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## DIGITAL TECHNOLOGIES IN NURSING AND MIDWIFERY EDUCATION IN GHANA: EDUCATORS PERSPECTIVE, PRACTICE AND BARRIERS

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# **DIGITAL TECHNOLOGIES IN NURSING AND MIDWIFERY EDUCATION IN GHANA: EDUCATORS PERSPECTIVE, PRACTICE AND BARRIERS**

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## **Abstract**

*This study assessed the perspective, practice and barrier that mitigate the integration of Information and Communication Technologies into nursing and midwifery education in Ghana. With purposive and convenience sampling techniques, a sample size of 108 health tutors was involved in the study. The findings revealed that most of the health tutors utilised information and communication technologies in the presentation of lessons to students and the management of examination results. Social media platforms, productivity tools and E-books were the most used technologies among health tutors. Barriers identified related to unavailability of task-appropriate ICT resources, and inadequate training for teachers to use technologies among others. The study recommended the practical training of health tutors in the use of digital technologies for teaching and learning; the provision of task-appropriate ICT resources to facilitate the integration in teaching, learning, and management of information in nursing and midwifery training colleges.*

**Keywords:** *Information and Communication Technology, Nursing and Midwifery Education, Nurse Educator, Health Tutor, Digital Technologies, Ghana*

## Background

At present, digital technologies are ubiquitous in every aspect of human activity, precisely, education, business, health, and entertainment. In schools, digital technologies or Information and Communication Technologies (ICTs) are transforming the dynamics of the 21st-century learning environment (1), and their application has led to creative teaching methods, innovative learning approaches, scientific research, and access to information (2,3). Educators are using these technologies to perform administrative tasks, access a wide range of new pedagogy, and assist students in learning effectively(4). It offers a flexible means to deliver teaching and assessment that is convenient, interactive and engaging for students(5,6). Additionally, ICTs influence educational administrative processes and management of higher educational institutions. It increases school efficiency in handling student admission, examination records, the monitoring and evaluation of staff, planning for school activities, curriculum development, and information dissemination(3,7,8).

The rapid pace of technological evolution demonstrates no signs of decline and has already significantly influenced nursing education curricula(9). Technology is gaining popularity in nursing and midwifery education as a way to deliver instructions to nursing and midwifery trainees with diverse learning needs in academic and clinical settings(5,6). During the 2015/2016 academic year, the nursing and midwifery council of Ghana introduced a course in nursing and midwifery informatics as part of the curriculum for the training of nurses and midwives in Ghana. This initiative intends to introduce nurses and midwives to the relevance of information and communication technologies in healthcare(10). The leverage of technologies such as computers, smart devices, and interactive multimedia presentations such as podcasts or blogs, computer software for creating and sharing professional documents have all as vital for future nursing professionals(9,11). A recent review of 24 studies on the application of technology in clinical nursing education found that ICTs enhance clinical learning, knowledge retention, improve productivity, increase confidence, and pharmacological knowledge of student nurses(6).

Mulaudzi and Chyun (1) argue that ICTs in education is necessary to accommodate 21st-century students, who are digital citizens, requiring different pedagogical methods(1). Nurse educators need to consider implementing innovative teaching strategies that use state-of-the-art technologies such as social media to engage students, promote interaction in the classroom, and encourage active learning(12). Robinson-Bassey and Edet (13,29,30) observed that the use of multimedia

presentations combined with videos, animations, and audio makes teaching much more engaging to students, thus making the students more attentive and focused. The use of video is particularly valuable (30,31) in teaching clinical procedures such as bed making, bed bathing, cardiopulmonary resuscitation, and open-heart surgery. It gives the student a much better understanding and appreciation of the actual clinical situation(13).

Notwithstanding, the importance of technologies in educating 21st-century nursing and midwifery students, O'Connor and Andrews (6) reported the cost of ICT equipment, poor computer knowledge, deficient technical support, and negative attitudes of students as some of the barriers to implementing ICTs in nursing education (6). Moreover, the application of technology in learning and teaching is not an intuitive skill. It requires more knowledge and skills than knowing how to use digital devices. The use of technology can, therefore, be stressful for nurse educators who are not skilled in the use of computers and other digital devices(13). This study assessed the use of ICTs in teaching and learning and the barriers that impede the application of ICTs in nursing and midwifery education.

## **Methodology**

This cross-sectional study reports the findings of a descriptive survey conducted at two Nursing and Midwifery Training Colleges in Northern Ghana: the Tamale Nurses and Midwives' Training College and the Nalerigu College of Nursing and Midwifery. The Tamale Nurses and Midwives' Training College is one of the oldest Nursing and Midwifery Training College in Ghana (14). It was established in 1974 and is currently offering the following nursing and midwifery programmes: Diploma in General Nursing, Diploma in Midwifery, Post NAC/NAP General Nursing, and Post NAC/NAP Midwifery. The college also serves as a regional centre for programmes offered by the Ghana College of Nursing and Midwifery. The Nalerigu College of Nursing and Midwifery was established in 2008 as a Health Assistants Training School and was later upgraded to run both diploma and certificate nursing programmes in 2013. The college currently offers the following programmes: Diploma in General Nursing, Diploma in Midwifery, Diploma in Community Nutrition and Dietetics, Post NAC/NAP Midwifery, Post NAC/NAP Nutrition, Post NAC/NAP Dietetics, and the Nurse Assistant Clinical programme (15). The current study population consisted of health tutors (nurse educators), administrators, and management information system (MIS) officers in the two Nursing and Midwifery Colleges who had worked in their respective colleges for at

least one academic semester. We excluded national service personnel, students, and personnel on attachment.

### **Data collection instrument**

Data were collected with a structured questionnaire designed for the study after a thorough review of the literature and previous studies on integrating ICTs into nursing and midwifery education. The survey featured five sections. Section A included questions about the socio-demographic characteristics of the participants (4 items). Section B was concerned about the use of ICT in the teaching, learning, and management of information (8 items). Section C collected data about the common ICT tools and applications health tutors use for teaching, communication, and management of information (9 items). Section D included questions about participants perceived value of ICT for teaching, learning and management of information (9 items). Section E collected data on the barriers to the effective integration of ICT in nursing and midwifery education (13 items). Section B to E comprised of questions with a 5 point Likert scale ranging from 'strongly disagree=1' to 'strongly agree=5'. The questionnaire was pretested on tutors of a Teacher Training College to ascertain the clarity of the questions and to identify poorly constructed and ambiguities in the question sets. Some questions were modified after the pre-test to enhance clarity and understanding. The internal consistency of the questionnaire was assessed and generated Cronbach's Alpha coefficient ( $\alpha = 0.72$ ) and found to be within acceptable limits (16).

### **Sampling and data collection**

A sample size ( $n = 108$ ) was estimated using Yamane's formula with a population of 149, an assumption of 95% confidence interval and 5% margin of error. Purposive and convenient sampling methods were employed in selecting health tutors (nurse educators), administrators, and management information system (MIS) officers in the two Nursing and Midwifery Colleges for the study. The study questionnaire was administered to participants in classrooms and offices before and after lessons. All participants were given detailed information about the questionnaire and the study objectives to acquaint them with the significance and purpose of the study. Participants were allowed enough time to complete and return the questionnaire to the research assistants. After four weeks of follow-up, the research team were able to retrieve 70 questionnaires from the participants (response rate of 64.8%). All participants provided voluntary written consent for their participation. We ensured absolute confidentiality of the information collected from the participants. We did not collect information on personal identifies and only members of the research team had access to the information. Permission was sought from the principals of the two nursing and midwifery colleges before the commencement of data collection.

## Data analysis

Data were coded and entered into Microsoft excel before imported into Stata version 14.1 for analysis. Descriptive statistics were used to present the results using frequencies, percentages, means and standard deviations. Logistic regression was performed to determine the association between the use of technology for teaching, common ICT tools and application used, and the educational level of the tutors.

## Results

### Socio-demographic characteristics of participants

The socio-demographic characteristics of the study participants are presented in Table 1. The results show that 52.9% of the participants were males while 47.1% were females. Bachelor's degree (61.4%) was the highest level of education attained by the majority of the health tutors. More than half (55.7%) of the participants had 1 to 5 years of teaching experience in their current institution. However, only 11.4% of them had professional ICT training or qualification.

**Table 1: Socio-demographic characteristics of participants**

Characteristics	Frequency	Percent
<b>Sex</b>		
Male	37	52.86
Female	33	47.14
<b>Level of education</b>		
Bachelor's degree	43	61.43
Master's degree	27	38.57
<b>Work experience</b>		
Less than data year	3	4.29
1-5 years	39	55.71
6-10 years	21	30.00
Above 10 years	7	10.00
<b>Professional ICT training or qualification</b>		
Yes	8	11.43
No	62	88.57

### Use of information communication technology (digital technologies)

Participants use of information communication technologies in learning, teaching and management of students' information was assessed with eight questions on a 5-point Likert scale and presented in Table 2. Most of the health tutors employed some ICT tools in the presentation of lessons to students ( $m = 4.21, sd = 0.79$ ); in the preparation of academic calendar and timetable ( $m = 4.12, sd = 0.85$ ); management of examination results (mean  $4.06 \pm 0.93$ ); and, in the registration of students ( $m = 4.03, sd = 0.85$ ). The least cited activity in which ICT tools were used related to the preparation of scheme of work and lesson plan ( $m = 2.37, sd = 1.16$ ).

**Table 2: use of ICT for learning, teaching and management of students' information**

Activities	Mean	SD
Preparation of scheme of work and lesson plan	2.37	1.16
Delivery of lectures	4.21	0.79
Preparation of academic calendar and class time table	4.12	0.85
Recording of exam scores and generation of results	4.06	0.93
Preparation of students' exam report forms	3.92	1.03
Registration of new students	4.03	0.85
Keeping of records	3.67	1.14
Training of staff and office workers	3.47	0.92

### Common ICT tools and applications used

Table 3 shows the common ICT tools and applications health tutors use for learning, teaching, communication, and management of information. Of the nine ICT tools and applications considered in this study, social media platforms ( $m = 4.0; sd = 0.79$ ), word processing tools ( $m = 4.01; sd = 0.79$ ), PowerPoint ( $m = 3.99; sd = 0.73$ ), and E-books ( $m = 3.76; sd = 1.08$ ) were rated as the most used applications for teaching, communication, and management of information. The results in Table 3 indicates that most of the health tutors do not use email clients ( $m = 3.01; sd = 1.15$ ), Learning Management System ( $m = 3.17; sd = 0.98$ ), and Internet Connectivity for teaching, communication, and management of information in the colleges.

**Table 3: Common ICT tools and applications nurse educators use for teaching, communication, and management of information**

Technologies	Mean	SD
E-mail clients	3.01	1.15
Use of E-books	3.76	1.08
Social media tools	4.01	0.79
Spreadsheets	3.34	0.93
Word processing tools	4.00	0.82
PowerPoint application	3.99	0.73
Information management system	3.36	0.92
Internet Connectivity	3.26	1.01
Learning Management System	3.17	0.98

**The perceived value of ICTs for learning, teaching, and management of information**

Participants' perceptions of the value of ICT for learning, teaching, and management of information in nursing and midwifery education are presented in Table 4. The participants agreed that incorporating ICT into teaching makes lessons interactive and engaging ( $m = 4.09$ ;  $sd = 0.81$ ). Furthermore, most of the participants agreed that ICT tools make it easy for them to access E-books ( $m = 3.94$ ;  $sd = 1.02$ ); practice proper record keeping ( $m = 3.92$ ;  $sd = 0.87$ ); and, facilitates interaction and collaboration with colleagues ( $m = 3.83$ ;  $sd = 0.99$ ). However, the role of ICT in the assessment of students (mean  $2.90 \pm 1.35$ ), as a substitute for teaching-learning materials (mean  $3.10 \pm 1.25$ ), and its importance in time management of contact hours ( $m = 3.17$ ;  $sd = 1.37$ ) recorded a low average score from the participants.

**Table 4: Perceived value of ICT for teaching, learning, and management of information**

Variables	Mean	SD
Teachers and students are able to easily access information	3.69	0.97
Facilitates group interaction and collaboration	3.83	0.99
Substitute for unavailable teaching learning materials	3.10	1.25
Easy access to E-books	3.94	1.02
Facilitates E-learning	3.16	1.19
Ensures proper record keeping	3.92	0.87
Makes lessons interactive and engaging	4.09	0.81
Ensures proper time management of contact hours	3.17	1.37
Facilitates the assessments of students	2.90	1.35



### **Barriers to the effective integration of ICT into nursing and midwifery education**

Barriers to the effective integration of ICT in learning, teaching, and management of information in nursing and midwifery education were assessed and the results presented in table 5. More than half of the participants agreed that absence of policies to guide the integration of ICT in teaching (55.7%), inadequate training of health tutors to use ICT in teaching (51.4%), and unreliable power supply (51.4%) were barriers to the effective integration of ICT into learning and teaching in the nursing and midwifery training colleges. The results show that a little over two-fifths of the participants agreed that unavailability of task-appropriate ICT tools (44.3%), fear of perceived risk associated with the use of ICT (45.7%), lack of ICT infrastructure (41.4%), and the lack of technical support for ICT integration (42.9%) in teaching and learning were barriers that could deter the use of ICT in nursing and midwifery education. Inadequate knowledge about the use of ICT (42.9%) was also considered a barrier to the effective integration of ICT in learning and teaching. Lack of internet connectivity (57.1%) and the unavailability of computers were not considered important barriers to ICT integration in teaching and learning. As shown in Table 5, more than two-fifths of the participants disagreed that teachers do not have enough time to integrate ICT into learning and teaching (42.9%). In addition, most of the participants did not consider 'poor attitude of staff towards ICT' (45.7%) as a barrier to the integration of ICT in nursing and midwifery education.

### **Association between the educational level of nurse educators and use of ICT for teaching**

Table 6 shows the association between the educational level of the participants and their use of ICT for teaching and management of student information. Educators with a master's degree were more likely to use ICT in the preparation of scheme of work and lesson plan (OR 1.14, 95% CI 0.75 - 1.73), preparation of academic calendar and class timetable (OR 1.05, 95% CI 0.59 - 1.86), and training of staff and office workers (OR 1.16, 95% CI 0.51 - 2.64). Further, the odds of delivering a lecture with ICT tools was significantly (OR 2.25, 95% CI 1.08 - 4.70) high among master's degree holders when compared with those with bachelor's degree.

**Table 5: Barriers to the effective integration of ICT into nursing and midwifery education**

Variables	SD (%)	D (%)	N (%)	A (%)	SA (%)
Lack of ICT infrastructure	3(4.29)	25(35.71)	8(11.43)	29(41.43)	5(7.14)
Teachers do not have sufficient time to integrate ICT in teaching	5(7.14)	30(42.86)	9(12.86)	21(30.00)	5(7.14)
Lack of technical support for ICT use	1(1.43)	23(32.86)	12(17.14)	30(42.86)	4(5.71)
Lack of confidence among tutors about the use of ICT in teaching	2(2.86)	26(37.14)	20(28.57)	18(25.71)	4(5.71)
Little previous experience on the use of ICT	9(12.86)	17(24.29)	19(27.14)	20(28.57)	5(7.14)
Lack of adequate training on teaching with ICT	1(1.43)	15(21.43)	10(14.29)	36(51.43)	8(11.43)
Fear of perceived risk associated with the use of ICT	2(2.86)	17(24.29)	15(21.43)	32(45.71)	4(5.71)
Inadequate knowledge about ICT	4(5.71)	22(31.43)	11(15.71)	30(42.86)	3(4.29)
Unavailability of task-appropriate ICT tools	3(4.29)	25(35.71)	7(10.00)	31(44.29)	4(5.71)
Poor attitude of staff	2(2.86)	32(45.71)	13(18.57)	19(27.14)	4(5.71)
Lack of internet access	7(10.00)	40(57.14)	6(8.57)	15(21.43)	2(2.86)
Unreliable power supply	1(1.43)	18(25.71)	6(8.57)	36(51.43)	9(12.86)
Lack of appropriate policies for ICT integration in teaching	4(5.71)	9(12.86)	5(7.14)	39(55.71)	13(18.57)

**Table 6 Association between the educational level of nurse educators and use of ICT for teaching**

Variables	OR (95% CI)	P value
Preparation of scheme of work and lesson plan	1.14 (0.75 - 1.73)	0.531
Delivery of lectures	2.25 (1.08 - 4.70)	0.031
Preparation of academic calendar and class timetable	1.05 (0.59 - 1.86)	0.878
Recording of exam scores and generation of results	0.84 (0.49 - 1.40)	0.502
Preparation of students report forms	0.84 (0.53 - 1.34)	0.462
Registration of new students	0.86 (0.49 - 1.52)	0.608
Keeping of records	0.91 (0.59 - 1.38)	0.644
Training of staff and office workers	1.16 (0.51 - 2.64)	0.728

### Association between nurse educators' educational level and the use of ICT tools and application

Table 7 presents the association between the nurse educators' level of education and their use of ICT tools and application for teaching, communication, and management of information. Master's degree holders were 2.9 times (95% CI 1.62 - 5.28) and 1.9 times (95% CI 1.10 - 3.26) more likely to use email clients for communication compared to tutors who had bachelor's degrees and these odds were statistically significant. Further, nurse educators with a master's degree were nearly 2 times (95% CI 0.92 - 4.32) more likely to use PowerPoint tools for teaching. However, they were less likely to use spreadsheets (OR 0.79, 95% CI 0.47 - 1.34), mobile and wireless systems (OR 0.89 95% CI 0.55 - 1.44) and E-learning applications (OR 0.90 95% CI 0.55 - 1.48) although these were not statistically significant.

**Table 7 Association between nurse educators' educational level and the use of ICT tools and application for teaching, communication, and management of information**

Technologies	OR (95% CI)	P value
E-mail for communication	2.93 (1.62 - 5.28)	0.001
Use of E-books	1.89 (1.10 - 3.26)	0.021
Social media platforms	1.30 (0.69 - 2.44)	0.415
Spreadsheets	0.79 (0.47 - 1.34)	0.390
Word processing tools	1.21 (0.66 - 2.21)	0.546
PowerPoint tools	1.99 (0.92 - 4.32)	0.078
Information management systems	1.03 (0.60 - 1.74)	0.923
Mobile and wireless systems	0.89 (0.55 - 1.44)	0.637
E-learning applications	0.90 (0.55 - 1.48)	0.681

OR = Odd Ratio; CI = Confidence Interval

### Discussion

Our study is the first study in Ghana to provide empirical evidence on the integration of ICT in learning, teaching, and management of information in Nursing and Midwifery Training Colleges. We found that health tutors in the colleges use digital technologies in the preparation of academic calendar and classroom timetable. Furthermore, digital technologies were integrated into the delivery of lessons to students. Most of the health tutors indicated that the integration of digital technologies into teaching makes lessons interactive and engaging. Robinson-basseyy and Edet, and Essel and Adjei (3) support these findings when they stated that ICT

enhance preparation and delivery of information to students and its integration into the teaching-learning process make the teaching more appealing and interesting to nursing students(13). According to Robinson-bassey and Edet the use of ICT applications such as videos and animations in the teaching of clinical procedures such as bed bathing, cardiopulmonary resuscitation, and open heart surgery gives the learner a better appreciation and understanding of the actual clinical situation (13). Likewise, Mikre indicated that ICT makes learning less abstract and eliminates the artificial barrier between theory and practice, which characterise traditional pedagogy (2).

Educational institutions, particularly schools, are custodians of knowledge and information (2), therefore, proper school record keeping is crucial to the effective administration of educational institutions. In this study, the majority of the health tutors considered ICT a valuable tool for proper record keeping in nursing and midwifery training colleges and this may explain why we found that most of the colleges employed ICT applications in the registration of new nursing students and in the management of examination results of students, which is inconsistent with findings reported in Zimbabwe (17). Mikre opines that ICT should be the fundamental information management tool at all levels of an educational system (2). However, the role of ICT in the assessment of students recorded a low average score from the participants, which is inconsistent with the findings of an earlier study (18). This is probably because the colleges do not currently use computer-based assessment in the assessment of student learning. Most of the Nursing and Midwifery Colleges in Ghana assess nursing students using the paper-based method of assessment and this may explain why the role of ICT in the assessment of students was not well recognised by the participants in this study. In line with the findings of several studies (18,19), most of the participants in this study agreed that ICT facilitates interaction and collaboration with colleagues and students.

The results of this study show that health tutors do not integrate ICT into the preparation of scheme of work and lesson plan. A possible explanation for this might be that health tutors do not use scheme of work and lesson plan in the preparation and delivery of lessons to student nurses. Bristol and Sherrill support our finding when they pointed out that few nurse educators' use lesson plan. They argued that nurse educators often feel that the preparation of lesson plan is a draw on time and therefore only prepare PowerPoint slides to facilitate their presentation of lessons (20).

Contrary to expectation, email clients (Gmail, Yahoo mail, etc.) were among the least ICT tools used for teaching and communication activities. However, social media

applications were among the frequently used ICT tools for teaching and communication purposes. This finding is in agreement with an earlier study, which showed high usage of social media among nursing faculty. However, the study observed that the majority of the nursing faculty used social media for personal rather than for academic purpose (21). Furthermore, the majority of the health tutors in this study used word processing tools, PowerPoint, and E-books for teaching, communication, and management of information in the colleges. Similarly, a study in Zimbabwe found that PowerPoint was one of the preferred methods of lecturers for the presentation of lessons to students (17). Robinson-bassey and Edet observed that the use of ICT tools such as PowerPoint in the presentation of lessons facilitates learning and makes the teaching-learning process lively and appealing to students (13).

Among the barriers of ICT integration that were assessed in this study, absence of policy guidelines on ICT, poor training of teachers in ICT, unavailability of task-appropriate ICT tools, lack of ICT infrastructure, the lack of technical support for ICT integration, faculty inadequate knowledge about ICTs, and unreliable power supply were considered key barriers to the effective integration of ICT into teaching and learning in the nursing and midwifery colleges. These findings are consistent with the findings of several studies in both high income and low-middle income countries (2,5,18,22–24). Leaders in nursing and midwifery education should address these challenges to ensure the effective use of technology in the education of the next generation of nurses and midwives.

## **Conclusion**

Our findings suggest that ICT is fairly integrated into the several facets of teaching, learning, and information management in the nursing and midwifery training colleges. The use of tools such as PowerPoint, word processors, E-books and social media platforms was common among the faculty of the colleges. We found that ICT was employed in the registration of new students, presentation of lessons, and in the management of examination results. However, it was poorly integrated into the preparation of lesson plan, assessment of nursing and midwifery students. With respect to barriers, the participants reported faculty inadequate knowledge, unreliable power supply, unavailability of task-appropriate ICT tools, poor training of teachers to use ICT among others. We recommend the training of nursing and midwifery faculty in the use of modern ICT tools in teaching and learning and the provision of task-appropriate ICT teaching and learning resources to facilitate the

effective integration of ICT in teaching, learning, and management of information in nursing and midwifery training colleges.

### **Abbreviations**

ICT: Information Communication Technology

MIS: management information system

NAC: Nurse Assistant Clinical

NAP: Nurse Assistant Preventive

### **Declarations**

#### **Availability of data and material**

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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## References

1. Mulaudzi FM, Chyun DA. Innovation in Nursing and Midwifery Education and Research. *Rwanda J* [Internet]. 2015;2(2):21. Available from: <http://www.ajol.info/index.php/rj/article/view/125399>
2. Mikre F. The Roles of Information Communication Technologies in Education Review Article with Emphasis to the Computer and Internet. *Ethiop Journa Educ Sci* [Internet]. 2011;6(2):109–26. Available from: <http://www.ajol.info/index.php/ejesc/article/view/73521>
3. Essel HB, Agyei DD. Globalization and O' DeL in Education [Internet]. Accra, Ghana: Lambert Academic Publishing; 2017. Available from: [https://www.researchgate.net/publication/318910001\\_Globalization\\_and\\_ODeL\\_in\\_Education\\_eLearning\\_made\\_easy](https://www.researchgate.net/publication/318910001_Globalization_and_ODeL_in_Education_eLearning_made_easy)
4. Flecknoe M. Innovations in Education and Teaching International How can ICT Help us to Improve Education ? How can ICT Help us to Improve Education ? *Innov Educ Teach Int l*. 2010;39(4):271–9.
5. O'Connor S, Hubner U, Shaw T, Blake R, Ball M. Time for TIGER to ROAR! Technology Informatics Guiding Education Reform. *Nurse Educ Today*. 2017;58(June):78–81.
6. O'Connor S, Andrews T. Mobile Technology and Its Use in Clinical Nursing Education: A Literature Review. *J Nurs Educ* [Internet]. 2015;54(3):137–44. Available from: <http://www.healio.com/doiresolver?doi=10.3928/01484834-20150218-01>
7. Oboegbulem A, Ugwu RN. The Place of ICT (Information and Communication Technology) in the Administration of Secondary Schools in South Eastern States of Nigeria. *US-China Educ Rev* [Internet]. 2013;3(4):231–8. Available from: [http://eric.ed.gov/?q=information+research&ft=on&ff1=dtIn\\_2013&ff2=subInformation+Technology&id=ED542971%5Cnhttp://files.eric.ed.gov/fulltext/ED542971.pdf](http://eric.ed.gov/?q=information+research&ft=on&ff1=dtIn_2013&ff2=subInformation+Technology&id=ED542971%5Cnhttp://files.eric.ed.gov/fulltext/ED542971.pdf)
8. Juma KS, Raihan A, Clement CK. Role of ICT in Higher Educational Administration in Uganda. *World J Educ Res*. 2016;3(1):1–10.
9. Risling T. Educating the nurses of 2025: Technology trends of the next decade. *Nurse Educ Pract* [Internet]. 2017;22:89–92. Available from: <http://dx.doi.org/10.1016/j.nepr.2016.12.007>
10. Achampong EK. Assessing the Current Curriculum of the Nursing and Midwifery Informatics Course at All Nursing and Midwifery Institutions in Ghana. *J Med Educ Curric Dev*. 2017;4(3).
11. Canadian Association of Schools of Nursing. Nursing Informatics Entry-to-Practice Competencies for Registered Nurses. *Casn*. 2012;1–15.
12. Ross JG, Myers SM. The Current Use of Social Media in Undergraduate Nursing Education. *Comput Informatics Nurs*. 2017;19085(July).
13. Robinson-bassey GC, Edet OB. Nursing Informatics Education And Use : Challenges And Prospects In Nigeria. *Glob J PURE Appl Sci*. 2015;21(2001):171-9.
14. Mohammed S, Abdulai A, Iddrisu OA. Pre-service knowledge, perception, and use of emergency contraception among future healthcare providers in northern Ghana. *Contracept Reprod Med*. 2019;4(1):1–7.

15. Essel HB, Boakye-Yiadom M, Mohammed S. Internal quality assurance practices of nursing and midwifery training colleges and the role of regulatory bodies : The perspectives of health tutors. *J of Nursing Educ Pract.* 2018;8(10).
16. Goforth C. Using and Interpreting Cronbach's Alpha [Internet]. 2015 [cited 2018 Dec 20]. Available from: <https://data.library.virginia.edu/using-and-interpreting-cronbachs-alpha/>
17. Bigirimana S, Jagero N, Daudi E. An Inquiry into the Impact of Information and Communication Technologies (ICTs) on the Enrolment, Registration, Examination Clearance and Access to Results of Students at Africa University, Mutare, Zimbabwe. *Arch Bus Res.* 2015;3(2).
18. Marzilli C, Delello J, Marmion S, Mcwhorter R, Marzilli TS. Faculty Attitudes Towards Integrating. *Int J Integr Technol Educ.* 2014;3(1).
19. Delello JA, Everling KM, Mcwhorter RR, Lawrence H. Fostering Presence in Online Discussions. *Acad Exch Q.* 2013;17(2).
20. Bristol TJ, Sherrill KJ. *NurseThink for Nurse Educators Success Manual Quickly Access Best Practices in Testing Development.* United States of America: NurseTim, Inc.; 2018.
21. Duke VJA, Anstey A, Carter S, Gosse N, Hutchens KM, Marsh JA. Nurse Education Today Social media in nurse education : Utilization and E-professionalism. *Nurse Educ Today* [Internet]. 2017;57(July 2016):8–13. Available from: <http://dx.doi.org/10.1016/j.nedt.2017.06.009>
22. Gonen A, Sharon. D, Lev-Ari L. Integrating Information Technology ' s competencies into academic nursing education – An action study. *Cogent Educ.* 2016;3(1193109):1–9.
23. Saranto K, Tallberg M. Nursing informatics in nursing education: A challenge to nurse teachers. *Nurse Educ Today.* 1998;18(1):79–87.
24. Button D, Harrington A, Belan I. Nurse Education Today E-learning & information communication technology ( ICT ) in nursing education : A review of the literature. *Nurse Educ Today* [Internet]. 2013;82013483. Available from: <http://dx.doi.org/10.1016/j.nedt.2013.05.002>
25. Asiamah, K. O., Essel, H. B., & Lamptey, R. B. (2018). The option of the Collegiate System at the Kwame Nkrumah University of Science and Technology (KNUST): Any Impact on the Provision of Library Service/a Decade of Collegiality: prospects and challenges.
26. Bonsu, F. M., Essel, H. B., & Ofori, E. (2018). Evaluating the Reasons for The Non-Participation of Kwame Nkrumah University of Science and Technology Institutional Repository by Academic Staff. *Journal of Basic and Applied Research International*, 24(2), 58-64.
27. Essel, H. B., & Osei-Poku, P. (2011). An Effective Knowledge Management of Graduate Research Output at Kwame Nkrumah University of An Effective Knowledge Management of Graduate Research Output at Kwame Nkrumah University of Science and Technology. *Journal of Science and Technology*, 31(2), 95-108. doi:10.4314/just.v31i2.69398
28. Essel, H. B., Butakor, P. K., & Nortey, S. (2019). Summative Examination for High Stake Assessment in Higher Education: A Case of Undergraduate Students at the Kwame



Nkrumah University of Science and Technology. *Global Journal of Human-Social Science Research*.

29. Essel, H. B., Nunoo, F. K. N., Tachie-Menson, A., & Amankwa, J. O. (2018). Higher Education Students' Ownership and Usage of Smart Phones and Tablets: The Case of Kwame Nkrumah University of Science and Technology (KNUST). *International Journal of Educational Technology*, 5(1), 20-28.
30. Essel, H. B., Osei-Poku, P., Tachie-Menson, A., & Opoku-Asare, N. A. (2016). Self-Paced Interactive Multimedia Courseware: A Learning Support Resource for Enhancing Electronic Theses and Dissertations Development. *Journal of Education and Practice*, 7(12), 74-84.
31. Ofosu-Asare, Y. A. W., Essel, H. B., & Bonsu, F. M. (2019). E-Learning Graphical User Interface Development Using the Addie Instruction Design Model and Developmental Research: The Need to Establish Validity and Reliability. *Journal of Global Research in Education and Social Science*, 78-83.