

# Implementing E-Learning in Resource-Constrained Nursing Education Institutions in Rwanda

Alexis Harerimana\* and Ntombifikile G Mtshali

School of Nursing and Public Health, University of KwaZulu-Natal, Durban, South Africa

\*For Correspondence: Alexis Harerimana, School of Nursing and Public Health, University of KwaZulu-Natal, Durban, South Africa, Tel: +27727314927; E-mail: haralexis@yahoo.fr

Received date: 10/11/2017; Accepted date: 19/12/2017; Published date: 27/12/2017

Copyright: © 2017 Harerimana A, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

## Research Article

### ABSTRACT

**Aim:** The aim of this paper is to present the intervening conditions that influence the implementation of e-learning in resource-constrained nursing education institutions in Rwanda.

**Methods:** Exploratory qualitative method was used. Forty participants were purposively selected from identified school's campuses in Rwanda, and included nursing students, nurse educators, and ICT managers. Data was collected using a semi-structured interview guide for in-depth interviews and focus group discussions. Document analysis was used to obtain additional data, with the qualitative data being thematically analysis.

**Results:** The findings demonstrated that there are intervening conditions that influence the proper implementation of e-learning in nursing education, these being facilitative and inhibiting factors. The sub-categories that emerged as facilitative conditions were (a) institutional support for teachers and students, (b) partnership and collaboration, (c) policies and regulations of e-learning; (d) effectiveness of learning management system (Moodle), (e) e-readiness, and (f) bridging the digital divide. The inhibitive conditions sub-categories to using e-learning were: (a) resource constraints; (b) insufficient ICT literacy (computer/Internet/Moodle); (c) challenges with the language of instruction; (d) generational age gap (e) lack of policies regarding e-learning; (f) resistance to change; and (g) issues related to the Moodle interface design.

**Conclusion/recommendations:** The results indicate that the success of e-learning depends not only on the availability of ICT infrastructures but also on the users' readiness, and the institutional abilities to respond to the challenges posed by a technology-mediated learning environment. Institutions must develop ICT support mechanisms to proficiently deliver media-intensive learning in an inexpensive way and to support daily e-learning facilitation for both teaching staff and students. It is essential to improve the digital literacy of the users and to enhance the utilisation of Moodle (or other e-learning platforms) as a Learning Management System.

**Keywords:** E-learning, Nursing education, ICT in education, Challenges to e-learning, Facilitative conditions to e-learning

### BACKGROUND

The use of technology and in particular of e-learning, in higher education is becoming increasingly used [1-3]. In nursing education, the literature reveals that incorporating ICT in teaching and learning, particularly e-learning, has numerous positive aspects. The flexibility provided by the online learning environment and the ability for self-directed learning is important [4,5]. Studies have demonstrated that students appreciate the online learning environment as it facilitates their interaction with one another, and enables them to study outside of the school settings [5-8]. Mitchell, et al. found that nursing students felt e-learning provides a more profound learning than regular classroom learning [9]. It was further argued by Balakrishnan that e-learning provides communication without boundaries (global education) [10]. Furthermore, Bouhnik point out that e-learning facilitates the ability to choose when to attend lessons, irrespective of the time and the location [11]. It allows self-directed learning, access to internet resources, and the possibility of collaborating with

colleagues without limitation. Carper cited in Liaw argued that new educational approaches and e-learning provides opportunities for facilitators and students to share innovations on their works with immediate support<sup>[12]</sup>.

In nursing, computer and network literacy have a significant impact on e-learning, with the internet being underutilized among healthcare professionals for database searching as a source of information<sup>[11,13,14]</sup>. Several factors hindered effective searching for information, such as lack of accessibility to computers and the internet<sup>[15-17]</sup> and limited time to search large volumes of health literature<sup>[18-20]</sup>. It is argued that a number of nurses are hesitant to use digital information resources, which is related to insufficient computer literacy<sup>[18,21,22]</sup>. In order to use the technology effectively in the education of health professionals, it is essential to assess their knowledge, practices and attitude toward the use of computer-based technologies<sup>[23,24]</sup>. According to Mills et al. it is important to take into consideration the availabilities of ICT resources and its usage in remote areas<sup>[25]</sup>. Although technology provides a mechanism for geographically isolated clinicians to engage in continuing professional development activities, and is designed to inform practice currency and maintain annual licensure, the extent to which these resources are used is largely dependent on individual levels of confidence and competence in the use of contemporary computer technologies<sup>[25]</sup>.

In nursing education, incorporating informatics competency in the curricula is essential for nursing students. The increasing number and diversity of students joining nursing programs are challenging to teaching institutions that need to cater for individual students' learning needs<sup>[26]</sup>. Edwards et al. state that adequate computer literacy allows new nursing students to use learning resources placed on the web by the institutions for academic purposes. When students face challenges with basic informatics competencies, frustrations may occur, often leaving them unable to use web-based learning contents<sup>[26]</sup>.

The literature reveals that e-learning overcomes boundaries posed by traditional education. It allows students to have access to information, and collaborate with peers and teachers irrespective, of the time and space<sup>[27,28]</sup>. However, the issues related to the digital divide still pose major challenges to education across the globe<sup>[29-31]</sup>. The concept of the digital divide is based on a differentiation between those who can afford the technology and those who cannot. Issues related to the affordability and accessibility to ICT includes ICT skills, costs, income, contents, occupation, level of education, geography and gender<sup>[32,33]</sup>.

The literature indicates a number of issues relating to incoming student nurses, including their age differences, varying levels of computer literacy, and the time since they finished school, with those recently completing having more access than those who have worked, where they may have less exposure to IT equipment. Deprived of basic informatics skills, learners often fail to cope, thus falling behind during the first few weeks at school. Effective integration of technology into the nursing school curricula would assist students learning, both in the clinical areas and classrooms<sup>[26]</sup>.

The importance of ICT, and particularly e-learning in nursing and tertiary education is well documented<sup>[34-37]</sup>. However, the gap between developed and developing countries in terms of the digital divide is still a major hindrance to the globalisation of e-learning. The literature reveals that these challenges are related to insufficient computer literacy, scarce resources, issues with language of instruction, poor teacher training in the use of innovative teaching strategies, and inadequate integration of the ICT into the curriculum<sup>[38-40]</sup>.

Being the majority of the health sector in Rwanda, many nurses have a Diploma level qualification that is no longer provided or accepted<sup>[41]</sup>, resulting in a many people needing to upgrade to an advanced diploma. E-learning was introduced as a way of enabling the upgrading on a large scale. The Rwanda Human Resource for Health Program<sup>[42]</sup> reported that the e-learning program was designed to adapt to the learning needs of nurses and midwives who are already working, but who are in need of further training. The curriculum was designed to cater to these requirements, making the program attractive to those targeted candidates and making it highly likely that they will graduate. Despite the advantages reported of e-learning, a number of factors have been reported to hinder its effective implementation, such as language barrier, poor infrastructures, lack of ICT tools, and insufficient ICT literacy. Although ICT is becoming a priority to the Rwanda Government and progress has been made, the digital divide cannot be ignored, particularly with the introduction of e-learning in nursing teaching institutions in 2012. Thus, this paper explores the implementation of e-learning in resource-constrained nursing education institutions in Rwanda, with a focus on the factors facilitating and hindering its proper implementation.

## METHODOLOGY

An exploratory descriptive qualitative method was used to explore the implementing of e-learning in resource-constrained nursing education institutions in Rwanda. The study location consisted of three campuses from a selected nursing school, with the 40 participants being purposively selected, these being 18 nurse educators, 17 nursing students, two ICT managers, and three participants in a focus group discussion. The inclusion criteria for the nurse educators and ICT managers were to: (i) have at least six months experience working in public or private nursing and midwifery campuses in Rwanda; (ii) be employed as nurse educators in the selected nursing campuses at the time of

data collection; (iii) be involved on a daily basis with the nursing and midwifery students; and (iv) be willing to participate. Regarding the students involved in this study, the inclusion criteria were to: (i) have used e-learning platform for at least one year for their learning purposes in the selected nursing and midwifery campuses; (ii) be registered in the selected nursing campuses at the time of data collection, and (iii) be willing to participate.

Data were collected from June to December 2015, and consisted of 40 in-depth interviews and one focus group discussion. The interviews were conducted after the study was explained to the participants and their consent forms had been signed. Each participant was asked: What are the intervening conditions (facilitating and inhibiting factors) that hinder the use of e-learning platform in the selected nursing school' campuses in Rwanda? The average duration of the interview was 20 min and they were all audio-recorded with the participants' permission. The focus group discussion consisted of a senior nurse educator and an e-learning expert, the researcher playing the role of the facilitator. Once the consent forms had been signed by the participants, a focus discussion commenced, however, the facilitator had to write important information as one participant did not consent to the session being recorded. A document analysis approach was used to explore the government documents relating to e-learning on health care and educational system.

Ethical principles were respected, and approval obtained from the University of KwaZulu-Natal Biomedical Research Ethics Committee (protocol HSS/1294/014D). Furthermore, clearance and permission were obtained from the Ministry of Education in Rwanda, and from the selected school at the University of Rwanda (UR), where the study was conducted.

Transcriptions of the interviews were analysed using the constant comparative method. Data analysis was iterative with data collection. Data were analysed as they were being collected through the process of coding. Through open coding, common themes of everyday life were identified and examined in relation to the context, meanings, and the utilisation of e-learning platform in selected nursing campuses. Interviews were coded by conceptualising underlying patterns in the data. Initial data analysis guided further data collection, leading to further conceptualisation of the data and refinement of the coding schemes. Conceptual saturation was reached when no new themes were generated. Through the process of open coding, memos were written throughout the coding process to track conceptual decisions and ideas as they were occurring.

As part of the analysis, similarities and differences found in open coding about the compiled codes were clustered together to create themes (Axial coding). After data saturation, qualitative data were analysed manually based on Strauss and Corbin's framework.

## RESULTS

This section presents the findings from this study about the challenges faced with the use of e-learning together with efforts being taken to solve them. Each respondent was allocated an occupation code followed by a number to protect their confidentiality (TP: Teacher Participant; SP: Student Participant and FGD-P: Focus Group Participant). To ensure their anonymity, the ICT managers were given the code for teachers, as they were only two. **Table 1** indicates the facilitative and inhibiting themes and subthemes that emerged from this study, with extracts for evidence.

**Table 1.** Themes, subthemes and evidence of the findings.

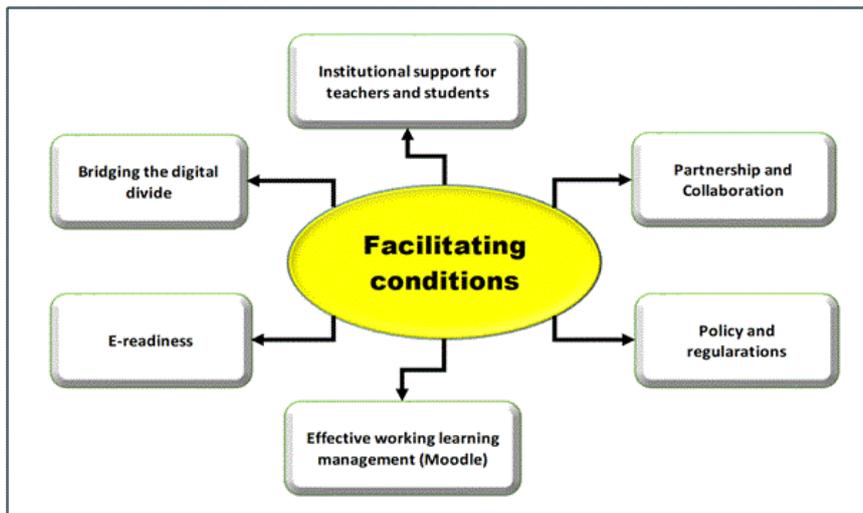
Subthemes	Evidence
<b>Theme: Facilitative conditions to the implementation of e-learning</b>	
Institutional support for teachers and students	<i>"The support system is the infrastructure...we have a computer laboratory that is available to everyone. Lecturers and tutorial assistants have been trained before, even the students were trained." (TP2)</i>
Partnership and collaboration	<i>"These faculty members provide expert guidance and teaching in their designated areas. Their efforts are geared towards capacity building of Rwandan faculty and practitioners by mentoring, teaching, training, and providing various learning experiences for Rwandan nurses and midwives." [43]</i>
Policies and regulations for e-learning	<i>"...the policy says that in 60%, students have self-directed learning, guided and assisted by the lecturer or tutorial assistant...and 40% is face to face...this policy has a big impact to help those who are working to upgrade their levels." (TP2)</i>
Functionally effective learning management system	<i>"...on Moodle I try to give the assignments, and I collect them on Moodle, I post some courses, some videos on Moodle so as to improve the online teaching and learning...so some teachers use Moodle...they post some outline courses, they put assignments, the forum discussion." (TP4)</i>
E-readiness	<i>"The institution should be ready first, they should get prepared enough, they should be equipped with e-learning tools...I think we should have enough staff, trained staff who are ready to teach</i>

	<p>online, the government should supply enough ICT tools, like computers, to increase the strengths for connection of Internet." (TP16)</p>
	<p>"They are some changes...do you see we are in vision [Vision 2020]...before we didn't know how to use the laptops, the Internet...now we use the Internet...if you meet a challenge on the disease which you don't know...you can go and you read yourself." (SP8)</p>
Bridging the digital divide	<p><b>Political commitment</b></p> <p>"Over 3,000 km of Fibre Optic cables were laid across the country connecting all the 30 districts and 11 border posts...Many sites across the nation are connected including secondary schools, universities, hospitals, district offices, judicial courts and most of the central government institutions<sup>[44]</sup>".</p> <p><b>Early socialization to IT</b></p> <p>"ICT buses are mobile telecentres as well as computer labs, more convenient and affordable for farmers, traders, students, women, youth groups, entrepreneurs and other rural-based Rwandans to access ICT services as well as training. Four buses are crossing the countryside to take the computing and Internet services to remote and underserved areas<sup>[44]</sup>".</p> <p><b>Emotionally matured students</b></p> <p>"It [e-learning] is a special program where both students and lecturers have to be hard working, from both side, because during the time of face to face, not just the lecturer prepared the content to deliver to the students, but also they participate through assignment, through group works...they are having a background in nursing sciences from A2, I would call it diploma...we just first take what they have as a standard." (TP6)</p>
<b>Theme: Inhibitive conditions or obstacles to the e-learning</b>	
Resource constraints	<p>"The equipment for video conferencing is not sufficient, there is no sound proof, and the same only computer lab is used for video conferences...the schools have insufficient classrooms to hold all the students...poor library and no sufficient of online books and journals." (TP20)</p> <p>"The teacher is supposed to have the time during the night to discuss with the students, because by the day they are working and they are free by the night...and the teacher will be working the whole day and meeting students the whole night." (TP6)</p> <p>"...network has been a challenge...when using Moodle, and we were at work...sometimes the network failed...to meet the facilitator was a challenge...and to do some quizzes on Moodle platform it was a problem." (SP8)</p>
Insufficient ICT literacy (computer/Internet/Moodle)	<p>"There is computer illiteracy among students...and on how to engage an online discussion...There is also lack of training among nurse educators and students on the use Moodle." (FGD-P2)</p> <p>"Student don't like Moodle because they don't have sufficient knowledge on the use of Moodle...and most of the time they are confused about different programs on Moodle and they find much difficulty in retrieving some information, even doing some exams or some work from Moodle it is very difficult for them...and it is a challenge for them." (TP1)</p>
Challenges with the language of instruction	<p>"The problem of English language is a very big challenge...the programme is elaborated in English, it was very difficult to adapt ourselves." (SP13)</p> <p>"...we have the language problem. Because the academic language is English but many of them, when you are teaching, they want you to explain in another language...maybe in French or Kinyarwanda...for more understanding...they are some students who don't have sufficient knowledge or understanding the English." (TP9)</p>
Generational age gap	<p>"...so in terms of using Internet from the new generation...they are able to use all the online resources but for the old generation it is very difficult and not very easy...because sometimes they want to access Moodle platform...and they forget their password...but for the new generation they don't have these problems...and sometimes for the older generation I prefer to give them the password and I write it on my paper...and when they forget I try to give back the password." (TP7)</p>
Lack of policies regarding e-learning	<p>"...now we don't have a policy regarding the plagiarism, nor having some software to detect plagiarism, this reduces the critical thinking of the students... I think we can use this kind of software to reduce this plagiarism rate, so that our students could work for themselves..." (TP19)</p> <p>"We are in the process of developing an online teaching and learning policy. So, there has not been any. You [referring to researcher] may need to look at the HEC distance learning policy; it may not necessarily apply though."</p> <p>"...ah...not much [referring to policies] in terms of using e-learning and Moodle." (FGD-P2)</p>
Resistance to change	<p>"...when this Moodle from MoH stopped, all the persons set in their mind...that they have to teach face to face...now this Tulane University is introduced...people are now used to the other method</p>

	<i>of teaching...so I tell you if there are 10 people who teach e-learning program...maybe one is using this[Moodle]..." (TP17)</i>
	<i>"...No motivation for lecturers who consider e-learning as an added task to their job, no motivation for their support, considering that they work every time [Night and Week end], Needs for IT and lecturers of laptops and charged modems to facilitate the support and the follow-up of students." (TP20)</i>
Issues of interface design of Moodle	<i>[Researcher's observation of Moodle platform]</i>

**Facilitating Conditions to the Implementation of E-Learning**

The findings from this study demonstrated that a number of facilitating conditions influence the proper implementation of e-learning in nursing education, these being those factors that would enhance the development, implementation and uptake of e-learning (Figure 1).



**Figure 1.** Facilitating conditions to the implementation of e-learning.

***Institutional support for teachers and students***

The teachers and nursing students indicated that support was essential to the continued success and growth of e-learning in higher education. Based on the pedagogical design of e-learning, facilitating activities that emerged from the data included the need for the following: e-learning modules in relation to national needs and available resources; e-learning opportunities for teachers' facilitation and students' engagement; effective teacher and student monitoring and evaluation, growth and retention in the number of students enrolled in e-learning; and extensive staff and student capacity building in the use of computer technology. The data revealed that in designing e-learning platforms, technological resources and support, and well-trained nurse educators who could use it effectively were essential to its success. The technical support provided by ICT managers was to assist both teachers and students when there is a network problem, computer problems or problems with access to Moodle. The participants noted that the institution provided modems and airtime to teachers during teaching periods, trained students and teachers to use Moodle, provided internet (wireless) access for both students and teachers, and an ICT laboratory with 30 computers, projectors and electricity. Providing adequate support is essential to teaching in a technology-mediated learning environment [42]. According to Baran et al. [45], successful online teaching is a result of adequate technical support for teachers, and assisting them to decide what technology is suited to their course contents. It is argued that nurse educators who are empowered pedagogically and technologically maintain a strong online presence and organise communities of practice through discussion forums and chat rooms [46].

***Partnership and collaboration***

The findings indicated that collaborating with other higher learning institutions both within and outside Rwanda in the field of education, particularly in the health sector, has been fruitful. In particular, collaboration with the Rwanda Human Resources for Health (RHRH) non-government organization has been fundamental for nursing education in establishing an e-learning in nursing and education program through a joint partnership with the Ministry of Health. The document analysis indicated that in this program, faculty from the United States teaching institutions (USF) 'twin' with Rwandan faculty (RF) to transfer skills to address the shortage of health professionals, particularly in speciality areas [43]. The twinning model was developed to enhance effective transfer of knowledge and skills [43]. Through this partnership,

stakeholders provide technological and pedagogical assistance as well as financial support for the nursing and midwifery school. It also emerged that the US educators partner with their Rwanda counterparts, with goals being set depending upon departmental needs, personal interests and the competencies of the twins. The findings indicated that a number of nurse educators from US Universities have been appointed by RHRH to work. In 2015, 36 US nursing and midwifery educators were twined to 72 Rwandan College Faculty. The document analysis revealed that the Government of Rwanda has put in place digital libraries in collaboration with Korea International Cooperation Agency (KOICA) that could be accessed from colleges around the country for a range of disciplines, including health<sup>[44]</sup>.

### ***Policies and guidelines***

Data from this study indicated that for the effective integration of ICT into national education systems, policies and guidelines need to be established. Policies not only put ICT in context, but also motivate teachers to make adequate use of ICT to bring about change in education. The e-learning policies and guidelines should demonstrate a commitment to high-quality educational practices. They should also provide a guide for classroom utilisation of ICT relating to computers and other hardware, computer programs (software), Internet and networking, legal issues such as plagiarism and copyright, payment of incentives for nurse educators and ICT managers, additional professional development opportunities and peer recognition. To ensure successful e-learning, faculty need to adhere to these policies and regulations, thereby enhancing teaching and learning as well as instructor and student satisfaction. The purpose of the Rwanda Ministry of Education ICT policy includes building a common shared understanding and synergy for what ICT in education means among all stakeholders, creating an enabling environment, mechanisms and priorities for ICT in education, and developing modern, relevant content fulfilling the needs and expectations of citizens, industry, and society in general. It also intends to ensure harmonisation between centralised and decentralised levels of the education system, leveraging public-private partnerships, support its development partners, and strengthening Rwanda's effort to export models for ICT in education to Africa in general, and to the East African Community (EAC) and the Common Market for Eastern and Southern Africa (COMESA) in particular<sup>[47]</sup>.

### ***Functionally effective learning management system (Moodle)***

Moodle was indicated as the learning management system used in Rwanda, having been introduced by Ministry of Health as part of the e-learning program. The platform stopped working in 2014 due to various problems, but has been operational effectively since early 2015, this having been achieved through a partnership with RHRH and the University of Rwanda. Currently, Moodle is accessible and being used by some teachers and students, for teaching and learning, and for evaluations. According to the Food and Agricultural Organization (FAO)<sup>[48]</sup>, a number of teaching organisations use learning management systems to offer and manage teaching programs through the internet.

In this study, a number of points were noted for effective use of e-learning platform: appropriate use by teachers in facilitating the students; good management access rights for the data on Moodle (for example, limited privileges for students, teachers, campus manager, etc.); appropriate security for access to any course; rapid response from the Moodle administrator in case of difficulties; the Moodle learning management system as a cornerstone of the future of nursing and midwifery (based on the log reports in some courses); access to Moodle is easier and mobile friendly (depending on the Internet network).

### ***E-readiness of institution, teachers and students***

The findings indicate that successful e-learning depends on the online learning readiness of the learners, teachers and the institution, which was supported by Mercado. These three conditions are interrelated, and if one is missing or inadequate, e-learning facilitation and success becomes problematic. Institutional e-readiness relates to how prepared the institution is in terms of using ICT in the sphere of education. Nurse-educator e-readiness depends on the preparedness, knowledge and skills of the educators to use instructional and technological design in their daily activities. For this group is also concerned with ease of using the technology, availability of adequate infrastructures support from the institution's administration. Nursing students need to be prepared to adopt e-learning and benefit from its advantages, and to have access to the necessary resources to enable this to occur. The results indicate that perceived usefulness of e-learning on the part of the stakeholders determines their actual readiness for it in their teaching and learning activities.

Individual properties, ICT competencies and motivation, together with access to technology, were identified as essential aspects for e-readiness<sup>[49,50]</sup>. According to Khan<sup>[51]</sup>, readiness assessment helps to review the comprehensive readiness status of an institution's e-learning initiative and it points to critical factors that should be considered in order to prepare for e-learning.

### ***Bridging the gap of the digital divide***

Within the theme of bridging the digital technology divide were three sub-themes, these being political commitment, early socialization to IT and emotionally mature students, each of which will be addressed.

**Political commitment:** The document analysis revealed that the Rwandan government is aware of the digital divide in ICT and internet access, and is trying to bridge it, by being guided by its Vision 2020 to transform Rwanda to a knowledge economy. In this regard, the government initiated the National Fibre Backbone project in 2008 to provide connectivity and adequate broadband communication services across the country. A related ICT-focussed government project is E-Rwanda, which is designed to encourage the traditional media to bridge the knowledge divide and facilitate the flow of cultural content, particularly in rural areas. Recently, Microsoft unveiled Windows 8 in Kinyarwanda. In the health sector, E-Health was developed to deal with applying ICT to promote quality of care through services such as the Rwanda Health Management Information System (R-HMIS), TracPlus program, TRACnet program and Telemedicine.

In the education sector, ICT is begin integrated into teaching and learning, with five centres for e-learning in 2015 to accommodate 614 nursing and midwifery students, successfully using video conferencing to upgrade nurses from A2 (A-level) to A1 (Advanced Diploma) <sup>[46]</sup>. In the digitalisation of the country, the government introduced innovations in education rarely seen in the region, such ICT buses, telecentres, public information kiosks, the National ICT Literacy and Awareness Campaign initiative, a digital public library and archive services. In this study, some nursing students noted that students enrolled in e-learning programmes are able to use ICT and others added that they are participating in the country's vision to use ICT. The document analysis indicated a targeted extension of electrification to the rural areas and an improvement in overall electricity supply with the hope of eliminating problems of power disruption that hinder internet access and retard computer literacy <sup>[52]</sup>.

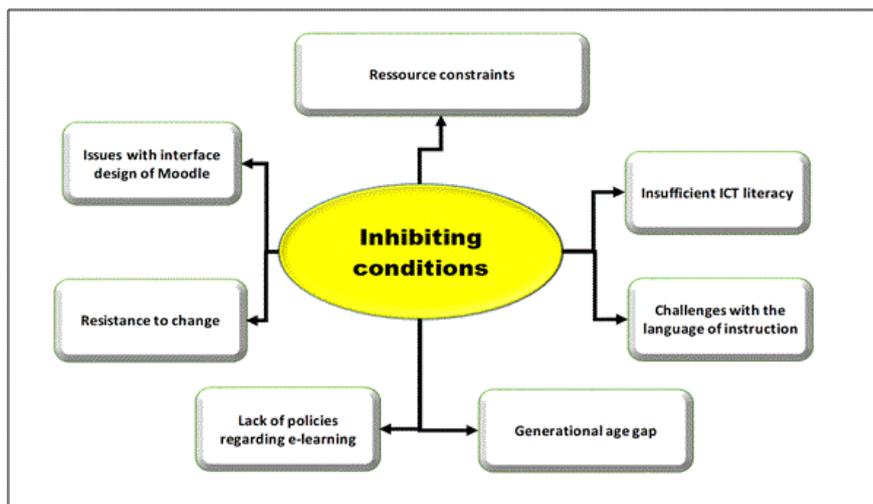
**Early socialisation to IT:** The study findings indicate that Rwanda has made considerable progress in socialising Rwandans in the use of IT. The data indicated that the government seeks to transform Rwanda into an ICT-literate nation by achieving 50% computer literacy, and raising awareness and the use of existing and future ICT-enabled information and services for at least 60% of the Rwandan population aged 15 and above by 2018. A related project is to supply one laptop per child in primary school, to which end the One Laptop Per Child program (OLPC) was launched in June 2008 and the currently proposed target is to provide all students from grades P4 to P6 with access to laptops <sup>[53]</sup>. To reduce the cost of textbooks and other printed materials, the government is also considering the digitisation of learning materials through its Smart Classroom initiative/programme <sup>[54]</sup>. Recently, the one laptop per students was initiated in tertiary education by the University of Rwanda at Huye campus and is expected to expand to others campuses in the Smart Rwanda programme <sup>[55]</sup>. It emerged from the document analysis that with a large number of people speaking Kinyarwanda, the introduction of Windows 8 in this local language will assist in building ICT literacy in the country, and spread its usage to a large proportion of the population <sup>[44]</sup>. The findings indicate that there is a focus on increasing ICT literacy and awareness, which is being done through capacity building, ICT buses (Mobile telecentres), digital public Kiosk, National ICT literacy and awareness campaigns.

**Emotionally mature students:** The data emerging from this study indicated that the main reason for the introduction of e-learning in nursing education by the Rwandan government, under the umbrella of the Ministry of Health and its partners, was to upgrade nurses who had originally been trained in a content-based curriculum from diploma level (A2) to advanced diploma level (A1). All of these nurses had been working in various health settings across the country, with an overall age range from 28 years to 50 years, and the average age of 36 years. Teaching mature students required a different approach that is student-centred, as it involves self-directed, collaborative, inquiry-based and interactive learning that requires the integration of theory and practice. The data showed that a blended learning approach was adopted, with 60% being self-directed via online learning management (Moodle) and 40% being face-to-face. Those who were enrolled in e-learning found it interesting because it helped them to become familiar with ICT and the English language and they continued to work while supporting their families, accessing the teaching and learning resources either in their respective places of work or in their homes.

The literature indicates that it is essential to take into consideration the age differences of the students in school settings in order to facilitate the knowledge acquisition, specifically in a technology-mediated learning <sup>[56-58]</sup>.

### **Inhibiting Conditions to Implementing E-Learning In Rwanda**

Although e-learning was positively perceived by participants, a number of hindering factors or obstacles to e-learning were reported, as presented in **Figure 2**.



**Figure 2.** Inhibitive conditions to the implementation of e-learning in Rwanda.

### ***Resource constraints***

Constraints reported by participants to the use of e-learning were: insufficient infrastructure, shortage of trained staff, work overload/time constraint, poor motivation, financial problems, and the inaccessibility of Internet/website/Moodle. The findings indicated insufficient infrastructure to accommodate regular and large numbers of e-learning students, with problems cited being: inadequate classrooms, poor libraries with insufficient online books, no ICT lab and skills laboratory, and no computers for all students, these factors having been a major problem in the implementation of e-learning. Adequate infrastructure is acknowledged as being associated with the success of e-learning <sup>[59]</sup> and is associated with users satisfaction and perceived usefulness of e-learning <sup>[59]</sup>.

In this study, the participants indicated that a shortage of staff was associated with the excessive workload and had a considerable impact on teachers' motivation and morale. They noted work overload not only by teachers but also by students and ICT managers. The students reported that they had to work and study, and combining both was not easy, because online facilitation was done during the evening or at night. The nurse educators felt overloaded with work, without time to care for their families or even prepare their next teaching sessions, as they needed to be available in the evening for their students. The data from this study indicated that when workload pressures increased, attention to quality teaching and student interaction was the first casualty. According to Meyer <sup>[60]</sup>, the increased workload of teachers negatively affects their productivities. Ballet et al. <sup>[61]</sup> state that with the teaching environment changing to include the traditional classroom and an online setting, teachers face several challenges that affect their work-related activities, thus having a negative effect on their job motivation.

The findings from this study indicated that to perform well in their teaching activities teachers need to be motivated. Study participants reported that there was no motivation for teachers due to the excessive workload, extra working hours, and teaching large numbers of e-learning and regular students. The campus managers who participated in this study also reported that there were no incentives for using ICT in teaching and learning, and one of them said that its lack of use was due to budget constraints. According to Timah <sup>[62]</sup>, motivational strategies should be put in place for teaching institutions to accommodate e-learning, and should be guided by a positive and transformative leadership. In addition, the school environment, the political image of the country, and financial status of the institution are other factors that influence teaching staff motivation <sup>[62]</sup>.

The participants indicated that a lack of Internet network and access to Moodle were problems for several students, which led to poor facilitation and the inability to do online activities as required. It emerged that Moodle had been out of action for a year due to various problems and had to be relocated, and while it was stable and working well, Internet access problems and electricity disruptions continued to create difficulties for participants to access it.. In addition, many teachers were not trained in how to incorporating e-learning into their teaching methods, and learners did not have the appropriate access to the internet outside educational institutions to make e-learning practicable. UNESCO <sup>[63]</sup> states that both developing and developed countries should ensure that institutions have adequate teaching facilities to prepare the younger generation to play a role in modern society. ICT should be an integral part of teaching and schools should have access to technology resources and to a variety of modern devices <sup>[63]</sup>.

### ***Inadequate ICT literacy: Computer/internet/Moodle***

Data from this study indicated that inadequate ICT literacy led to inadequate online facilitation of the students by teachers, and to both teachers and students being unable to derive maximum benefit from e-learning. Similarly, Munyemana [64] reported that with the introduction of e-learning in nursing schools in Rwanda a number of challenges have been noted including the use of computers, internet, and ICT equipment by nursing students and nurse educators [64].

In this study, the participants indicated that challenges in the use of ICT tools by students caused frustration among the nurse educators, with some teaching only face-to-face for courses that were supposed to be taught in a blended mode. Nursing student participants reported that more time was needed for learning to use computers and the Internet, and nurse educators, felt that students at the selected school did not have enough Moodle packages. Hallila et al. state that computer and internet literacy are important skills for nursing students [5]. They reported that students need to use the computer and the internet to find information from websites and be able to use various software. Computer and internet literacy helps nursing students to achieve their learning goals, and the skills required are important for their future career. Issues related to computer literacy, information literacy and e-learning facilitation hinder the advancements of nursing students and nurses in general [2,65-69]. Despite its high profile, e-learning is not straightforward and very often raises issues [67]. According to Assareh et al. [70], attention should be paid to instructors and their capacity to facilitate online learning. Furthermore, there is a need to put in place infrastructure and the equipment needed for designing and delivering the courses [70]. For the future success of e-learning, both nursing students and educators must be sufficiently skilled in ICT, with insufficient ICT literacy has been reported at all three campuses [71].

### ***Challenges with language of instruction***

The findings from the current study indicated that the use of English as a language of instruction (LoI) was a challenge for mature-entry nursing students, who had been instructed at school in French until 1994, with English since then having been the main language used in public or private school settings. The language of instruction was viewed as part of the digital divide for mature students who also had to contend with learning to use computer technology. In this study, the participants indicated that the use of English as a language of instruction was a challenge for mature-entry nursing students. After the 1994 genocide against the Tutsi, English was introduced as the 3rd official language in Rwanda, after Kinyarwanda and French [72]. In recent years, English has become the only language of instruction, and French and Kinyarwanda are taught as subjects [73].

### ***Generational age of nursing students: "Digital natives and digital immigrants"***

The participants indicated that the age of the nursing students was an important aspect to consider when implementing e-learning. While recent school leavers had been born into the world of technology (digital natives), older students were not born into the digital world (digital immigrants) and faced challenges related to computer literacy. Many study participants were above 36 years of age, are referred to as the older generation, and faced more challenges than the younger students (digital natives). The challenges observed were in terms of using e-learning, particularly the ability to use computers and the Internet. The literature indicates that it is essential to take into consideration the age variations of the students in school settings, in order to facilitate knowledge acquisition in a technology-mediated learning [56-58].

### ***Lack of policies regarding the E-learning in nursing school***

The findings indicated that there were no policies regarding e-learning, plagiarism, copyright or how e-learning should be managed in nursing schools. It is important to establish what support the integration of ICT in teaching and learning requires in order to achieve the desired changes [74,75]. The literature guiding the direction of higher education indicate that policies to effectively integrate an e-learning culture within organisations is indispensable for future educational development [76]. Nyerere et al. [77] point out that the absence of clearly defined national distance education policies in most African countries poses another challenge. Policies provide standards for designing of the online program, the absence of which is a major hindrance to online teaching and learning [77].

### ***Resistance to change***

The findings from this study indicated that the fear of adopting new technologies, poor attitudes towards e-learning, age and the perception that e-learning is an additional workload caused resistance to effectively implementing e-learning. Some participants preferred teaching students face-to-face rather than using the online Moodle platform. The data further revealed a lack of facilitation of students online, and a lack of motivation to use Moodle.

A number of nurse academics chose to continue teaching in a traditional didactic approach to appease the students who were having difficulty using the online methods. In a study conducted in Tanzania by Kisanga et al. [78], it was found

that resistance to change was associated with fear of adopting new technologies, negative attitudes towards e-learning and a perception that e-learning is an extra load. According to the Nursing Times <sup>[79]</sup>, there is an ideological discrepancy between higher education's change in approach and the reality of what students and educators see as a responsibility to prepare them to provide safe patient care, which influences their decisions regarding the use of technology. This is particularly because e-learning has been tailored and promoted as a tool to facilitate self-directed and autonomous learning. A number of nurse academics chose to continue teaching in a traditional didactic approach to appease students <sup>[79]</sup>. Studies have reported that e-learning projects are failing because teachers and students are used to traditional teaching methods, and are resistant to changes associated with ICT <sup>[80,81]</sup>.

### ***Issues with Moodle interface design***

It emerged from the data collected on Moodle from the three campuses where this study was conducted that a better organisation of the modules provided on Moodle was required. A document analysis of the three campuses indicated that there were no ethical guidelines on how Moodle should be used for academic purposes and no Moodle user guide documents. The participants also indicated that the quality of forum discussions and chats was low. Log reports indicate the overall poor participation of students and teachers; some students having never logged in, and some teachers, co-teachers, and campuses managers not following what teachers and students were posting online. The majority of students from the three campuses accessed Moodle simply to see what had been posted and very few used it to interact with their teachers. Problems were also noted with Moodle integration of the Adobe Captivate and Big Blue Button software applications.

Effective use of Moodle as a Learning Management System (LMS) is essential to fully benefit from e-learning. The growing popularity of the internet and the rapid advances in web-based technologies has extended the boundaries and pedagogies of teaching and learning. A prominent example is the use of LMSs to complement face-to-face instruction in various educational settings, particularly in higher education <sup>[82]</sup>. However, the implementation of LMSs in education faces two major challenges, the first relating to different learning styles <sup>[82]</sup>. The second being teachers' scepticism about the effectiveness of online activities in improving learning <sup>[82]</sup>. In a study by Nyandara <sup>[83]</sup>, it was found that until March 2011, most of the courses at the Open University of Tanzania were not uploaded onto Moodle, implying that there was minimal use of the platform at the Open University of Tanzania for teaching and learning.

According to Snowball et al. <sup>[84]</sup>, teaching transitioning students about academic integrity, and enabling them to find their authorial voice, is a prime concern to educators in the higher education sector. Increasingly, the text matching software Turnitin has become the platform of choice to detect plagiarism and assist universities in upholding their academic honesty policies. Learning writing skills and understanding academic integrity is a challenge for many transitioning students, particularly second language and alternate pathway students <sup>[84]</sup>. In the absence of a plagiarism checking software linked to the online e-learning platform, students who are already challenged by the use of computer-based instruction are unlikely to know where or how to access such software.

## **CONCLUSION AND RECOMMENDATION**

The implementation of e-learning in nursing education in Rwanda is an effective enabler to improve the health of populations, both directly and through improved health workforce capacity and accessibility. However, the success of e-learning depends not only on the availability of ICT infrastructures and policies, but also on the users' readiness and the institutional abilities to respond to the challenges posed by a technology-mediated learning environment in low- and middle-income countries.

It is therefore essential to improve the digital literacy of the users and to enhance the utilization of Moodle as a Learning Management System. Bridging the digital divide in nursing education is a cornerstone to the future of e-learning, particularly in resource-constrained environments. Hence, efforts should be put in place to build substantial ICT infrastructures and improve the computer literacy of students and teachers. Collaboration and partnerships between developed and developing countries should aim to build the capacity of teaching institutions, and to share best teaching and learning practices in the technology-mediated learning environment. Continuous support and capacity building for nurse educators and students needs to be planned and implemented by the school until new members of academia are sufficiently confident to adopt ICT in their teaching and learning strategies. Motivational strategies should be put in place for teaching institutions, and be guided by positive and transformative leadership and appropriate policies for using e-learning platform in nursing education. Furthermore, it is imperative to recruit more qualified teachers and provide incentives to nurse's educators and ICT managers due to increased workload. Due to challenges posed by the language of instruction, it is important to plan a refresher course in English to assist the nursing students who have difficulties with the language, as it plays a crucial role in education, and particularly in the technology-mediated learning environment.

## REFERENCES

1. Applebee AC, et al. Balancing act: How can universities recognise the scholarly nature of eLearning development for university teachers? 2005;17-25.
2. Button D, et al. E-learning; information communication technology (ICT) in nursing education: A review of the literature. *Nurse Educ Today*. 2013;10:1311-1323.
3. Njenga JK and Fourie LCH. The myths about e-learning in higher education. *Br J Educ Technol*. 2010;41:199-212.
4. Farrell G, et al. Survey of ICT in education in Africa, Country Reports. Washington, DC: InfoDev/World Bank. 2007;2:53.
5. Hallila LE, et al. Nursing student's use of internet and computer for their education in the College of Nursing. *Int J Nurs Clin Pract*. 2014;1:1-5.
6. Halverson R and Smith A. How new technologies have (and have not) changed teaching and learning in schools. *J Comput Teach Educ*. 2009;26:49-54.
7. Kelly M, et al. A multi-method study to determine the effectiveness of, and student attitudes to, online instructional videos for teaching clinical nursing skills. *Nurse Educ Today*. 2009;29:292-300.
8. Maag M. Nursing students' attitudes towards technology: A national study. *Nurse Educ*. 2006;31:112-118.
9. Mitchell EA, et al. An exploratory study of web enhanced learning in undergraduate nurse education. *J Clin Nurs*. 2007;16:2287-2296.
10. Balakrishnan M. Academic use of internet among undergraduate students: A preliminary case study in a Malaysian University. *Int J Cyber Soc Educ*. 2010;3:171-178.
11. Bouhnik D and Marcus T. Interaction in distance-learning courses. *J Am Soc Inf Sci Technol Learn*. 2006;57:299-305.
12. Liaw SS. Investigating students' perceived satisfaction, behavioral intention and effectiveness of e-learning: A case study of the Blackboard system. *Comput Educ*. 2008;51:864-873.
13. Dutton J and Perry J. How do online students differ from lecture students? *J Manag Inf Syst*. 2002;18:169-190.
14. McGowan J, et al. Electronic retrieval of health information by healthcare providers to improve practice and patient care. *Cochrane Libr*. 2010;3:1-26.
15. De Veer AJ, et al. Successful implementation of new technologies in nursing care: A questionnaire survey of nurse-users. *BMC Med Informatics Decision Making*. 2011;11:1.
16. Kalyanpur M, Kirmani MH. Diversity and technology: Classroom implications of the digital divide. *J Special Educ Technol*. 2005;20:9-18.
17. Richwine M and McGowan J. A rural virtual health sciences library project: Research findings with implications for next generation library services. *Bull Med Libr Assoc*. 2001;89:37-44.
18. Dee C, et al. Information-seeking behavior of nursing students and clinical nurses: Implications for health sciences librarians. *J Med Libr Assoc*. 2005;93:213-222.
19. Kelly S, et al. Barriers and facilitators to the uptake and maintenance of healthy behaviours by people at mid-life: A rapid systematic review. *PLoS One*. 2016;11:e0145074.
20. Verhey MP. Information literacy in an undergraduate nursing curriculum: Development, implementation and evaluation. *J Nurs Educ*. 1999;38:252-259.
21. Bachman J and Panzarine S. Enabling nursing students to use the information super highway. *J Nurs Educ*. 1998;37:155-161.
22. Mccaughan D, et al. Acute care nurses' perceptions of barriers to using research information in clinical decision-making. *J Adv Nurs*. 2002;39:46-60.
23. Gırdaş Topkaya S and Kaya N. Nurses' computer literacy and attitudes towards the use of computers in health care. *Int J Nurs Pract*. 2015;21:141-149.
24. Kaya N, et al. Views of nurses about computer usage. *Journal of Istanbul University Florence Nightingale School of Nursing*. 2008;16:83-89.

25. Mills J, et al. Enhancing computer literacy and information retrieval skills: A rural and remote nursing and midwifery workforce study. *Collegian*. 2015;22:283-289.
26. Edwards J and O'Connor PA. Improving technological competency in nursing students: The passport project. *J Educ Online*. 2011;8:1-20.
27. Pawlowski T. *Information technology and education*. Leads: Kork. 2006.
28. Rabiee A, et al. An explanation for internet use obstacles concerning e-learning in Iran. *The International Review of Research in Open and Distributed Learning*. 2006;14:361-376.
29. Kontos E, et al. Predictors of eHealth usage: insights on the digital divide from the Health Information National Trends Survey 2012. *J Med Internet Res*. 2014;16:e172.
30. Ritzhaupt AD, et al. Differences in student information and communication technology literacy based on socio-economic status, ethnicity and gender: Evidence of a digital divide in Florida schools. *J Res Technol Educ*. 2013;45:291-307.
31. Saheb T. ICT, education and digital divide in developing countries. *Glob Media J*. 2014.
32. Fuchs C, Horak E. Africa and the digital divide. *Telematics Informatics*. 2008;25:99-116.
33. Wilson EJ. *The information revolution and developing countries*. Cambridge, MA: MIT Press. 2006.
34. Kheswa SE. Use of the internet by undergraduate third-year students of the Faculty of Humanities, Development and Social Sciences at the University of KwaZulu-Natal, Pietermaritzburg campus. 2010.
35. Koch LF. The nursing educator's role in e-learning: A literature review. *Nurse Educ Today*. 2014.
36. Kumar R and Kaur A. Internet and its use in the engineering colleges of Punjab, India: A case study. *Webology*. 2015;2:1-22.
37. Nwezeh CMT. *The Use of ICT in Nigerian Universities: A case study of Obafemi Awolowo University, Ile-Ife*. Libr Philos Pract. 2010.
38. Kader CB. A study on how university students in Durban, KZN, use the internet during their spare time. (Masters of Education Dissertation), University of KwaZulu-Natal (UKZN), Durban. 2007.
39. Mengxue H, Yan H. Integrating the online nursing evidence-based information resources for evidence-based nursing study in China. *Int J Nurs Pract*. 2012;18:429-436.
40. Najafabadi MO, et al. Challenges of application ICTs in technical and vocational training from students' and instructors' perception in Maragheh. *Int J Adv Sci Technol*. 2013;54:54-112.
41. Rwanda HRH. *Rwanda Human Resources for Health Program, 2011-2019: Funding Proposal Part I*. 2011.
42. Scheepers D. *Professional development for teaching with technology*. South Africa: Universities South Africa. 2015.
43. Mukamana D, et al. Nursing and midwifery education in Rwanda: Telling our story. *Rwanda J*. 2015;2:9-12.
44. Republic of Rwanda. *DRAFT (1st Physical Meeting): WSIS+10: Overall review of the implementation of the WSIS Outcomes*. 2015.
45. Baran E and Correia AP. A professional development framework for online teaching. *TechTrends*. 2014;58:95-101.
46. McCarthy J. Implications of online learning for nurse managers. *Nurs Manag*. 2014;21.
47. Rwanda Ministry of Education. *Ict in Education Policy*. Kigali, Ministry of Education. 2016.
48. FAO. *E-learning methodologies. A Guide for Designing and Developing E-Learning Courses*. Rome: Food and Agriculture Organization of the United Nations. 2011.
49. Budiharto W, et al. A literature review: Readiness factors to measuring e-learning readiness in higher education. *Proc Comput Sci*. 2015;59:230-234.
50. Ilgaz H and Gьlbahar Y. A snapshot of online learners: E-readiness, e-satisfaction and expectations. *The International Review of Research in Open and Distributed Learning*. 2015;16:171-187.
51. Khan BH. *Managing e-learning: Design, delivery, implementation and evaluation*. London: Information Science Publishing. 2005.
52. African Development Bank Group. *Rwanda Energy Sector Review and Action Plan*. Tunis: African Development Bank Group. 2013.

53. Kanyesigye F. Rwanda: Project to distribute 100,000 more laptops. 2012.
54. Mark E. Rwanda: Paperless “Smart Classroom” will save Govt U.S. \$8 Million. 2015.
55. Tuyishimire P. UR-huye campus abanyeshuri biga mu mwaka wambere bashyikirijwe laptops nshyashya. 2016.
56. Berman R and Hassell D. Digital native and digital immigrant use of scholarly network for doctoral learners. *J Educ Online*. 2014;11.
57. Prensky M. Digital natives, digital immigrants part 1. *On the Horizon*. 2001;9:1-6.
58. Ransdell S, et al. Digital immigrants fare better than digital natives due to social reliance. *Br J Educ Technol*. 2011;42:931-938.
59. Alsabawy AY, et al. IT infrastructure services as a requirement for e-learning system success. *Comput Educ*. 2013;69:431-451.
60. Meyer KA. The influence of online teaching on faculty productivity. *Innov High Educ*. 2012;37:37-52.
61. Ballet K and Kelchtermans G. Workload and willingness to change: Disentangling the experience of intensification. *Journal of Curriculum Studies*. 2008;40:47-67.
62. Ck Timah A. Motivational strategies used by principals in the management of schools: The case of some selected secondary schools in the Fako Division of the Southwest Region of Cameroon. (Master’s Thesis in Education), University of Jyvaskyla. 2015.
63. UNESCO. Information and communication technology in education: A curriculum for schools and programme of teacher development. 2002.
64. Munyemana G. Harmonizing capacity building and work responsibilities of Rwandan nurses through E-learning. 2012.
65. Barnard AG, et al. Information literacy: Developing lifelong skills through nursing education. *J Nurs Educ*. 2005;44:505-510.
66. Capdeferro N and Romero M. Are online learners frustrated with collaborative learning experiences? *Int Rev Res Open Distance Learn*. 2012;13.
67. Childs S, et al. Effective elearning for health professionals and students' barriers and their solutions. A systematic review of the literature findings from the HeXL project. *Health Inf Libr J*. 2005;22:20-32.
68. Tohm C. Student satisfaction and frustration with online education: A CMC theoretical analysis. (Master of Arts in Communication and Leadership Studies Dissertation), Gonzaga University. 2012.
69. Turker A, et al. The challenge of content creation to facilitate personalized e-learning experiences. *Int J E Learn*. 2006;5:11-17.
70. Assareh A and Bidokht MH. Barriers to e-teaching and e-learning. *Proc Comput Sci*. 2011;3:791-795.
71. Button D, et al. E-learning and information communication technology (ICT) in nursing education: A review of the literature. *Nurse Educ Today*. 2014;34:1311-1323.
72. The Republic of Rwanda. RPF - History About Rwanda. Kigali: Government of the Republic of Rwanda. 2008.
73. Samuelson BL and Freedman SW. Language policy, multilingual education and power in Rwanda. *Lang Policy*. 2010;9:191-215.
74. Du Toit J. Teacher training and usage of ICT in education: New directions for the Uis global data collection in the post-2015 context. 2015.
75. UNESCO. UNESCO ICT competency framework for Teachers. Paris: UNESCO. 2011.
76. McVeigh H. Factors influencing the utilisation of e-learning in post-registration nursing students. *Nurse Educ Today*. 2009;29:91-99.
77. Nyerere JKA, et al. Delivery of open, distance and e-learning in Kenya. 2012.
78. Kisanga D, Ireson G. Barriers and strategies on adoption of e-learning in Tanzanian higher learning institutions: Lessons for adopters. *Int J Educ Dev Using Inf Commun Technol*. 2015;11:126-137.
79. Nursing Times. E-learning adoption in pre-registration training. *Nurs Times*. 2013;109:26-27.

80. Howard SK and Mozejko A. Teachers: Technology, change and resistance. *Teaching and digital technologies: Big issues and critical questions*. 2015;307-317.
81. Parlakkılız A. Change management in transition to e-learning system. *QQML*. 2014;3:637-665.
82. Cheng G, Chau J. Exploring the relationships between learning styles, online participation, learning achievement and course satisfaction: An empirical study of a blended learning course. *Br J Educ Technol*. 2016;47:257-278.
83. Nyandara ZI. Challenges and opportunities of technology based instruction in open and distance learning: A comparative study of Tanzania and China. Paper presented at the 5th UbuntuNet Alliance annual conference, Lilongwe, Malawi. 2012.
84. Snowball T, et al. Beyond plagiarism: Utilising Turnitin as a tool to develop students' academic voice. 2015.