

Information Technology Integration Perception on Ghanaian Distance Higher Education: A Comparative Analysis

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Abstract. This study examined students' perception on the integration of Information Technology (IT) in Ghanaian distance Education, and provided a comparative analysis of the levels of integration among public universities in Ghana. The research was conducted at the distance learning centres of the 4 major public universities, namely: University of Ghana (UG), University of Cape Coast (UCC), University of Education, Winneba (UEW) and Kwame Nkrumah University of Science and Technology (KNUST). Questionnaires were used to collect data from a sample of 297 students, using a cluster sampling technique and the data were analysed using One-Way ANOVA and chi-square statistics. The study showed that although computer literacy among distance learners was high, technology integration was low and varied among the institutions. Smart phones were the major internet access devices. The online learning tools for self-efficacy were vital to IT integration. Based on the gathered results, recommendations such as implementing a robust national IT infrastructure, among others, were provided for reflection by higher education institutions offering distance education in Ghana.

Keywords: distance education; higher education; Information Technology; integration; Ghana

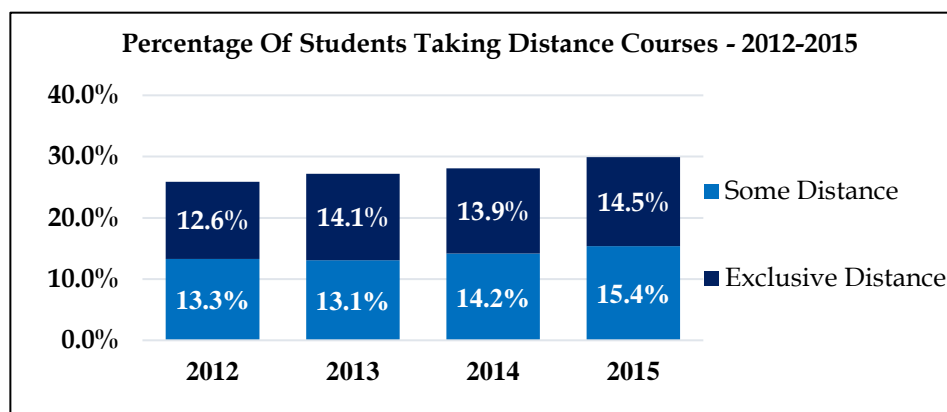
1. Introduction

The buzz word for reaching large number of students from diverse socio-cultural background simultaneously was open and distance education (DE). Revolution and recent advancements in computing and internet technologies had spawned

savvy distance learning opportunities compatible with different types of learners. Wang and Sun (2001) traced the history of distance education to 1833 in Sweden through the “Composition through the medium of the Post.” Although, global statistics on DE was often rare, institutional, regional and national data on DE enrolment and graduation continued to grow with an ever-increasing pace. According to Allen and Seaman (2015) total online enrolments in 2002 came in just under ten percent of total student population in the United States. Data from research institutions showed incremental growth in distance education.

Ghana started DE towards the end of the 20th century to make quality education at all levels more accessible and relevant to meet the learning needs of Ghanaians, so as to enhance their performance and improve the quality of their lives (Mensah & Owusu-Mensah, 2002). Ghana had been experiencing massive growth in distance learning in recent decades. University of Education of Winneba (UEW) started DE in 1996 whiles University of Ghana (UG) and Cape Coast (UCC) started DE in 1996 with diploma programs by distance in 2001/2002 academic year (Hope & Guiton, 2005). Distance enrolment had seen a 39.4% increase in enrolment from 2012 to 2014 (Ankomah-Asare et al., 2016). They also noted that 75% of total enrolment between 2008 and 2015 were done by UEW and UCC. Schaffhauser (2019) also observed that although DE was increasing annually, on-campus students had been declining by five percent (about 931,317 students) between 2012 and 2015. The following figure explicitly showed the percentage of students taking distance courses from 2012 to 2015.

Figure 1. Digital Learning Compass: Distance Education Enrolment Report 2017



Actually, several definitions of DE existed. According to Digest of Education Statistics (2014) DE is primarily delivered using live, pre-recorded instructional videos, interactive audio or video-conferencing, and computer-based systems delivered online. Similarly, Radford (2012) defined distance education as any online class or degree program entirely conducted online. It did not include correspondence courses. That is to say and according to Integrated Postsecondary Education Data System (IPEDS) (2013), DE is “education that uses one or more technologies to deliver instruction to students who are separated from the instructor and to support regular and substantive interaction between the students and the instructor synchronously or asynchronously” p. 21. As for ADEA

(2002), in DE the learner is separated from the instructional base or teacher, either in space or time, for a significant portion of their learning.

The rapid growth in DE, among other benefits, can be traced to the advancement in information technology. The latter had transformed firms into global networked infrastructures, with processes extended all over the world, making virtual global distributed markets and systems (Cunha & Goran, 2007; Tanye, 2017). In parallel, society had gradually transitioned from “technology age” to “information age” giving the computer, Internet and the World Wide Web an outstanding status which had revolutionized virtually every scope of human activity with mixed reception. Accordingly, education had evolved from the traditional face-to-face system to electronic learning and self-study using wiki, blogs, etc., web-based education (or WBTs), video/audio tape, virtual class (CBTs), distance education, mobile learning, and social learning. Endless opportunities and capacities now existed to educate large populations through the technology with particular emphasis on sophistication and learner-centeredness.

1.1. Statement of the Problem

The demand for DE by the large teeming youth of Ghana was increasing with young workers preferring to work while upgrading themselves academically. Also, high graduates’ unemployment had necessitated the acquisition of new skills through DE. Setup of new tertiary institutions was bureaucratic and capital intensive for the government and private institutions in Ghana. Many prospective tertiary students were unfortunately refused admission into the existing tertiary institutions due to incessant lack of facilities and lectures. In this sense, Agbofa (2012) also identified large student-lecturers ratio due to large enrolments. DE departments have been a great avenue for public universities to provide services for distance students. However, these public entities lack adequate resources (infrastructure, ICT personnel, applications, etc.) to match with the growing demand of DE. Yearly complaints from both fresh and continuing DE students were cyclical emanating from delays in supplying reading materials, registration issues, and quiz delays to the disaffection of students with institutional LMS. Some DE departments had instituted blended learning with varying success. Therefore, this study undertook a comparative analysis on integrating ICT into distance learning program by DE students in four Ghanaian public universities.

1.2. Research Questions and Hypotheses

The study sought to address the following research questions:

1. What is the mode of instructional delivery in distance education institutions?
2. What is the level of IT infrastructure integration in education institutions in the four Ghanaian public universities?
3. What is the self-efficacy of distance educational students towards ICT integration?

Based on the above stated research questions, the following research hypotheses were put forward:

H₀₁: There is no statistical difference in instructional delivery mode among the four distance education institutions.

H₀₂: There is no statistical difference in level of IT integration infrastructure among the distance education institutions.

H₀₃: There is no statistical difference in the self-efficacy of distance education students towards the use of online learning tools in the selected universities.

2. Literature Review

This session involved reviewing literature relevant to distance education. It included theoretical framework, benefits of integrating information technology, overview of Ghana's distance education, and finally challenges associated with distance education.

2.1. Theoretical Framework

There were several theories and theoretical frameworks proposed on successful implementation of distance education. Theories of DE attrition and persistence models had been proposed to explain why there was high dropout of DE student. These ranges from Tinto's student integration model in 1993, Bean and Metzner's student attrition model in 1985, Kemper's longitudinal process model of dropout distance education in 1989 to Rovai's composite persistence model in 2003. These models had been imperative to the enhancement of distance education globally (Wladis et al., 2015). Picciano (2017) identified online educational learning theories such as Community of Inquiry (Garrison et al., 2000), Anderson's Online Learning Model in 2011, Blending with Pedagogical Purpose Model, and Multimodal Model for Online Education.

The successful setup of any DE was partly modelled after learning theories of traditional educational system. There were many frameworks, models and concepts deemed as vital elements of DE theories. Several DE theories in the 20th century had been explored by Lee (2004). The prominent theories include behaviourism, cognitivism, and social Constructivism. These theories had and continued to influence DE designs and practices. AECT (2001) identified 6 key elements of DE, namely: separation of teacher and learner; influence of an educational organization; use of media to link teacher and learner; two-way exchange of communication; learners as individuals rather than grouped; and educators as an industrialized form. According to Garrison (2000), theory in distance education must evolve to reflect current and emerging innovative practices of designing and delivering education at a distance. He further stressed on DE design adaptability through affordability and highly interactive communications technology.

In the same vein, ADEA (2002) identified (a) efficiency and effectiveness in administration and management; (b) curriculum design; (c) course production; (d) quality assurance; (e) learner support; (f) use of information and communication technologies; (g) continental, national and regional associations that promote ODL; (h) current research being conducted; initiatives supporting ODL developments; and (i) availability of national and regional databases as critical to the success of DE implementation in Sub Saharan Africa (SSH). Again, Moore and Kearsley (2012) proposed components of a working distance education system to include: (i) a source of content knowledge and teaching; (ii) a course design subsystem to structure this into materials and activities for students; (iii) a

subsystem that delivers the courses to learners through media and technology; (iv) a subsystem that delivers the courses to learners through media and technology; (v) instructors and support personnel who interact with learners as they use these materials; (vi) learners in their different environments; (vii) and a management subsystem to organize policy, needs assessment, and resource allocation to evaluate outcomes and to coordinate other subsystems.

2.2. Distance Education in Ghana

Distance education had gained prominence in developing SSA countries. The history of DE had been comprehensively described by Mensah and Owusu-Mensah (2002). The demand for DE in SSA and Ghana in particular was increasing at a very fast rate (Ankomah-Asare et al., 2016; Kumi-Yeboah et al., 2013; Betchoo, 2015). Schaffhauser (2019) noted that on-campus enrolment was shrinking while online continued its ascent. SSA relied mostly on print media, simulated lecture video recording and actual tutored lectures at designated learning centres nationwide (Mnyanyi & Mbwette, 2009; Ankomah-Asare et al., 2016)). A seven-year period analysis of DE in Ghana showed a total of 374,017 in total admissions with an annual rate of increment of 7984 students (Ankomah-Asare et al., 2016). They also noted that out of the 374,017 enrolled during the period, less than 1% went to private institutions while more than 99% used public universities. This could be due to the history, experience, popularity, affordability, and more importantly the credibility of these public institutions. ADEA (2002) noted SSA countries were smartly using DE to address lifelong learning among the general adult population and to accelerate social development. Kumi-Yeboah et al. (2013) discussed the demographics of Ghana as well as Ghana's history of distance education.

2.3. Benefits of Technology in Distance Education

The advantages of technology had been vastly discussed by many researchers. These covered: cost-effectiveness; access to knowledge; social interaction; pedagogical richness; personal agency; and ease of revision (Osguthrope & Graham, 2003). Many academic and governmental institutions included MIT Open Courseware, Carnegie Mellon University (CMU), Virtual Centre for Technology Enhanced Learning (VCTEL), University of Phoenix, Cisco Networking Academy, African Virtual University (AVU), National Institute of Information Technology (NIIT) Netvarsity, in which they were among the renowned institutions that offered electronic learning (Chandwani et al., 2010; Gerson, 2002).

Recent advancement in computer internet technologies had spawned new programs that combine email, wiki and blog groups, authoring tools, video conferencing and instant messaging via text, audio and video. Learning Management Systems (LMSs) had the amazing ability to integrate the above tools for education masses of distance students with flexibility and personalization. It promoted international, multi-disciplinary variations in educational practice and equipped faculties, students, and administrators with resources to compete in modern academia (Darkwa & Mazibuko, 2000). Embedded in LMS in managing DE were: Massive Online Open Courses (MOOC), Sharable Content Object Reference Model (SCORM), Learning Tools Interoperability (LTI), and Mobile

Learning (M-Learning). LMS was also referred to as Course Management System (CMS), Integrated Learning System (ILS) or Computer-based learning environment (CBI), and virtual learning platform. The use of computers in the teaching process, testing and evaluation process, guidance purposes, library, and school administration were cited as real life used in education, as claimed by Singh (2009). Annku (2014) reported high potential in using digital technologies to augment the traditional teaching method.

Significantly, online education continued to increase due to students' preference and off campus constraints (Allen & Seaman, 2017). Many universities were leveraging on technology to increase their admission rate to replenish their on-campus student population. United States' students enrolled exclusively in DE courses by institutional sector data trends from 2012 to 2016 showed percentage increase of 25 % public, 54.7% private, Non-Profit and a decline of 24.3% Private, For-Profit. Total percentage increase was 13.2%. (Taylor-Straut, 2017). DE can enhance in-service training of untrained teachers and professional upgrading in pre-tertiary education (Robinson & Latchem, 2002; Saint, 1999). African Virtual University (AVU) started with 57 learning centres in 27 African countries aimed at supporting economic development and offered many programs leading to certification in many educational programmes (African Virtual University, 2012). Besides, the AVU helped in increasing access to university education to many SSAs through the use of ICT and multimedia (AVU, 2005).

2.4. Challenges of Distance Education

In spite of the high demand for distance learning and the obvious advantages in transforming the economy of Ghana, several challenges existed. Asabere and Enguah (2012) asserted that DE programs generally required better management skills compared to traditional tertiary programs. ADEA (2002) posited that, for quality provision of distance education, a clear policy framework with clearly defined roles, responsibilities and lines of communication for DE managers was of fundamental importance. Access to DE continued to be a major challenge in Ghana although annual admission continued to grow. Leary and Berge (2007) opined that despite the continued development of information and communication technology (ICT), including videos, online training modules, and web-based training (WBT) systems, traditional DE delivery methods (printed manuals and texts) continued to prove as the most reliable, most sustainable, and most widely used. According to ADEA (2002) report, there was an apparent lack of culture of inter-institutional collaboration with regard to the establishment, maintenance and utilisation of ICT potential among DE institutions.

The report also noted that the use of ICTs in SSA was severely hampered by a lack of expertise, poor infrastructure and a largely technologically illiterate user-group. Awareness and funding of ICT tools by institutions continued to be a challenge. Currently, the UG had deployed Sakai LMS, while KNUST and University of Professional Studies had adopted the Moodle LMS (Darko-Adjei, 2018). Other technological challenges of DE included frequent power outages; slow Internet bandwidths; limited telephone connections; low computer ownership; poor ICT infrastructure; and ICT experts (Dube, 2017; Kulshrestha & Ramswaroop, 2013; Hassan & Mirza, 2020). Globally, mainstream distance

education generally was designed without consideration for the physically disabled. Pant (2014) cited lack of the presence of a teacher; low status of DE institutes; rigidity imposed by university regulations; misconception about the role of DE departments; discrimination with the product of the DE departments; and lack of support by the faculty were actually some setbacks of DE. Kinyanjui (2000) noted the increasing pressure on African countries to provide Open and Distance learning institutions.

The abrupt transition of students from paper-based learning to an electronic one was a daunting task for DE students. Inadequate orientation and poor computer literacy skills can result in poor perception of electronic learning by students. Self-efficacy theory derived from psychology and presented a theoretical framework which accounted for human behaviour changes from diverse modes of treatment (Bandura, 1997), Darko-Adjei (2018) found that fresh DE students inadequately prepared for the Sakai LMS. In the same line of thought, most Senior High Schools (SHS) graduates got their first computer experience at the high schools' ICT laboratory, which were inadequately furnished and often manned by poorly trained ICT staff, coupled with high student-to-computer ratio, and limited timetable period for practice (Nyagorme et al., 2017). Lack of computer self-efficacy or confidence posed a significant barrier to engaging in DE (Tagoe, 2012; Lee et al., 2005; Acheampong, 2016). Adequate self-efficacy in using online tools by DE students was one of the significant determiners of persistence and achievement in DE (Joo et al., 2000; Zhang et al., 2001). Kuo (2010) identified Internet self-efficacy and self-regulation as typically the sole predictors of student satisfaction from previous studies.

3. Methodology

The research design, instrumentation, data collection and data analysis were covered under this session.

3.1. Research Design and Participants

The survey research design was used to collect quantitative data for a quantitative analysis using descriptive and inferential statistics. A survey design was an approach that collected data through sampling from the population and used statistical analysis to make inferences about the population (Curtis & Curtis, 2011). The DE undergraduate students of the 4 major public universities, namely: UG, UCC, UEW and KNUST were used as the target population for the study. These chosen universities were pioneers of DE in Ghana and also accounts for more than 90% of DE students in the country.

3.2. Instrumentation

The instrumentation for the study was used to broadly measure the demographics of the participants, the modes of instructional delivery, the level of IT infrastructure integration, and the online learning tools self-efficacy of distance educational students. Ethical principles such as informed consent, voluntary participation and confidentiality were factored into the preparation and administration of the questionnaires. Questionnaires consisted of 21 open and closed ended questions as well as Likert scale items. Both manual and online versions of the research instrument were employed. The collected data included

categorical, 4-point and 5-point Likert scales, and scale variables. It was modified to include manual as supplementary option since some DE students were less comfortable with the online option. The Cronbach's alpha scores for modes of instructional delivery, level of IT infrastructure integration and online learning tools self-efficacy were 0.72, 0.68 and 0.85, respectively.

3.3. Procedure

Permission was sought from the 4 university authorities and granted before administering the questionnaires. The study used quantitative data from a survey questionnaire consisting of participants' regional distribution, age, gender, and educational level. Also, their skills of internet usage, mode of instructional delivery and assessment methods, and knowledge of institutional e-learning / learning management systems were also collected. Modes of internet access, bandwidth, hour per week and amount (in Ghana cedis) spent on the internet were also identified. The purposes for using the internet, frequency of usage and the confidence in using it were also explored. The researchers created an online survey using Google forms for the pilot study and administered to 51 participants from UCC and UEW public universities. The online questionnaire was reviewed to include a manual version as a complementary option for the less tech savvy participants.

Questionnaires were used to elicit information from a sample of 297 respondents from the 4 public universities in the descriptive survey. The sample size included 26.2% (n = 77) from KNUST, 20.7% (n = 61) from UCC, 25.2% (n = 74) from UEW, and 27.9% (n = 82) from UG, as shown in Table 1. The cluster sampling method was employed due to economy, reduced variability, and feasibility as the DE study centres were many and scattered across the country (Creswell, 2009). Out of ten regions, only 4 were selected. Seven study centres were then selected from Accra, Kumasi and Sogakope for the survey. Simple random sampling was then used to sample the participants for this study. Data analysis and presentation were done using the Statistical Package for Social Sciences (SPSS) version 21, and both descriptive and inferential statistics were done. The descriptive test involved cross-tabulations, bar charts, and pie-charts. The One-Way analysis of variance (ANOVA) and chi-square statistics were used to test the hypotheses of the study. The tukey test for post-hoc analysis was employed to determine if the relationships between the sets of data were statistically significant.

4. Results

The study analysed comparative analysis of public universities in Ghana in integrating IT into DE as perceived by the participants.

Table 1. Participants' Demographic Information

Demographic Variables		KNUST	UCC	UEW	UG	Total
Region	Ashanti	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	1 (0.3)
	Central	64 (26.3)	42 (17.3)	55 (22.6)	82 (33.7)	243 (82.7)
	Greater Accra	13 (40.6)	18 (56.3)	1 (3.1)	0 (0.0)	32 (10.9)
	Volta	0 (0.0)	0 (0.0)	18 (100.0)	0 (0.0)	18 (6.1)
	Total	77 (26.2)	61 (20.7)	74 (25.2)	82 (27.9)	294 (100.0)

Gender	Female	15 (12.3)	38 (31.1)	33 (27.0)	36 (29.5)	122 (42.8)
	Male	61(37.4)	24 (14.7)	37(22.7)	41(25.2)	163 (57.2)
	Total	76 (26.7)	62 (21.8)	70 (24.6)	77 (27.0)	285 (100.0)
Age	Up to 30 years	32 (17.3)	40 (21.6)	44 (23.8)	69 (37.3)	185 (65.1)
	31 - 35 years	31 (46.3)	18 (26.9)	11 (16.4)	7 (10.4)	67 (23.6)
	36 - 40 years	12(50.0)	1 (4.2)	9 (37.5)	2 (8.3)	24 (8.5)
	41 - 45 years	1(20.0)	1 (20.0)	3 (60.0)	0 (0.0)	5 (1.8)
	46 - 50 years	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0)	1 (0.3)
	51 and above	0 (0.0)	0 (0.0)	0 (0.0)	2 (100.0)	2 (0.7)
	Total	76 (26.8)	60 (21.1)	67 (23.6)	81 (28.5)	284 (100.0)
Students' Level	1st year	10 (58.8)	1 (5.9)	4 (23.5)	2 (11.8)	17 (6.0)
	2nd year	8 (7.7)	21 (20.2)	25 (24.0)	50 (48.1)	104 (37.0)
	3rd year	23 (38.3)	6 (10.0)	11(18.3)	20 (33.3)	60 (21.4)
	4th year	11 (14.3)	32 (41.6)	26 (33.8)	8 (10.4)	77 (27.4)
	Masters	22 (95.7)	0 (0.0)	1 (4.3)	0 (0.0)	23 (8.2)
	Total	74 (26.3)	60 (21.4)	67 (23.8)	80 (28.5)	281 (100.0)

Table 1 also showed the regional distribution, gender, age, and students' classification of the DE students in the 4 public universities in Ghana. Out of the 297 participants, 1(0.3%) was from Ashanti region, 18 (6.1%) were from Volta region, 32 (10.9%) were from Greater Accra region, and the majority (82.7%) were from central region. The gathered data reflected that 122 (42.8%) were females while 163 (57.2%) were males. Besides, the table also displayed research informants' different ages, in which most of the participants 185 (65.1%) were up to 30 years, 67 (23.6%) were between 31 - 35 years, 24 (8.5%) were between 36 - 40 years, 5 (1.8%) were between 41 - 45 years, 1 (0.3%) were between 46 - 50 years, and finally 2 (0.7%) were 51 years and above. As for students' classification, 17 (6.0%) were in first year, 104 (37.0%) were in second year, 60 (21.4%) were in third year, 77 (27.4%) were in final year, and 23 (8.2%) were in graduate school.

Table 2. Instruction Received through Technology

	Distance Education Institution									
	KNUST		UCC		UEW		UG		Total	
	N	%	N	%	N	%	N	%	N	%
No	20	14.5	52	37.7	45	32.6	21	15.2	138	46.9
Yes	57	36.5	11	7.1	28	17.9	60	38.5	156	53.1
Total	77	26.2	63	21.4	73	24.8	81	27.6	294	100

As shown from Table 2, the majority of the participants (53.1%) stated the institutional use of educational technology, while 46.9% stated no.

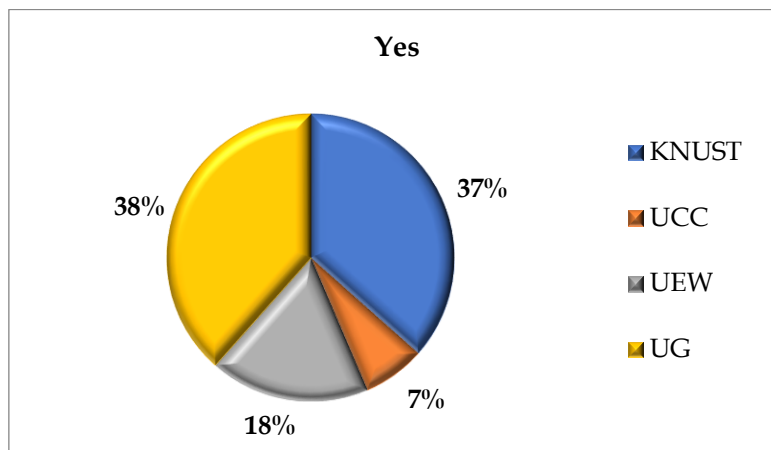


Figure 2. Instructional Technology Usage by DE Institution

In details, 60 (38.5%) of UG students stated yes, followed by 57 (36.5%) KNUST students, then 28 (17.9%) UEW students, and finally 11 (7.1%) UCC students as revealed in Figure 2. The homogeneous test consisted of KNUST and UG in a group with UCC and UEW in other separate groups using Tukey HSD^{a,b} test (See Table 7).

Table 3. Institutional Instructional Media

	Distance Education Institution				Total
	KNUST	UCC	UEW	UG	
None	28(17.8%)	54(34.4%)	45(28.7%)	30(19.1%)	157(53.2%)
Printed Media	4(12.9%)	7(22.6%)	10(32.3%)	10(32.3%)	31(10.5%)
Television	1(33.3%)	1(33.3%)	0(0.0%)	1(33.3%)	3(1.0%)
Computer software	28 (35.4%)	1(1.3%)	19(24.1%)	31(39.2%)	79(26.8%)
CD ROMs	0(0.0%)	0(0.0%)	0(0.0%)	1(100%)	1(0.3%)
Video-conferencing	6(66.7%)	0(0.0%)	0(0.0%)	3(33.3%)	9(3.1%)
Audio/Video tapes	10(66.7%)	0(0.0%)	0(0.0%)	5(33.3%)	15(5.1%)
Total	77(26.1%)	63(21.4%)	74(25.1%)	81(27.5%)	295 (100.0%)

Table 3 reflected the instructional media used by DE institutions. A larger proportion of participants 157 (53.2%) did not state any instructional media. However, out of the 138 (46.8%) who specified instructional media mode, 31(10.5%), 3(1.0%), 79(26.8%), 1(0.3%), 9(3.1%), 15(5.1%) stated printed materials, television, computer software, CD ROMs, Audio/Video-conferencing, and Audio/Video tapes, respectively. Both UEW and UG students reported the highest score (32.3%) in the use of printed material. Television, Audio /Video-conferencing, Audio/Video tapes, and CD ROMs were not a popular educational technology for all the institution reporting less than 12 participants in the universities. Computer softwares were more than a third (>33.3%) of instructional technology according to KNUST and UG students. KNUST and UG had virtually similar responses compared to UCC and UEW which were also in separate groups as table 7 showed.

Table 4. Mode of Assessment (quizzes, tests, etc.) Conducted

	Distance Education institution.									
	KNUST		UCC		UEW		UG		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Manual	53	28.5	58	31.2	69	37.1	6	3.2	186	65.3
Online	1	2.6	0	0.0	0	0.0	38	97.4	39	13.7
Mixed	22	36.7	3	5.0	1	1.7	34	56.7	60	21.1
Total	76	26.7	61	21.4	70	24.6	78	27.4	285	100.0

The popular mode of assessment (quizzes, tests, group work) reported by students was paper-based 168 (65.3%), with 39 (13.7%) stating online mode, while 60 (21.1%) reporting both the manual and online modes. On institutional basis, KNUST, UCC and UEW were heavily dependent on paper-made assignments, while UG focused more on online assignments and to a less extent mixed modes as Table 4 displayed. Also, UEW and UCC were found in the same homogeneous subset and varied differently from KNUST and UG (See Table 7).

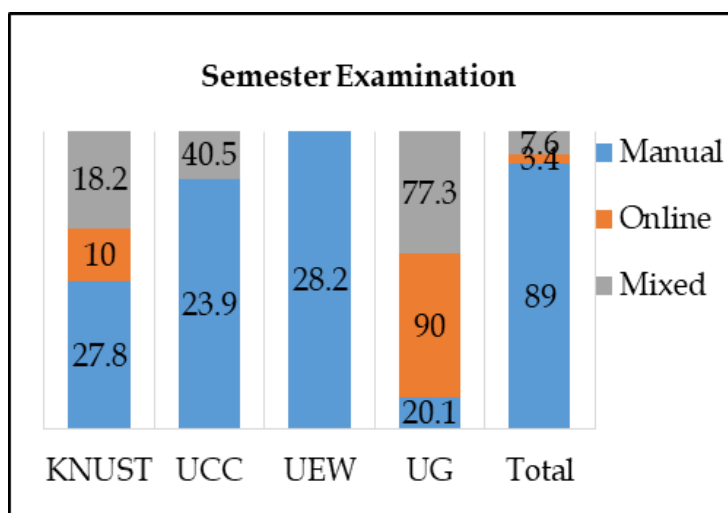
**Figure 3. Mode of End-of-Semester Examination**

Figure 3 reflected on the fact that all the participating institutions focused on paper-based end of semester examinations 259 (89.0%).

Online mode was lowest 10 (3.4%) with the rest 22 (7.6%) stating the mixed method. UEW, UCC and KNUST were found in the same homogeneous subset with UG being different according to what Table 7 covered.

Table 5. Immediate Feedback on Assessments

	Distance Education Institution									
	KNUST		UCC		UEW		UG		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
No	53	26.9	60	30.5	60	30.5	24	12.2	197	73.8
Yes	14	20.0	0	0.0	4	5.7	52	74.3	70	26.2
Total	67	25.1	60	22.5	64	24.0	76	28.5	267	100.0

138 (48.6%) of the participants stated no immediate feedback on formative assessments was conducted by lecturers, while 146 (51.4%) had immediate feedback as revealed from table 5. For the yes group, UG and UCC recorded relative higher values with 47(32.2%) and 38 (26.0%) respectively compared to KNUST 35 (24.0%) and UEW 26 (17.8%).

Table 6. Feedback Mode

	Distance Education Institution									
	KNUST		UCC		UEW		UG		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Face-to-face	29	28.2	38	36.9	28	27.2	8	7.8	103	67.3
Online	5	10.6	1	2.1	0	0.0	41	87.2	47	30.7
Phone	1	33.3	0	0.0	1	33.3	1	33.3	3	2.0
Total	35	22.9	39	25.5	29	19.0	50	32.7	153	100.0

Table 6 above showed the three main options available to students in communicating with lecturers. Out of the 297 participants, 158 (53.2%) interacted with their lecturers on assignments. Face-to-face feedback was the major option 103 (67.3%) with 47 (30.7%) using online options and 3(2.0%) using the mobile phone.

Table 7. Tukey ^{HSD} Tests

	Institution mode of Instruction			Forms of technology			Assignments Mode			End-of-Sem Mode		Feedback Mode	
	1	2	3	1	2	3	1	2	3	1	2	1	2
UEW		.38			6.57		1.03			1.00		1.07	
KNUST			.74	5.00				1.59		1.12		1.20	
UG			.74	5.37					2.36		1.55		1.86
UCC	.17					7.59	1.10			1.03		1.03	

Homogeneity test of the variables above showed interesting results among the four DE universities according. There were 3 subgroups using instructional technology with UCC in 1 group, UEW in the next group, with KNUST and UG in the third group. A similar pattern was observed among the institutions with the forms of technology. Assignment mode also had 3 different subgroups with UEW and UCC in a single group with KNUST and UG in different groups. End of semester mode and feedback mode had two subgroups each with similar groupings: UEW, KNUST and UCC in the first group and UG in the second group.

4.1. IT Infrastructure Integration in Distance Educational Institutions

This session dealt with the level of IT integration with the services offered by distance educational institutions in available wireless-fidelity (Wi-Fi), e-learning, and LMS.

Table 8. Reliable Wi-Fi Internet Connectivity at the Learning Centre for Effective Studies

	Distance Education Institution									
	KNUST		UCC		UEW		UG		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
No	53	26.9	60	30.5	60	30.5	24	12.2	197	73.8
Yes	14	20.0	0	0.0	4	5.7	52	74.3	70	26.2
Total	67	25.1	60	22.5	64	24.0	76	28.5	267	100.0

Table 8 covered the presence of reliable Wi-Fi internet facility at the learning centres for effective studies. As shown, 267 out of 297 participants answered this question item, in which 197 (73.8%) stated the absence of Wi-Fi internet, whereas 70 (26.2%) stating its presence. Also, only UG participants responded more yes (68.6%) than no (31.6%).

Table 9. Internet Speed

Internet Speed	Distance Education Institution									
	KNUST		UCC		UEW		UG		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Very Fast	5	23.8	6	28.6	4	19.0	6	28.6	21	7.4
Fast	38	31.7	27	22.5	28	23.3	27	22.5	120	42.3
Manageable	28	32.9	18	21.2	13	15.3	26	30.6	85	29.9
Slow	6	12.2	10	20.4	16	32.7	17	34.7	49	17.3
Very Slow	0	0.0	0	0.0	5	55.6	4	44.4	9	3.1
Total	77	27.1	61	21.5	66	23.2	80	28.2	284	100.0

As far as DE participants' view of the internet bandwidth for using online resources are concerned, 21 (7.4%) indicated it as very fast, 120 (42.3%) stated fast, while 85 (29.9%) noted it as manageable, 49 (17.3%) stated slow, and 9 (3.1%) declared very slow. Generally, out of the 226 participants who were comfortable with the internet speed, 71 (31.4%) were from KNUST, 51 (22.7%) were from UCC, 45 (19.9%) were from UEW and 59 (26.0%) were from UG. Conversely, participants with unstable and low bandwidth were 6 (10.3%) from KNUST, 10 (17.2%) from UCC, 21 (36.2%) from UEW, and 21 (36.2%) from UG.

Table 10. E-learning Platform Used by Academic Institutions

	Frequency	Percent (%)
Unanswered	182	61.3
None	2	.7
Not Sure	7	2.4
Internet	13	4.4
V CLASS	27	9.1
Schoology	1	.3
National Program for Technology Enhanced Learning	2	.7
Sakai	63	21.1
Total	297	100.0

When investigating the types of e-learning services offered by DE institutions, different data were gathered. As shown in Table 10, 182 (61.3%) participants did not state any e-learning platform, 9 (3.0%) stated either none or not sure. As for

the remaining research informants 106 (35.7%), 63 stated Sakai LMS, 27 stated virtual (V) class, 2 stated NPTEL, 1 stated Schoology LMS, and 13 stated just the Internet.

The use of LMSs by DE institutions was investigated and data were gathered from participants as found in Figure 4.

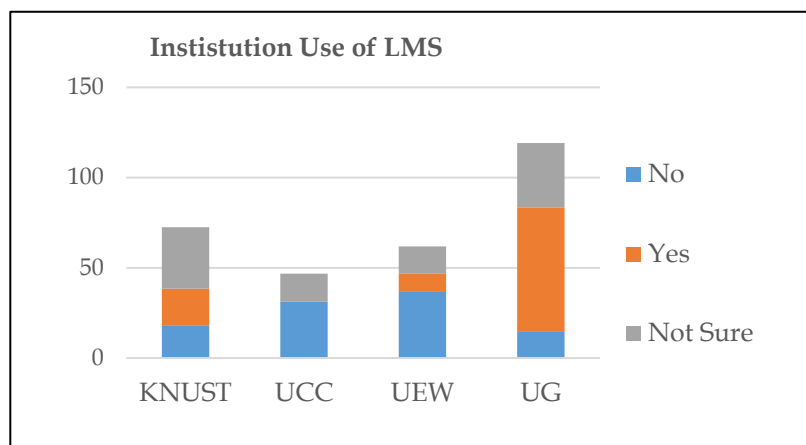


Figure 4. Engage in LMS in your Institution

From Figure 4, 234 (78.8%) participants answered this out of 63 (21.2%). Also, 90 (38.5%) students said no, 115 (49.1%) said they were not sure, and 29 (12.4%) stated yes. This implied that 209 (87.6%) of DE students had no engagement with LMSs. Only UG students had more yes 20 (69.0%) responses than no 13 (14.4%) responses.

Table 11. State any LMS Used by your Academic Institution

	Frequency	Percent (%)
Unanswered	272	91.3
Lamass	2	0.7
Internet	4	1.3
Not Sure	4	1.3
Sakai	16	5.4
Total	298	100.0

The types of LMSs used by the 4 public universities were shown in Table 11. The majority of participants (91.3%) did not answer this question item compared to participants who did (8.7%), and (7.4%) who actually stated the particular LMSs. Findings also revealed that 16 (5.4%) stated Sakai LMSs, 2 (0.7%) mentioned Lamass, and 4 (1.3%) stated the internet.

4.2. DE Students' Self Efficacy towards Online Learning Tools

The self-efficacy towards online learning tools by DE participants was centred on the average weekly time spent on browsing the internet, internet bandwidth, and confidence in using online resources.

Table 12. Average Weekly Internet Usage

Hours / week	Distance Education Institution									
	KNUST		UCC		UEW		UG		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
0 - 1	9	18.4	9	18.4	18	26.7	13	26.5	49	17.7
2 - 4	27	29.3	18	19.6	27	29.3	20	21.7	92	33.3
5 - 6	12	29.3	14	34.1	5	12.2	10	24.4	41	14.9
7 - 9	13	43.3	6	20.0	6	20.0	5	16.7	30	10.9
10 - 20	3	12.5	5	20.8	5	20.8	11	45.7	24	8.7
Above 20	11	27.5	8	20.0	6	15.0	15	37.5	40	14.5
Total	75	27.2	60	21.7	67	24.3	74	26.8	276	100.0

Table 12 displayed average weekly usage spent on the internet. On weekly basis, 49 (17.7%) participants spent about 0 - 1 hour, 92 (33.3%) spent 2 - 4 hours, 41 (14.9%) spent 5 - 6 hours, 30 (10.9%) spent 7 - 8 hours, 24 (8.7%) spent 10 - 20 hours, and 40 (14.5%) spent over 20 hours. Comparatively, all the DE participants mostly spent 2 - 4 hours weekly on the internet.

Table 13. Confidence in Using the Computer for Education

	Distance Education Institution				Total
	KNUST	UCC	UEW	UG	
Very Confident	46(34.8%)	26(19.7%)	30(22.7%)	30(22.7%)	132(47.1%)
Quite confident	15(17.6%)	18(21.2%)	26(30.6%)	26(30.6%)	85(30.4%)
Confident	13(26.0%)	12(24.0%)	10(20.0%)	15(30.0%)	50(17.9%)
Not confident	0(0.0%)	3(27.3%)	3(27.3%)	5(45.5%)	11(3.9%)
Don't Know	0(0.0%)	0(0.0%)	0(0.0%)	2(100.0%)	2(0.7%)
Total	74(26.4%)	59(21.1%)	69(24.9%)	78(27.9%)	280(100.0%)

The confidence of DE students in using computers for educational purpose was identified, in which 132 (47.1%) were very confident, and 85 (30.4%) were quite confident. While 50 research informants (17.9%) were confident and 11 (3.9%) were not confident, 2 (0.7%) did not know. Therefore, it is safe to conclude that data on the confidence in using the computer for education in each university was significant to a great extent, wherein 74 (27.7%), 56 (21.0%), 66 (24.7%), and 71 (26.6%) were respectively recorded in KNUST, UCC, UEW, and UG public universities,

Table 14. Confidence in Using a Web-Browser

	Distance Education Institution				Total
	KNUST	UCC	UEW	UG	
Very Confident	52(33.5%)	31(20.0%)	32(20.6%)	40(25.8%)	155(55.4%)
Quite Confident	11(17.2%)	16(25.0%)	14(21.9%)	23(35.9%)	64(22.9%)
Confident	10(22.2%)	12(26.7%)	12(26.7%)	11(24.4%)	45(16.1%)
Not Confident	0(0.0%)	0(0.0%)	11(84.6%)	2(15.4%)	13(4.6%)
Don't Know	0(0.0%)	1(33.3%)	0(0.0%)	2(66.7%)	3(1.0%)
Total	73(26.1%)	60(21.4%)	69(24.6%)	78(27.9%)	280(100.0%)

Table 14 showed participants' confidence in using a web-browser. Generally, 155 (55.4%) were very confident, 64 (22.9%) were quite confident, 45 (16.1%) were confident, 13(4.6%) were not confident, and 3(1.0%) did not know. 264 (94.3%)

were in the confidence group while 16 (5.7%) were in the non-confidence group. Institutionally the confidence group had 73 (27.7%) from KNUST, 59 (22.3%) from UCC, 58 (22.0%) from UEW and 74 (28.0%) from UG participants.

Table 15. Confidence in Using Wikipedia

	Distance Education Institution				Total
	KNUST	UCC	UEW	UG	
Very Confident	31(32.6%)	21(22.1%)	18(18.9%)	25(26.3%)	95(34.4%)
Quite confident	17(22.7%)	13(17.3%)	17(22.7)	28(37.3%)	75(27.2%)
Confident	13(26.0%)	12(24.0%)	12(24.0%)	13(26.0%)	50(18.1%)
Not confident	5(20.0%)	3(12.0%)	11(44.0%)	6(24.0%)	25(9.1%)
Don't Know	7(22.6%)	7(22.6%)	11(35.5%)	6(19.4%)	31(11.2%)
Total	73(26.4%)	56(20.3%)	69(25.0%)	78(28.3%)	276(100.0%)

As far as students' confidence level in using Wikipedia was concerned, the following data were collected. 95(34.4%) were very confident, 75(27.2%) were quite confident, 50(18.1%) were confident, 25(9.1%) were not confident, and 31(11.2%) did not know. The sum of the confidence group was 220 (79.7%) and that of the non-confidence group was 56 (20.3%). Also, the confidence group had 61 (27.7%) for KNUST, 46 (21.0%) UCC, 66 (24.7%) for UEW, and 71 (26.6%) for UG.

Table 16. Confidence in Downloading from the Internet

	Distance Education Institution				Total
	KNUST	UCC	UEW	UG	
Very Confident	46(34.1%)	28(20.7%)	30(22.2%)	31(23.0%)	135(48.2%)
Quite confident	11(16.7%)	14(21.2%)	16(24.2%)	25(37.9%)	66(23.6%)
Confident	16(27.1%)	9(15.3%)	16(27.1%)	18(30.5%)	59(21.1%)
Not confident	1(7.1%)	8(57.1%)	4(28.6%)	1(7.1%)	14(5.0%)
Don't Know	0(0.0%)	1(16.7%)	3(50.0%)	2(33.3%)	6(2.1%)
Total	74(26.4%)	60(21.4%)	69(24.6%)	77(27.5%)	280(100.0%)

Confidence of DE students in downloading information from the internet was investigated and summarised as reflected in the above table. 135 (48.2%) indicated that they were very confident, 66 (23.6%) indicated quite confident, and 59 (21.1%) indicated confident summing up to 260 (92.9%). Also 14 (5.0%) stated the fact that they were not confident and 6 (2.1%) opted for the last alternative tallying 20 (7.1%). Institutionally, 73 (28.1%) were from KNUST, 51 (19.6%) were from UCC, 62 (23.8%) were from UEW and 74 (28.5%) were from UG.

Table 17. Confidence in Uploading in the Internet

	Distance Education Institution				Total
	KNUST	UCC	UEW	UG	
Very Confident	31(30.4%)	25(24.5%)	18(17.6%)	28(27.5%)	102(37.2%)
Quite confident	15(23.4%)	11(17.2%)	19(29.7%)	19(29.7%)	64(23.4%)
Confident	23(34.3%)	8(11.2%)	16(23.9%)	20(29.9%)	67(24.5%)
Not confident	2(6.9%)	10(34.5%)	10(34.5%)	7(24.1%)	29(10.6%)
Don't Know	3(25.0%)	1(8.3%)	4(33.3%)	4(33.3%)	12(4.4%)
Total	74(27.0%)	55(21.1%)	67(24.5%)	78(28.5%)	274(100.0%)

Table 17 recorded the confidence of participants in uploading data in the internet. As displayed, 102 (37.2%) were very confident, while 64 (23.4%) and 67 (24.5%) were quite confident and confident, respectively. Surprisingly, 29 (10.6%) were not confident and 12 (4.4%) noted that they don't know. More significantly, 233 (85.0%) indicated some degree of confidence and 41(15.0%) noted the lack of confidence in uploading contents in the internet. From the former group, 69 (29.6%) were from KNUST, 44 (18.9%) were from UCC, 53 (22.7%) were from UEW, and 67 (28.8%) were from UG.

Hypothesis One

H₀₁: There is no statistical difference in instructional delivery mode among the four distance education institutions

Table 18. One Way ANOVA Table of Mode of Instructional Delivery

	DF	F	Sig.
Receive instruction through technology	3	28.171	.000
Forms of technology used to receive instructions	3	23.246	.000
Mode of assignments (quizzes, tests, etc.) conducted	3	71.899	.000
Mode of end-of-semester examinations conducted	3	19.348	.000
Immediate feedback on the assessment from lecturers	3	4.350	.005
Feedback Mode	3	49.005	.000

The One-Way ANOVA for each variable under the mode of instructional delivery system of the 4 public institutions was statistically different with $p < 0.05$ according to Table 18. With the $df=3$, instruction through technology ($F=28.171$, $p=0.000$); forms of instructional technology ($F=23.246$, $p=0.000$); mode of assignments ($F=71.899$, $p=0.000$); mode of semester exams ($F=19.348$, $p=0.000$); immediate feedback ($F=4.350$, $p=0.005$); and feedback mode ($F=49.005$, $p=0.000$) showed different and important data. The gathered data implied that each DE institution had different policies and practices. In other terms, each DE institution was autonomous in the implementation of DE. Therefore, it was safe to reject hypothesis 1 (H_{01}).

Hypothesis Two

H₀₂: There is no statistical difference in level of IT integration infrastructure among the distance education institutions

Table 19. One Way ANOVA for Internet Speed at Learning Centre for Effective Studies

	Sum of Squares	DF	Mean Square	F	Sig.
Between Groups	8.883	3	2.961	3.338	.020
Within Groups	248.339	280	.887		
Total	257.222	283			

Table 20. Tukey Test for Internet Speed

	N	Subset for alpha = 0.05
		1
UEW	66	2.85
KNUST	77	2.45
UG	80	2.83
UCC	61	2.52

Tables 19 and 20 represented one-way ANOVA of the internet speed across the learning institutions and the Tukey homogeneity test, respectively. The value of $p < 0.05$ in table 19 implied statistically significant difference in the internet speed for using online resources learning centres ($F=3.338$, $df=3$, $p=0.020$). Hypothesis 2 was therefore rejected. However, all the different institutions were in one homogeneous group according to the Tukey's test.

Table 21. Chi Square Test of Presence of Wi-Fi Connectivity at Learning Centres

	Value	DF	Asymp. Sig. (2-sided)
Pearson Chi-Square	105.472 ^a	3	.000
Likelihood Ratio	113.814	3	.000
Linear-by-Linear Association	44.176	1	.000
N of Valid Cases	267		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 15.73.

According to Table 21, there was a statistically significant difference among DE institutions offering Wi-Fi connectivity at the learning centres with $\chi^2(2, N=267) = 105.472$, $p=.000$. Hence, hypothesis 2 was also rejected.

Null Hypothesis	Test	Sig.	Decision
The distribution of 'Engage in LMS in your institution is normal' with mean 1.107 and standard deviation 0.93	One-Sample Kolmogorov-Smirnov Test	.000	Reject the null hypothesis

Figure 5. Chi Square test of Institutional LMS

Asymptotic significance is displayed. The level is 0.05

Table 22. Chi Square Test of Presence of Institutional LMS

Total N	Most Extreme Difference			Test Statistic	Asymptotic Sig. (2-sided test)
	Absolute	Positive	Negative		
234	.323	.267	-.323	4.934	.000

Both Figure 5 and Table 22 showed that there was a statistical significant difference in the institutional utilization of LMS among the DE institutions $\chi^2(2, N=234) = 4.934$, $p=.000$. Hypothesis 2 was hence rejected.

Hypothesis Three

H₀₃: There is no statistical difference in the self-efficacy of distance education students towards the use of online learning tools in the selected universities.

Table 23. One-Way ANOVA for Self-Efficacy in Online Learning Tools

	DF	F	Sig.
Confident in using the computer for education	3	3.364	.019
Confident in using opening a web-browser (Firefox, Chrome, etc.)	3	4.875	.003
Confident in using Wikipedia	3	4.085	.075
Confident in using search engine	3	2.731	.198
Confident in downloading on the internet	3	2.461	.063
Confident in uploading on the internet	3	1.412	.240

Table 23 covered the One-Way ANOVA for the self-efficacy of DE students in using online learning tools. There were significant statistical differences for educational use of computer with $F(3, N=280) = 3.364, p=.019$, and using web browsers with $F(3, N=280) = 4.875, p=.003$ among the different institutions. However, there were no statistical differences among the participants in the use of Wikipedia $F(3, N=276) = 4.085, p=.075$; search engine $F(3, N=277) = 2.731, p=.198$; downloading $F(3, N=280) = 2.461, p=.063$; and uploading $F(3, N=274) = 1.412, p=.240$.

Table 24. Tukey HSD^{a,b} Test

	N	Confident computer for education		Confident In web browser		Confident in Wikipedia	Confident in search engine	Confident in download	Confident in upload
		1	2	1	2	1	1	1	1
UEW	64	1.80	1.80		2.03	2.71	2.41	2.04	2.45
KNUST	67	1.55		1.42		2.18	2.00	1.62	2.07
UG	76		2.01	1.76	1.76	2.23	2.35	1.94	2.23
UCC	60	1.86	1.86	1.73	1.73	2.32	2.40	2.00	2.11

The post hoc results in Table 24 showed that confidence in computer use for education had 2 subgroups with UEW, KNUST and UCC in one group with UEW, UG and UCC in the other group. Similarly, the confidence in using web browsers yielded 2 subgroups with KNUST, UG and UCC in one group and UEW, UG and UCC in the other. The homogeneity test for confidence in using Wikipedia, search engines, download and upload were felt in single groups.

5. Discussion

This study sought to compare the level of IT integration into distance learning programs of 4 public universities in Ghana. The main variables investigated were the demographics of the participants, mode of instructional delivery in distance education institutions, level of IT integration infrastructure, and the online learning tools self-efficacy of distance educational students. Accordingly, the following paragraphs covered an in depth discussion of the collected data for the set research questions.

Research Question 1

What is the mode of instructional delivery in distance education institutions?

The mode of instructional delivery in distance educational institutions was predominantly manual or paper-based popularly known as face-to-face tutorials. Textbooks and photocopied items served as the main medium for knowledge transfer. Although the majority of the participants responded yes (53.1%) to instructional use of technology, table 3 showed that 53.2% were unable to list specific technologies. Zaina et al., (2001) analysed the main aspects of 5 web-based distance education system used by DE institutions. Despite the numerous, robust, inexpensive and open source learning management systems available for efficient management of DE, only 2 of the participating institutions functionally used them for their students in a blended mode. UCC and UEW were yet to utilize LMS to enhance their activities. The findings met in this study did not align with what Raja and Nagasubramani (2018) claimed. That is to say, they regard technology as

making the teaching and learning process more enjoyable. Research was ambivalent on the impact of technology (virtual worlds) on students' academic performance. While a positive correlation was found among them (Sun et al., 2008; Gregory & Gregory, 2011) the reverse phenomenon was observed in other studies (Strasburger et al., 2010; Dalgarno et al., 2009).

The high percentage for paper-based formative (65.3%) and summative (89.0%) assessments the DE programs of the 4 public universities raised numerous underlying issues in relation to ICT integration. These underlying factors included lecturers and tutors' adoption, perception, training and usage of ICT for DE, adequate instructional/course designer; prospective students' awareness, preparation, prior IT literacy skills, perception, motivation, demand and relevance of ICT for DE, institutional and national policies for ICT implementation in DE, and ease of accessibility of the online platforms were critical to transform traditional mode to current modern trend. Darko-Adjei (2018) noted involuntary attitude of UG students in using the Sakai platform. The high variability of the mode of instructional delivery among the 4 major DE institutions as shown by ANOVA table 18 reflected the lack of standardization and collaboration of programs (Elameer & Idrus, 2011). Also, lack of a national examination body implied that DE graduates from each of the public universities completed their programs with different skill sets although they engaged in similar educational programs. In this vein, effective partnership between government and academic institutions is needed (Kinyanjui, 2000).

Research Question 2

What is the level of IT infrastructure integration in education institutions in the four Ghanaian public universities?

The study showed that students enrolling in DE in Ghana had internet experience, evidenced by 283 (96.3%) of the participants. Also, portable devices, especially mobile phone (53.4%), were the main internet accessing devices implying high penetration among tertiary students from the study. With the majority of participants reporting absence of Wi-Fi internet (73.8%), DE institutions' quest for seamless ICT integration needed to be reviewed. 153 (53.9%) participants were unaware or not sure that their universities used e-learning and 191(64.4%) could not state e-learning platform. This, again, was attested by the fact that 205 (87.6%) participants either said no or were not sure whether their DE institution used LMS, and 288 (92.6%) could not state institutional LMS. Caruth and Caruth (2013) noted USA enrolment rate exceeded total rate in higher education. Ankomah-Asare et al. (2016) also confirmed this finding. University of Ghana deployed Sakai LMS in 2012 (Oheneba-Sakyi & Amponsah, 2018). KNUST used Virtual Classroom (V class) for its students (Ofosu-Asare, 2017).

Both the ANOVA and the Chi square tests for the level of IT integration infrastructure in the DE institutions underscored the vast disparity of IT infrastructure and the challenges, both institutions and DE students have integrated educational technology. Nyerere et al. (2012), Özen (2012), and Usluel, Mumcu and Demirarslan (2007) reported similar challenges with IT integration. Huge investment in technology and training by the government was needed to provide an integrated and uniformly distributed DE and IT infrastructure. In this

concern, Mensah and Owusu-Mensah (2002) recommended networking all learning centres to facilitate its integration.

Research Question 3

What is the self-efficacy of distance educational students towards ICT integration?

The time spent online for educational studies by the 76.8% of participants was less than 10 hours per week due to the predominantly traditional nature of instructional delivery in DE. Blended and pure e-learning modes can significantly increase the online hours of DE students to improve their self-efficacy. There were similarities, among all the DE students, in the self-efficacy of using Wikipedia, search engines, downloading and uploading data with their p-values greater than 0.05 from the ANOVA table. However, self-efficacy of the different DE students for both computers for education and web browsers were statistically significant. Exposure to different educational programs and ease of use or popularity of particular web browsers could account for these variations. In addition, the self-efficacy of the distance education students was adequate and varied for engagement with online distance learning. These results resonated to that of Kuo (2010), Zhang et al. (2001), and Joo et al. (2000).

6. Conclusion

The distance education sector of Ghana continued to evolve from the manual and labour intensiveness to current and internationally technology - driven standards. The public universities needed to harness the immense potential of information and communication technology to offer online programs both nationally and globally. Old barriers to education such as distance, accommodation, and cost and internet coverage had been substantially minimized or eliminated to provide both tertiary and lifelong learning to potential learners of Ghana and beyond. A paradigm shift is needed to transform the traditional DE to a fully technologically integrated one. Registration of new applicants, managing of finance and student records has been IT integration. However, provision of full online academic programs continues to be a challenge to public universities distance education faculties. More focus and investments need to be channelled into these areas to enable them offer services to more local and international distance learners. Furthermore, the lack of adequate manual instructional materials for learners coupled with periodic delays in posting of assessment results would be immensely minimized.

7. Limitations

There were some limitations in this study. The study was confined to distance education undergraduates of 4 public universities in Ghana. Secondly, no more than 2 learning centres, out of the many, were chosen from each of the universities for data collection. Finally, only students' views were captured in this study without considering that of the administrators and students' instructors.

8. Recommendations for Policy and Practice

The demand for distance education was increasing due to the large number of students graduating from the senior high school yearly without proportionate expansion of high educational facilities. Information technology had the

capability to absorb this huge future demand to enable countries adequately prepare its future workforce. A robust national IT infrastructure designed for distance learning was capable for effectively maximizing the human inefficiencies associated with the institutional delivery of distance education. This will enable the universities to focus on their functions to deliver quality education without being saddled with the underlying technology. If IT infrastructure was seamlessly integrated into distance education, current and potential DE students will improve their self-efficacy in online learning tools to enjoy the many benefits of DE. Travelling long distances to learning centres will be reduced and students will be encouraged to upgrade their computer skills. The transformation of academic provision of DE institutions would enable the National Tertiary Council (NTC) to streamline, monitor and accurately certify the new DE programs and prospective institutions for quality national education. DE can also be effectively modified to comprehensively include learners with disability issues.

9. Recommendations for Future Research

Future studies could investigate a mediation relationship between DE students' internet data cost, frequent online resources use, perception and peer studies to establish its existence or otherwise. The relationship between online hours and internet data cost by distance education students can also be explored. Future research could also cover a comparative study of frequency of online resources usage among distance education students. Furthermore, the perception of the effectiveness of online peer studies among distance education students and their online resources usage categories could also be investigated.

10. References

- Acheampong, E. K. (2016). *Students' use of electronic resources in University of Professional Studies, Accra* [Master's thesis, University of Ghana].
- African Virtual University. (2012). Open distance and e-learning (ODEL) centres, Nairobi. <http://www.avu.org/AVU-Multi-national-support-project/avu-capacity-enhancement-program-acep.html>.
- Agbofa, F. J. (2012). *Challenges and prospects facing students of distance education in Ghanaian public universities: The case of University of Cape Coast study centre*. [MA dissertation, University of Cape Coast.] <https://erl.ucc.edu.gh/jspui/bitstream/123456789/2686/1/AGBOFA%202012.pdf>
- Allen, I. E., & Seaman, J. (2015). *Grade level: Tracking online education in the United States*. <https://files.eric.ed.gov/fulltext/ED572778.pdf>
- Allen, I. E., & Seaman, J. (2017). *Digital learning compass: Distance education enrolment report 2017*. <https://www.onlinelearningsurvey.com/reports/digitallearningcompassenrolment2017.pdf>
- Anderson, T. (2011). *The theory and practice of online learning* (2nd ed.). Edmonton, AB: AU Press. https://www.aupress.ca/app/uploads/120146_99Z_Anderson_2008-Theory_and_Practice_of_Online_Learning.pdf
- Ankomah-Asare, E. T., Larkai, A.T., & Nsowah-Nuamah, N. N. N. (2016). *Distance education in Ghana: An overview of enrolment and programme patterns*.

- Annku, E. (2014). *Technology-enhanced teaching and learning: A case of the faculty of art In Kwame Nkrumah university of science and technology* [Master's thesis, Kwame Nkrumah University of Science and Technology].
- Association for the Development of Education in Africa, ADEA. (2002). *Distance learning in sub-Saharan Africa: A literature survey on policy and practice*. The Commonwealth of Learning. http://oasis.col.org/bitstream/handle/11599/183/02DEinSSA_LiteratureSurvey.pdf?sequence=1&isAllowed=y
- Association for Educational Communications and Technology (AECT). (2001). What is the Knowledge Base? Association for Educational Communications and Technology. <http://www.aect.org/standards/knowledgebase.html>
- Asabere, N. Y., & Enguah, S. E. (2012). Development of an information and communication technology business model for electronic learning. *International Journal of Engineering Science & Advanced Technology*, 2(5), 1178-1191.
- Asunka, S. (2008). Online learning in higher education in Sub-Saharan Africa: Ghanaian university students' experiences and perceptions. *International Review of Research in Open and Distance Learning*, 9(3).
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman. <http://doi.org/10.5860/choice.35-1826>
- Betchoo, N. K. (2015). Sub-Saharan Africa's perspective of distance learning. *International Letters of Social and Humanistic Sciences*, 48, 185-191. <http://doi.org/10.18052/www.scipress.com/ILSHS.48.185>
- Caruth, D. L., & Caruth, G. D. (2013). Distance education in the United States: From correspondence courses to the internet. *Turkish Online Journal of Distance Education*, 14 (2), 141-149. <https://files.eric.ed.gov/fulltext/EJ1013772.pdf>
- Chandwani, A., Lihitkar, S., & Anilkumar, S. (2010). *E-learning initiatives in India* [Conference Paper]. Conference on Modern Practices in Library and Information Services, Nagpur, India. <http://hdl.handle.net/10760/15721>
- Clinefelter, D. L., & Aslanian, C. B. (2015). *Online college students 2015: Comprehensive data on demands and preferences*. Louisville, KY: The Learning House, Inc. <http://www.learninghouse.com/wpcontent/uploads/2015/07/OnlineCollegeStudents2015.pdf>
- Creswell, J. W. (2009). *Research design: Qualitative, quantitative and mixed approaches* (3rd ed.). Los Angeles: SAGE publications.
- Cunha, M. M., & Goran, D. P. (2007). A changed economy with unchanged universities? A contribution to the university of the future. *International Journal of Distance Education Technologies*, 5(4), 5-25. <http://doi.org/10.4018/jdet.2007100102>
- Curtis, B. & Curtis, C. (2011). *Social Research: A Practical Introduction*. London: Sage.
- Dalgarno, B., Bishop, A., Adlong, W., & Bedgood, D. (2009). Effectiveness of a virtual laboratory as a preparatory resource for distance education chemistry students. *Computers and Education*, 53(3), 853-865. <https://doi.org/10.1016/j.compedu.2009.05.005>
- Darko-Adjei, N. (2018). *Students' perceptions and use of the Sakai learning management system in the university of Ghana*. <http://ugspace.ug.edu.gh>
- Darkwa, O., & Mazibuko, F. (2000). Creating virtual learning communities in Africa: Challenges and prospects. *First Monday*, 5(5). http://www.firstmonday.dk/issues/issue5_5/darkwa/index.html
- Digest of Education Statistics. (2014). *National postsecondary student aid study*. <https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2016006>

- Dube, S. (2017). The 21st century students' educational ICT preferences. *International Robotics & Automation Journal*, 3(5). <http://medcraveonline.com/IRATJ/IRATJ-03-00069.pdf>
- Elameer, A. S., & Idrus, R. M. (2011). *National e-learning strategy to enhance and enrich the Iraqi universities*. <https://files.eric.ed.gov/fulltext/ED526803.pdf>
- Garrison, D. R. (2000). Theoretical challenges for distance education in the 21st century: A shift from structural to transactional issues. *International Review of Research in Open and Distance Learning*.
- Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education model. *The Internet and Higher Education*, 2(2-3), 87-105. [https://doi.org/10.1016/S1096-7516\(00\)00016-6](https://doi.org/10.1016/S1096-7516(00)00016-6)
- Gerson, B. (2002). *University helping to improve education for thousands in India*. http://www.cmu.edu/cmnews/020411/020411_helpindia.html
- Gregory, S., & Gregory, B. (2011, November 28-30). *Do virtual worlds have a role in increasing student engagement as measured by their higher academic grades?* CreateWorld, Brisbane, Australia.
- Hassan, M. M., & Mirza, T. (2020). Information and communication technology (ICT) in the distance education system: An overview. *IOSR Journal of Research & Method in Education (IOSR-JRME)*, 10(6), 38-42. <http://doi.org/10.9790/7388-1006053842>
- Hope, A., & Guiton, P. (2005). *Strategies for sustainable open and distance learning*. New York: Routledge/Falmer Press.
- Joo, Y., Bong, M., & Choi, H. (2000). Self-efficacy for self-regulated learning, academic self-efficacy, and internet self-efficacy in Web-based instruction. *Educational Technology Research and Development*, 48(2), 5-17. <http://doi.org/10.1007/BF02313398>
- Kinyanjui, P. E. (2000). Future trends in open and distance education, in Huria. *Journal of the Open University of Tanzania*, (3),1-10.
- Kulshrestha, T., & Ramswaroop, S. (2013). Benefits of learning management system (LMS) in Indian education. *International Journal of Computer Science & Engineering Technology*, 4(8), 1153-1164. <http://www.ijcset.com/docs/IJCSET13-04-08-036.pdf>
- Kumi-Yeboah, A., Young, W., & Boadu, K. (2013). *21st century distance learning in sub-Saharan Africa: Distance and blended learning in Ghana*. <https://www.researchgate.net/publication/290572198>
- Kuo, Y. C. (2010). *Interaction, internet self-efficacy, and self-regulated learning as predictors of student satisfaction in distance education courses*. <https://digitalcommons.usu.edu/etd/741>
- Leary, J., & Berge, Z. (2007). Successful distance education programs in sub-Saharan Africa. *Turkish Online Journal of Distance Education*, 8(12). http://tojde.anadolu.edu.tr/tojde26/pdf/article_12.pdf
- Lee, M. K. O., Cheung, C. M. K., & Chen, Z. (2005). Acceptance of internet-based learning medium: The role of extrinsic and intrinsic motivation. *Information and Management*, 42(8), 1095-1104. <http://doi.org/10.1016/j.im.2003.10.007>
- Lee, R. (2004). *E-Learning prospects for the developing world*. In K. Stanoevska-Slabeva (Ed.), *The digital economy. Anspruch und Wirklichkeit*, Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-17032-4_25
- Mensah, S. K. E., & Owusu-Mensah, F. (2002). *Priorities and strategies for capacity building in tertiary distance education for human resources development in Ghana*. http://siteresources.worldbank.org/EDUCATION/Resources/278200-1099079877269/547664-1099079956815/Ghana_capacity_building_En02.pdf

- Mnyanyi, C. B., & Mbwette, T. S. A. (2009). *Open and distance learning in professional development in third world countries* [Conference presentation]. Maastricht's 23rd International Conference on Distance Education.
- Moore, M., & Kearsley, G. (2012). *Distance education: A systems view*. New York: Wadsworth Publishing Company.
- National Centre for Education Statistics. (2003). *Distance education at degree-granting postsecondary institutions: 2000-2001*. <http://nces.ed.gov/pubs/2003/2003017.pdf>
- Nyagorme, P., Qua-Enoo, A. A., Bervell, B., & Arkorful, V. (2017). The awareness and use of electronic learning platforms: A case of a developing country. *World Journal of Computer Application and Technology*, 5(2), 13-23. <http://doi.org/10.13189/wjcat.2017.050201>
- Nyerere, J. K. A., Gravenir, F. Q., & Mse, G. S. (2012). Delivery of open, distance, and e-learning in Kenya. *The International Review of Research in Open and Distance Learning*, 13(3), 185-205. <http://doi.org/10.19173/irrodl.v13i3.1120>
- Oforu-Asare, Y. (2017). *Impact of aesthetics and design on e-learning usability and credibility: The case of KNUST virtual classroom graphic user interface* [Master's dissertation, Kwame Nkrumah University of Science and Technology].
- Oheneba-Sakyi, Y., & Amponsah, G. K. (2018). *Still offline and behind in this digital world? Join in the Sakai LMS experience*. Paper presented at the meeting of an Inter-college lecture series, University of Ghana. <https://www.ug.edu.gh/pad/sites/pad/files/u6/paddocs/2017%20INTER%20COLLEGE%20LECTURE%20SERIES.pdf>
- Osguthrope, R. T., & Graham, C. R. (2003). BL systems: Definitions and directions. *Quarterly Review of Distance Education*, 4(3), 227-234. <https://eric.ed.gov/?id=EJ678078>
- Özen, R. (2012). Distance education for professional development in ICT integration: A study with primary school teachers in turkey. *International Journal of Business and Social Science*, 3(3), 185-195. http://www.ijbssnet.com/journals/Vol_3_No_3_February_2012/19.pdf
- Pant, A. (2014). Distance Learning: History, Problems and Solutions. *Advances in Computer Science and Information Technology (ACSIT)*, 1(2), 65-70.
- Picciano, A. G. (2017). Theories and frameworks for online education: Seeking an integrated model. *Online Learning*, 21(3), 166-190. <http://doi.org/10.24059/olj.v21i3.1225>
- Radford, A. W. (2012). *Learning at a Distance Undergraduate Enrollment in Distance Education Courses and Degree Programs*. National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.
- Raja, R., & Nagasubramani, P. C. (2018). Impact of modern technology in education. *Journal of Applied and Advanced Research*, 3(1), 33. <http://doi:10.21839/jaar2018.v3iS1.165>
- Robinson, B., & Latchem, C. (2002). *Teacher education through open and distance learning*. London: Routledge.
- Saint, W. (1999). *Tertiary distance education and technology in Sub-Saharan Africa*. Washington, DC: The World Bank.
- Seaman, J. E., Allen, I. E., & Seaman, J. (2018). *Grade increase: Tracking distance education in the United States*. <http://trendsandissues.org/node/413>
- Singh, K. D. (2009). *Computers in education*. http://wikieducator.org/index.php?title=Computers_in_Education&oldid=292994
- Schaffhauser, D. (2019). *A personalized learning backlash*. <http://thejournal.com/article/2019/personalized-learning-backlash.aspx>

- Strasburger, V. C., Jordan, A. B., & Donnerstein, E. (2010). Health effects of media on children and adolescents. *Pediatrics*, 125(4), 756-767. <https://doi.org/10.1542/peds.2009-2563>.
- Sun, K. T., Lin, Y. C., & Yu, C. J. (2008). A study on learning effect among different learning styles in a Web-based lab of science for elementary school students. *Computers & Education*, 50(4), 1411-1422. <https://doi.org/10.1016/j.compedu.2007.01.003>
- Tagoe, M. (2012). Students' perceptions on incorporating e-learning into teaching and learning at the University of Ghana. *International Journal of Education and Development using Information and Communication Technology*, 8(1), 91-103.
- Tanye, H. A. (2017). Quality e-learning in distance learning: Benefits and implications for national e-learning policy in Ghana. *International Journal of Multicultural and Multi-religious Understanding*, 4(3), 1-11. <http://dx.doi.org/10.18415/ijmmu.v4i3.73>
- Taylor-Straut, T. (2017). *Distance education enrolment growth – Major differences persist among sectors*.
- The Association for Educational Communications and Technology, AECT. (2001). *History of distance education*. <http://members.aect.org/edtech/ed1/13/13-02.html>
- Usluel, K. Y., Mumcu, K. F., & Demiraslan, Y. (2007). ICT in the learning-teaching process: Teachers' views on the integration and obstacles. *H.U. Journal of Education*, 32, 164-179.
- Wang, Y., & Sun, C. (2001). Internet-based real time language education: Towards a fourth generation distance education. *CALICO Journal*, 18(3), 539-561. <https://doi.org/10.1558/cj.v18i3.539-561>
- Wladis, C., Conway, K. M., & Hachey, A. C. (2015). The online STEM classroom – Who succeeds? An exploration of the impact of ethnicity, gender, and non-traditional student characteristics in the community college context. *Community College Review*, 43(2), 142-164. <https://doi.org/10.1177/009155211557172>
- Zaina, L. A. M., Bressan, G., Silveira, R. M., Stiubiener, I., & Ruggiero, W. V. (2001). *Analysis and comparison of distance education environments* [Conference presentation]. International Conference on Engineering Education, Oslo, Norway.
- Zhang, J., Li, F., Duan, C., & Wu, G. (2001). Research on self-efficacy of distance learning and its influence to learners' attainments. In C. H. Lee (Ed.). *Proceedings of the International Conference on Computers in Education (ICCE)* (pp. 1510-1517).