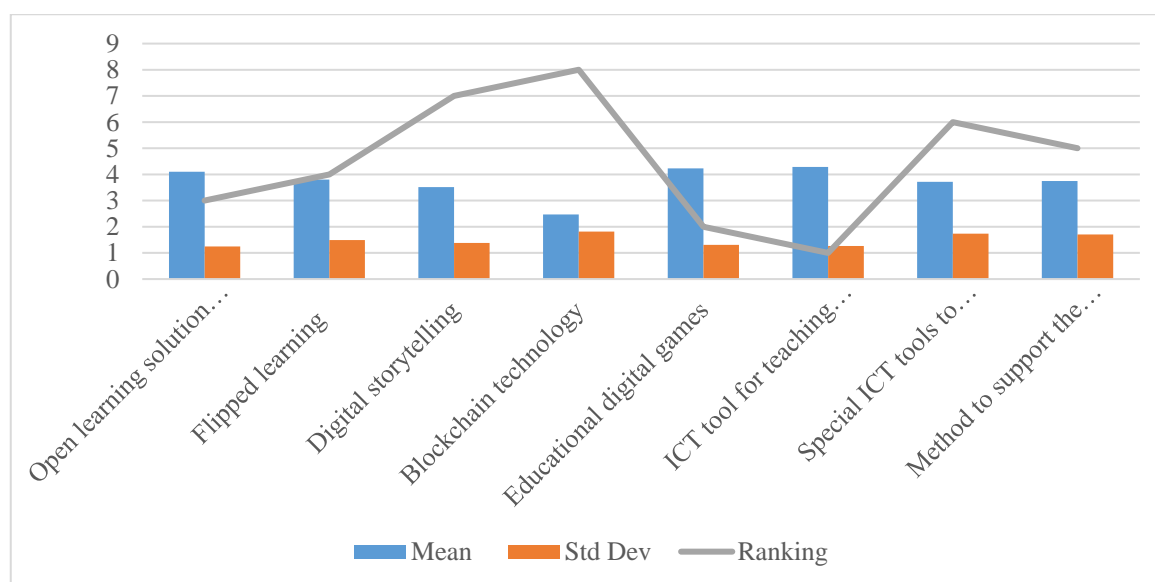
Figure 4. Perception of Effectiveness of ICT Solution in Education

Challenges concerning Curriculum

The researcher in his bid to understand the impact of curriculum structure and ICT content on technology integration undertook exploratory studies in the three colleges of education he visited in the Ashanti region of Ghana. Out of these three colleges, one college takes ICT as a major program, one takes ICT as a minor program and the last one takes a general course meaning ICT is only studied as a core subject. A review of curriculum content about the four-year BEd program was undertaken. It was realized that apart from the colleges that are taking ICT/Computing as either a major or minor program, all the other colleges had the opportunity to teach computing as a subject for only one semester for the entire duration of the program. Educational technology is not catered for in the program. Added to this is that: content of ICT/Computing education presented to the pre-service teachers is purely knowledge-based. Implying that learners are not allowed to learn and practice concepts that would have a better impact on how they use technology in their daily routines in the classroom. The content over-emphasis "what is" instead of concentrating on "how to". This phenomenon develops teachers who have knowledge of content but are not able to effectively apply these concepts to better teach their subject specializations.

Challenges about Infrastructure

The availability of computers and the technologies they are associated with, such as Open Educational Resources (OER), dependable internet access shared over a local area network or campus-based network, computer-assisted and television-assisted instructional programs, and a steady power supply, are according to (Natia & Al-Hassan, 2015), essential elements for effective integration of technology in education. Therefore, if colleges of education want to successfully use technology to enhance teaching and learning, they cannot do away with these infrastructure needs. According to the researcher's observations, Ghana's colleges of education have the following infrastructure challenges:

Lack of computers and technology resources: The researcher noticed a dearth of technological resources in the various colleges of education. Computers for professors and students, internet connectivity (through cable or wireless connection), projectors, tiny boards, printers, and photocopiers are all crucial digital tools that must be provided for technology integration at institutes of education. These will make it possible for instructors and students to create free educational materials like multimedia, textbooks, workbooks, and tutorials. According to Aikins & Arthur-Nyarko (2019), these and other technological resources are lacking in colleges of education, and there is also a high cost for internet bandwidth that isn't very large. It is important to note that, in contrast to institutions where ICT is taught as a general or minor subject, those that offer ICT as a major are fast improving their infrastructure. The unreliable availability of electricity in Ghana is an additional factor. A significant barrier to technology integration in the institutions was the frequent power outages observed in the different colleges. Most lessons involving technical resources ended abruptly due to power outages. This also became a concern because few colleges have a backup power source in case the national grid goes down, and those that did have to deal with the rising cost of gasoline to run the backup generators. Digital technologies are essential in the development of any digital technologies, regardless of the sector within which it is implemented. Unfortunately,

this is lacking in the context of the colleges of education in the Ashanti region and thus has the capacity of limiting the implementation and use of digital technology at these institutions. According to Susanto et al. (2020) and Karipidis et al. (2017), the popularity of Wi-Fi as a means of encouraging the development of digital technologies has grown over the years due to the advantages that come with its use. The study argues that this is so because using Wi-Fi enables local area networks (LANs) to function without wires and infrastructure. Moreover, many contemporary devices, including laptops, smartphones, tablets, and gaming consoles, can also be connected to the Internet wirelessly using Wi-Fi, making an important infrastructure (Karipidis et al., 2017).

Given how important the internet and Wi-Fi are, it can be very frustrating to have poor internet quality, and it can be even more tedious to try to diagnose the problem. Govathson et al. (2022) believe that the performance of the internet connection might be impacted by the router and modem used on the campuses of these institutions. The position of the equipment may impact performance if Wi-Fi is being used. The performance is probably going to be better the closer the router is to the machine, which is sometimes difficult due to the nature of the building design of these institutions. Particularly in some older buildings – typical of the colleges of education in the Ashanti region, the signal may be impacted by the walls, ceilings, and flooring. Hedendahl et al. (2017) on the other hand argue that the performance may be constrained by the fact that some hardware and software such as modems, laptops, routers, and tablets are not built for extremely quick data transfer. Your Internet connection may be slower due to older, less efficient equipment and devices. Performance could be enhanced by getting updated hardware or software. This assertion is the same for all the other forms of electronic-related activities, making it a great problem (Govathson et al., 2022).

Conclusions

The main goal of this study was to examine the key variables that are most likely to affect the adoption of technology in Ghana's Ashanti Region schools of education as well as the difficulties instructors encounter when attempting to use technology in the classroom. The overwhelming majority of the respondents significantly value the role that learning technologies play in advancing and inspiring student learning, according to the data. Results also showed that practically all responders from the three colleges in Ghana's Ashanti Region were attempting to incorporate new technology. As previously explained, this research revealed several variables that are likely to affect the quick uptake of these technologies, including the attitudes of the instructors toward new media, the accessibility of technological infrastructure, the knowledge and experience of the tutors, and administrative assistance. According to Pelgrum (2001), the expertise and experience of educators have a significant role in the success of any innovation. The success of an educational technology program in any institution also depends on the teachers' support, attitudes, and beliefs about the potential of a particular technology to change their teaching practices and improve student learning, according to Buabeng-Andoh (2012). The majority of research participants think that employing learning technologies would considerably increase their teaching effectiveness. They emphasized the fact that incorporating learning technologies into their instruction would increase the likelihood that students would be engaged, which supports the literature's assertions that educational technology offers opportunities for students to develop their creativity and improve their capacity for higher-order thinking (Chigona & Chigona, 2010; Trucano, 2005). Respondents who are currently using learning technologies in their

instruction stated that they do so for a variety of reasons, including creativity, facilitating students' learning, achieving specific learning objectives, and conducting academic work. Lectures value the contribution of learning tools to student learning, which is another important finding of this study. According to current research, the most essential elements required to promote the potential integration of learning technologies into teaching are users' attitudes toward technology and their perceived utility of it. The conclusions reached here have not diverged from those of research of a similar kind, as reported by (Shiue, 2007; Teo, 2008, 2012; Taylor & Todd, 1995), which found that attitude was a major determinant of the adoption of innovative technologies. In-service training, administrative support, the availability of technical infrastructure, attitude, perceived usefulness, and self-efficacy are other important characteristics that have been discovered and are expected to have an impact on how learning technologies are adopted and integrated into teaching in the future. Related elements like simplicity, expertise, and self-assurance in using technologies were also seen as crucial. Like Ajzen & Madden's (1985) findings, data analysis showed that most respondents thought that using technology in the classroom was something they could and should control. Resources, money, incentives, the influence of supervisors, and professional prospects relating to technology at the institutional level were also noted as crucial. In general, respondents exhibited a readiness to use and incorporate learning technologies into their teaching and were fully aware of the opportunities provided by these tools. The issues that are likely to prevent future adoptions were also acknowledged by the respondents, who emphasized the need for institutions in removing systemic obstacles to adoption. However, as innovative technologies continue to transform learning in higher education, many tutors will need to become familiar with multiple technologies and gain confidence for integration to be successful. Responses indicated that a lack of knowledge and skills, a lack of adequate resources and institutional support, and sociocultural dynamics within Ghana's Ashanti Region's colleges of education are among the potential obstacles to the effective integration of learning technologies into teaching.

Study Constraints

This study was limited to colleges of education in the Ashanti Region, so its findings might not generalize to other colleges in Ghana even though it was intended to address contextual and institutional factors that are likely to be a barrier to the integration of learning technologies into teaching in Ghanaian colleges of education. Additionally, because the sample was self-selected, social desirability bias may have already affected it because only individuals who were interested in the use of technology in education may have participated. Furthermore, if administrators and students had participated in the study, the findings would have been more insightful and thorough.

Recommendations

Policymakers and curriculum designers would do well to incorporate more technological concepts oriented toward increasing teaching and learning in the classroom as technology develops and modern technologies and teaching trends emerge. The main goal of teaching technology at different universities should be to translate that knowledge into more practical applications of technological instruments in the teaching of different topics. Additionally, college administrators want to have a general policy that serves as a framework within which every instructor will develop his or her integration strategy for the efficient use of technological instruments in the classrooms. Each

year, administrators and individual tutors must make sure to evaluate and reflect on such policies. To evaluate instructors' technical proficiency before receiving a teaching license, the National Teaching Council should include ICT content in its admission examination policy. College administrators should recognize the value of technology in education and allocate funds for the construction of technical facilities and ongoing tutor training. Future studies should also include additional Ghanaian institutes of education.

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Note

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