

# E-Learning Initiative Capacity Building for Healthcare Workforce of Developing Countries

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Received 2012-11-01, Revised 2013-04-24; Accepted 2013-05-23

## ABSTRACT

This study aims to explicate the strategic utilisation of e-learning is of utmost significance as e-learning plays a pivotal role in the improvement of healthcare learning and knowledge transfer, especially in developing countries and in pursuing of Millennium Development Goals (MDGs). Rapid technology changes in the learning and knowledge transfer landscape markedly, the swift pace of e-learning leaving healthcare providers no choice if they want to remain competitive. Human capital, an important element in contemporary employee relations scenario, has become the most significant competitive advantage in healthcare delivery systems. As such, healthcare providers need a new strategy for learning and training of their employees. Besides, the knowledge and competencies of healthcare providers are not only vital component but also essential to the quality of care and health of the society. Thus, these rationales exert that today's healthcare providers are embracing e-learning. The benefits of e-learning are extremely compelling. They include a reduction in costs associated with employee travelling; reduction in time spent away from the patients and reduced learning times. Also, this study describes the United Nations University International Institute for Global Health (UNU-IIGH) strategies, best practices and experiences in delivering e-learning to healthcare workforce of developing countries.

**Keywords:** E-Learning, Developing Countries, Health Information Systems, Healthcare Workforce, Best Practices

## 1. INTRODUCTION

The emergence of e-learning, the fast growth of the Internet and the advent of the World Wide Web (WWW) has made significant impact in how knowledge transfer and learning are conducted. e-learning is an outcome of the progression of distance education where digital technology is used in the teaching and learning process. The Internet is a widely used educational medium for both distance and face-to-face learning (Chen *et al.*, 2013; Vrasidas, 2004).

Among the obvious benefits of e-learning, namely are, learners can learn at or from various locations, often at their own convenience and pace, thus avoiding the time constraint and expense associated with attending regular

classes (Chen *et al.*, 2013; Idachaba and Idachaba, 2012). In addition, e-learning's flexibility provides personalised content when it is required and needed by the learners (Idachaba and Idachaba, 2012; Karamanis *et al.*, 2004; Eklund *et al.*, 2003). As the learners can control the process and content volume (Chen *et al.*, 2013; Cantoni *et al.*, 2004; Zhang *et al.*, 2004), they are provided with customised training (Ruggeri *et al.*, 2013; Kruse, 2004).

Some of the wonderful advantages to a healthcare provider for e-learning are learning times are reduced an average of 40-60% as compared to classroom based instruction (Idachaba and Idachaba, 2012) and increased retention as well as application of information to the job increases an average of 25% over classroom instruction (Ruggeri *et al.*, 2013).

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As well as the balance between the human and physical resources, it is also vital to preserve an appropriate mix between the different types of health promoters and caregivers to guarantee the system's success. Due to their palpable and significant differences, it is crucial that human capital is managed in a different way from physical capital. The relationship between human resources and healthcare is incredibly multifaceted and it merits further examination and study.

Workforce training is another key issue. It is critical that human resources personnel deliberate on the composition of the health workforce in terms of both skill categories and training levels. New options for the education and in-service training of health care workers are needed to warrant that the workforce is aware of and geared up to meet a particular country's present and future needs. A properly trained and competent workforce in e-health is fundamental to any successful healthcare system, particularly in the developing countries. This study aims to explicate the strategic utilisation of e-learning as it plays a pivotal role in the improvement of healthcare learning and knowledge transfer, especially in developing countries and in pursuing of Millennium Development Goals (MDGs).

### 1.1. E-Learning Challenges in Developing Countries

As expected, e-learning challenges are indeed abundant. In most developing countries, there is a dearth of fundamental e-learning components such as computers, electricity and related skills (Idachaba and Idachaba, 2012; Rajesh, 2003).

As for the learners, the lack of active and participative learners who are required for interactive learning is also a frustrating constraint. In fact, active learners participation is exceptional practice in countries where the tradition for a teacher or academician to teach in a more didactic manner (Piette *et al.*, 2012; Evans, 2005; Sehrt, 2003). These challenges can be divided into three general aspects, namely:

- Technological requirements
- Course Content
- Student characteristics

### 1.2. Technological Requirements

The first category relates to the "e" in e-learning and refers to technological requirements. Issues discussed are choices of technologies, namely access, technology costs and interface design. Access refers to whether one has

physical access to a computer and an Internet connection, but also to the reliability of the connection and the bandwidth-basically everything that is required to access the full range of the content needed. Home Internet access is an obvious determinant of who has access to e-learning and those who benefits from these e-learning initiatives.

According to Mackintosh (2005) and supported by Piette *et al.* (2012), 42% of the inhabitants of developed countries have telephone connections in contrast with 4.5% in developing countries and only a meager 1.4% in sub-Saharan region of Africa. Additionally, most single telephone connections in rural areas in developing countries are usually shared among communities, rather than owned by individual households (Ruggeri *et al.*, 2013; Mackintosh, 2005). The cost of internet connections remains significantly high for those who cannot afford such basic educational necessities, per se. This basic lack of infrastructure in telecommunications continues to define the e-learning experience of different groups of learners in developing countries.

The second factor is the cost of these technologies. Viable e-learning projects need affordable and low-cost internet access and computer technology as well as low user charges. Final factor is corresponding to the technology, in particular, is the software and interface design. Aspects that are discussed are whether the Learning Management System (LMS) selected supports the chosen learning model and pedagogy and if the software is easy to use (Safie, 2009).

### 1.3. Course Content

Ellaway and Masters (2008) and Idachaba and Idachaba (2012) recommended that e-learning is not merely about the content and delivery of teaching, but is a pedagogical approach that aims to be flexible, engaging and learner-centered undertaking. It is the one that promotes interactions collaboration and communication. With most educational institutions now engaging in e-learning, it is imperative to consider which courses can be delivered wholly online and which are best to adopt a blended model of learning.

Prior to an effective e-learning strategy can be launched, online facilitators and Information Technology (IT) staff must be sentient of the technical tools available to them, how these can play a role to enhancing the learning experience and to review them thoroughly for feasibility and appropriateness. It is indispensable that the availability of technology does not supersede the need for ensuring that it supports effective learning. As in the medical education field, Sandars and Haythornthwaite

(2007) and Idachaba and Idachaba (2012) support this approach and insist that the challenge for medical educators is to be responsive of the new changes and to mull over how the latest technology can be utilized to improve learning, indefinitely.

#### 1.4. Learners's Characteristics

According to Safie (2009), learner motivation is a factor that is frequently discussed in surveys on what affects learners' satisfaction and capacity. Highly motivated learners perform well in most cases whereas non-motivated learners tend to drop out. The relation between motivation and other e-learning factors is rarely elaborated; the reasons for success or failure in the studies are simply referred to as "personal motivation" or "lack of motivation".

Another factor is conflicting priorities, which have to do with the amount of time learners have to and want to, devote to the online courses. Having enough time for learning is an important predictor of a learners learning and retention and those who study more hours are generally more successful in their studies. Learners say they feel stressed and that they have big problems in arrangement of the time for the program due to conflicting priorities with work and family commitments (Idachaba and Idachaba, 2012).

A third concern is the learner's economy and the economic prerequisites for studying. Financial difficulties and lack of learner funding can be a predictor of learner withdrawal. The learner's academic confidence seems to be another good predictor of a learner's success or failure in e-learning courses. According to some research academic factors such as previous academic experience and qualifications are the best predictors of a learner's performance (Albert and Johnson, 2011).

Academic confidence can also be about the learner's self-efficacy, which is the learner's confidence in his or her ability to study and successfully complete the course. The learners also need some technological confidence; just having access to the technology is obviously not enough. The learners also need to have the necessary computer skills and feel confident in using computers (Piette *et al.*, 2012). Lack of experience with computers can be a major hindrance for learning especially for learners who are entirely new to computers whereas computer confidence accounts for much of the predictive power of good achievements (Piette *et al.*, 2012).

Finally, learner age and gender are factors reported to make a difference in their progress (Ruggeri *et al.*, 2013; Kuhlen and Michels, 2006). A further aspect, not directly related to the learner's personal, which has an impact on

the learners performance is the home environment. A stable and supportive study environment affect e-learning to a very large extent and some research even suggest that this is the most important factor influencing drop out and retention (Piette *et al.*, 2012). Social support can be about the time and help the learner get from family and friends but also about the attitudes on studying in itself; being told it is good to study and not having family members complaining about the learner neglecting other duties.

#### 1.5. Research Problem

The inability of the healthcare sector in developing countries to get the benefit of e-learning has hindered many healthcare workforces from achieving further studies and enhancing their knowledge. Most of the healthcare sectors in developing countries have common challenges such as lack of infrastructure, resources, awareness and mindset change, which in turn become major impediment for the implementation of e-learning. Scarcity of human resources in healthcare sector is a serious challenge in developing countries. Therefore, finding effective learning methods to produce qualified healthcare workforce is an urgent need in order to address healthcare delivery challenges in these countries. For this, The United Nations University International Institute for Global Health (UNU-IIGH) has begun by initiating its own strategic e-learning training portal as part of the human capital capacity building program.

#### 1.6. Significance of the Study

The overall objective of e-learning is to facilitate learning and prevail over barriers in terms of time and space. Among advantages of e-learning for health workforce which allows healthcare workforce to upgrade their skills at anticipated times, without having to leave their workplace, ability to gain easy access to learning resources, flexible learning patterns, facilitating the exchange of experiences among healthcare workforce and provides them with a resource effective learning platform.

#### 1.7. Approach

In response to these learning trends and challenges, UNU-IIGH has developed an interactive e-learning course, entitled "Open Source Healthcare Information Systems for Healthcare Workforce in Developing Countries". Many developing countries are experimenting with open source software and the phenomenon is on the rise. These interesting developments are varied and cover the management of

general and multi-disciplinary medical records, as well as more specialized information systems such as pharmacy information systems.

The overall objective of this e-learning course is to empower healthcare workforce or workers to recognize the potential of open source healthcare information system and to make innovative use of these tools to improve efficiency and effectiveness of their work. The e-learning course has a robust collaborative nature, consisting of activities such as wiki, blog and threaded discussion to facilitate learning.

Online facilitators guide learners through their learning experience, including facilitating collaborative task and knowledge exchange right through the course. Lastly, in order for them to get the certificate of attendance, learners need to sit for a multiple objectives test in order to assess their understanding of the course.

## 2. MATERIALS AND METHODS

A structured survey has been administered to all UNU-IGH learners in late 2012. Demographic data of the students was extracted and analysed. A descriptive analysis approach is utilised accordingly.

## 3. RESULTS

UNU-IIGH utilizes Moodle as a file and information repository for learners and instructors. Moodle is an open source e-learning platform which is a cost effective way to introduce e-learning strategies into an institution, especially those that are financially limited. Moodle supports the Web 2.0 approach of supporting interaction and collaborative construction of content.

Learners are enrolled into interactive modules where they can download curriculum materials, instant message facilitators or other learners, interact in daily discussion board sessions and download or stream RSS podcast recordings of each lecture. Calendar informs learners of live lecture times. Live teaching software is integrated into the Moodle platform allowing a synchronous and asynchronous approach such as discussion board interaction with other learners and the instructor. The welcoming page of the online course is projected in **Fig. 1**.

The online course approaches to learning and teaching promote the value of learner discussions and collaborative working. Several communication modes are offered in, giving more flexibility in the methods they choose to communicate with online facilitators and peer. For example, direct email, the 'Announcement and News', asynchronous and synchronous discussion forums.

Individual contributions to these discussions can be integrated into both summative and formative assessment and can give the online facilitators valuable

feedback on how they are progressing. One interesting observation with discussion forums is that unlike face-to-face discussion, the learner tends to think and reflect more upon statements presented as shown in **Fig. 2**.

Rather than direct commenting so to speak as often occurs in face-to-face discussion, the learner has more time to think and reflect carefully upon the comments that they would like to contribute and hence discussion tends to be of a higher quality.

The UNU-IIGH e-learning course is composed of ten modules which are divided into ten weeks, for a total of one hundred learning hours, covering open source software development concepts, knowledge tools, methods and techniques. Mainly, there are ten (10) modules describes in **Table 1**.

### 3.1. Demographic Outcomes

Since the launching of UNU-IIGH learning portal in June 2010, a total number of eighty-two (82) learners were participated from around the world.

### 3.2. Geographical Region

The following data reflected the learner population across geographical regions is shown in **Table 2**. Asian region represents the highest learners enrolled in the online course with 44% followed by African region with 25.6%. European learners tag along with a percentage of 12.2%. As for both North and South America continents, the learner percentages are 6.1 and 7.3%. Finally, both Oceania and Caribbean regions represented by 2.4% of the total number of learner population.

### 3.3. Economic Status

In term of country economic status, the breakdown of both developed and developing countries are shown in **Table 3**. Sixty three (63) of them are coming from developing countries while only nineteen (19) learners originated from developed countries.

### 3.4. Profession

The learners were grouped into four categories of professions, namely healthcare sector, information technology sector, academia sector and others. Medical doctor, dentist and nurses belong to the healthcare sector. System analyst, programmer and software developers were grouped in the information technology sector.

Profession such as lecturer, researchers and post-graduate fall in the academia segment. Finally, profession such as economist, lawyer and sociologist were segmented in others group. 30% of the derived from healthcare sector while 26% were from information technology segment. Academic area contributed 29.4% of the whole profession and finally 14.6% comes from others sector. **Table 4** projected the profession of the learners.



Fig. 1. Main page

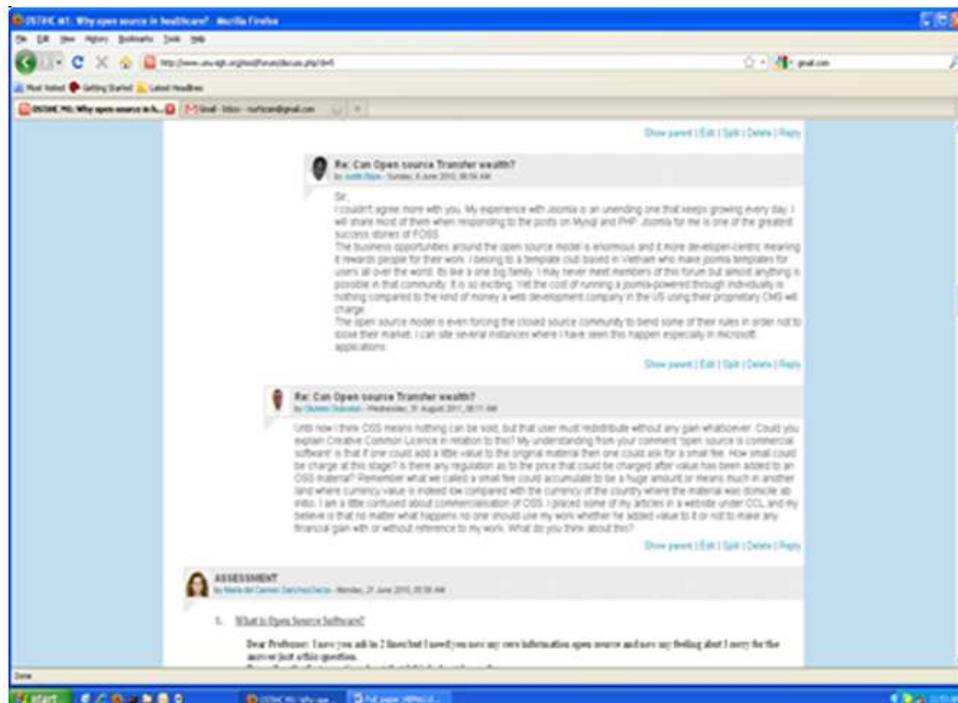


Fig. 2. Threaded discussion

**Table 1.** Module description

<p><b>Module One: Foundation of Open Source Health Information Systems</b></p> <p>Introduce learners to the concept, philosophy and historical background of open source software. The module brings together current advanced topics in strategic management and project management into a digestible and coherent framework of open source health information systems planning and implementation.</p> <p><b>Module Two: Managing Open Source Information Systems Project</b></p> <p>Introduces the theory and practice of project management, presenting a comprehensive, integrated perspective of the many concepts, skills, tools and techniques involved in healthcare information systems project management.</p> <p><b>Module Three: Installation and Initial Setups</b></p> <p>The module teaches the learners on the installation, configuration and creating a database for the open source systems.</p> <p><b>Module Four: Patient Management</b></p> <p>The module will teach the learners the patient master index which holds patient demographic, registration and admission management.</p> <p><b>Module Five: Financial Management</b></p> <p>Learners will be taught the account receivable and account payable, cash management, services tax and general ledgers.</p> <p><b>Module Six: Pharmacy Information Systems</b></p> <p>In this module, learners shall learn on the fully-integrated pharmacy information system that provides access to all vital pharmacy functions and supports a wide variety of practice settings.</p> <p><b>Module Seven: Laboratory Information Systems</b></p> <p>The module introduces the concept of a laboratory information system which receives, processes and stores information generated by medical laboratory processes. Learners will learn to configure the system with other application by using a wide variety of laboratory workflow models</p> <p><b>Module Eight: Radiology Information Systems</b></p> <p>In this module, learners will learn the radiology information system which is a computerized repository to store, manipulate and distribute patient radiological data and imagery. Learners will learn the patient tracking and scheduling, result reporting and image tracking capabilities.</p> <p><b>Module Nine: Pathological Information Systems</b></p> <p>The module introduces learners to the full-service solution capable of handling pathological needs such as hematology, chemistry, immunology, blood bank (Donor and Transfusion Management), pathology, anatomical pathology and microbiology</p> <p><b>Module Ten: Mini Project</b></p> <p>Learners shall learn how to develop new healthcare module as well as to integrate with other modules. They will learn how to install and integrate with current information system as well.</p>
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**Table 2.** Geographical regions

Geographical regions	Learner population	Percentage of learner
Asia	36	44.0
Africa	21	25.6
Europe	10	12.2
North America	5	6.1
South America	6	7.3
Oceania	2	2.4
Caribbean	2	2.4
Total	82	100.0

**Table 3.** Economic status

Country economic status	Learner population	Percentage of learner
Developing countries	63	77
Developed countries	19	23
Total	82	100

**Table 4.** Profession

Profession	Learner population	Percentage of learner
Healthcare	25	30.0
Information technology	21	26.0
Academic	24	29.4
Others	12	14.6
Total	82	100.0

**Table 5.** Gender

Gender	Learner population	Percentage of learner
Male	71	87
Female	11	13
Total	82	100

**Table 6.** Academic qualification

Qualification	Learner population	Percentage of learner
Post-graduate	12	14.6
Degree	65	79.4
High school/diploma	5	6.0
Total	82	100.0

**Table 7.** Information technology skills

IT Skills	Learner population	Percentage of learner
With IT skills	17	21
No IT skills	65	79
Total	82	100

### 3.5. Gender

In terms of gender, seventy one (71) of the learners were male and there were only eleven (11) women attended the online course as reflected in **Table 5**.

### 3.6. Academic Qualification

In term of academic qualification, **Table 6** showed that more than eighty percents or sixty five (65) learners were degree holders, twelve of them holding post-graduate degrees and only five (5) of them holding diploma or high school leavers.

### 3.7. Information Technology (IT) Skills

Finally, in term of Information Technology skills among them, majority of the learners (79%) do not possess any Information Technology skills as projected in **Table 7**.

## 4. DISCUSSION

From the present enrollment of the learners reveals that there is a serious need to expand educational opportunities while putting into operation methods to develop the quality of knowledge and skills which healthcare workforce acquire. e-learning is one of the effective strategies to attend to such issues. It is equally vital to expand the opportunities for continuing lifelong learning to update knowledge and skills of healthcare workforce.

The selective use of e-learning as part of a blended learning facilitates them to connect with high quality facilitator in both real time and asynchronous learning events. As technologies become more extensively accessible at reasonable cost and as healthcare providers work collaboratively to tackle infrastructure challenges, the use of such technologies in healthcare education will become more pervasive. Technology has been efficiently used to provide learning material, improve communication and administration.

Demographic factors such as level of academic qualification, gender, economic status and profession are major factors in understanding and appreciating e-learning. 77% of the learners are healthcare workforce from developing countries. This statistics shows the e-learning endeavor is definitely on the right track. It is supposed that learners with high levels and strong educational back grounds have a broader knowledge on the use of IT and its advantages on gaining scholastic attainment. They are projected to be more computer literate which makes it easy for them to delve into the Internet. Also, learners with higher level of education tend to update their knowledge and information that can effortlessly be acquired from e-learning.

For example, rather than go to the library to search about a new topic, they just make use of the online library. Consequently, e-learning for them is effectual. Results show that gender is a key in appreciating e-learning. Safie (2009) indicated that those female learners come to the class with less computer experience than the male learners. This matter is a demonstration in the society where a small number of women entering technology fields in university. Few women are also observed working in computer-related jobs beyond the data-entry work in hospitals. In the class, female learners make up only a small percentage. As discussed by Safie (2009), it also found that only 17% of advanced learners in computer science were females in while the rest were males.

Males usually utilize the computers for programming and problem solving while women tend to use them for word processing alone. Additionally, male learners also have more experience with computers outside of the university, which develop their self-confidence and positive attitudes about computers. Consequently, men are the ones who will most probably appreciate e-learning and learn new knowledge from it since they are more attracted in technology. While there are no specific studies that may support such supposition but one central finding demonstrated that women favor working in a group than working alone. This may entail that women are more contented learning in a classroom environment where interaction with the online facilitator and other learners can be subjected to.

This study may open the method for upgrading the methods of instruction being used today. e-learning for healthcare workforce can be collaborated with the traditional method, which is classroom-based to facilitate teaching. The finding from the present work may afford reference of background knowledge for future studies on exploring the effectiveness of e-learning for healthcare workforce and its effects on other areas such as

employment, training and development, balanced work life and sustainable socio-economy.

Results of this study also demonstrate that e-learning is an effective tool in healthcare workforce training and development. One way or another, it has positive effect on the learning process of learner. It can in fact provide supplementary and updated knowledge that may not be acquired in a traditional classroom-based instruction. The effect of e-learning may be extended to other sectors like in professional pharmacy field. Indeed, e-learning presents prospective benefits for healthcare workforce. It offers flexibility since it can effortlessly be accessed anytime and anywhere. It also expands accessibility to learning opportunities through internet access. Information literacy like related facts on medical and healthcare work, writing and presentation skills can be obtained. It also brings an improved motivation and engagement through the new things to be learned.

Though e-learning, healthcare workforce can easily access, monitor and record their learning progress. Hence, this will make them aware of the strengths and weakness they have and what they will need to have a strong background in healthcare (Islam *et al.*, 2011). Realizing the positive effects that e-learning offers, UNU-IIGH may consider into the need of improving the training for healthcare workforce in developing countries. e-learning can be integrated in the trainings. If properly executed, the method can be an effective tool to support learning as a collaborative, collective and social experience. In addition, this study highlights the necessity for the healthcare workforce to be computer-literate and interested with the latest advancement in healthcare related technology.

This effort will in some way improve their healthcare knowledge and acquire their critical thinking skills that will nurture their active involvement in rendering service to the community they work for. One principal interpretation result of the study is about the technical barriers that women may face. They are considered as not much appealed in learning new technology. This effect may create awareness on the empowerment of women in terms of education and employment. In healthcare, the use of IT and its applications indisputably facilitates in absorbing the lessons and solving numbers related problems. Hence, it is de rigueur that women are computer-literate to take advantage of the updated information that can be acquired online. Having a strong background in IT will help them to get a better-paid job. This advantage will also transform them into competitive individuals in the workforce.

Improving accessibility to healthcare learning and knowledge transfer is an important way to address expertise issues in the healthcare sector of developing countries. There is increasing evidence for effective use of e-learning in healthcare education in developing countries (Chhibber, 2004; Wautier *et al.*, 2005). New and advancing technologies provide huge opportunities for healthcare workforce of developing countries to engage in exciting and innovative e-learning experiences for their benefits. Limited access to information technology devices, reliability and speed of the infrastructure may mean that healthcare professional of developing countries may have fewer opportunities available to them than their counterparts in more developed countries.

## 5. CONCLUSION

Evidently, UNU-IIGH envisions that healthcare delivery organizations and health authorities worldwide are increasingly turning to technological innovations to improve patient care, reduce costs and incorporate measures to comply with laws and regulations. These factors clearly increase the demand for professionals with specialized technical knowledge and skills of health informatics in the healthcare services and industry.

Finally, this is the huge benefit of e-learning, in that tomorrow's healthcare workforce of developing countries will be true "digital natives", working to care for patients, providing access to screening, preventive care and medical treatment delivered in new ways by healthcare workforce who are familiar and confident in using a range of open source technologies as part of their everyday practice.

## 6. REFERENCES

- Albert, L.J. and C.S. Johnson, 2011. Socioeconomic status- and gender-based differences in students' perceptions of e-learning systems. *Dec. Sci. J. Innov. Educ.*, 9: 421-436. DOI: 10.1111/j.1540-4609.2011.00320.x
- Cantoni, V., M. Cellario and M. Porta, 2004. Perspectives and challenges in e-learning: Towards natural interaction paradigms. *J. Visual Lang. Comput.*, 15: 333-345. DOI: 10.1016/j.jvlc.2003.10.002
- Chen, S., A. Cheng and K. Mehta, 2013. A review of telemedicine business models. *Telemedicine e-Health*, 19: 287-297. DOI: 10.1089/tmj.2012.0172

- Chhibber, N., 2004. Enhancing developmental opportunities by promoting ICT use: Vision for rural India. *J. E-Govt. Policy*, 27: 190-196.
- Eklund, J., M. Kay and H.M. Lynch, 2003. E-learning: Emerging issues and key trends: A discussion paper. Australian Flexible Learning Framework.
- Ellaway, R. and K. Masters, 2008. AMEE Guide 32: e-Learning in medical education Part 1: Learning, teaching and assessment. *Med. Teach.*, 30: 455-473. DOI: 10.1080/01421590802108331
- Evans, R., 2005. Explaining low learner participation during interactive television instruction in a developing country context. Ph.D. Thesis, University of Pretoria.
- Idachaba, F.E. and E.M. Idachaba, 2012. Robust e-health communication architecture for rural communities in developing countries. *Eng. Technol. Applied Sci. Res.*, 2: 237-237.
- Islam, M.A., N.A.A. Rahim and T.C. Liang, 2011. Effect of demographic factors on e-learning effectiveness in a higher learning institution in Malaysia. *Int. Educ. Stud.*, 4: 112-121.
- Karamanis, V., P. Zaharias and A. Poulymenakou, 2004. Instructional strategy for designing e-learning courses for adult learners. *Proceedings of the World Conference on Educational Multimedia, Hypermedia and Telecommunications, (HT' 04)*, Chesapeake, VA., pp: 3909-3914.
- Kruse, K., 2004. The benefits and drawbacks of e-learning. article in e-learning.
- Kuhlen, R. and D. Michels, 2006. Collaborative e-learning-an opportunity to identify and to overcome gender barriers. University of Konstanz, Germany.
- Mackintosh, W., 2005. Can You Lead From Behind? Critical Reflections on the Rhetoric of E-Learning, Open Distance Learning and ICT for Development in Sub-Saharan Africa (SSA). In: *Global Perspectives on E-Learning: Rhetoric and Reality*, Carr-Chellman, A.A. (Ed.), Sage Publications, ISBN-10: 1412904889, pp: 222-240.
- Piette, J.D., K.C. Lun, L.A. Moura Jr, Fraser, H.S. Michael and P.N. Powell *et al.*, 2012. Impacts of e-health on the outcomes of care in low- and middle-income countries: where do we go from here? *Bull. World Health Organ.*, 90: 365-372. DOI: 10.2471/BLT.11.099069
- Rajesh, M., 2003. A study of the problems associated with ICT adaptability in developing countries in the context of distance education. Indira Gandhi National Open University, Haryana-India.
- Ruggeri, K., C. Farrington and C. Brayne, 2013. A global model for effective use and evaluation of e-learning in health. *Telemed. J. E Health*, 19: 312-321. DOI: 10.1089/tmj.2012.0175
- Safie, N., 2009. An investigation on the relationship between e-learning usability attributes towards motivation to learn. Unpublished Doctoral Thesis, International Islamic University Malaysia.
- Sanders, J. and C. Haythornthwaite, 2007. New horizons for e-learning in medical education: Ecological and Web 2.0 perspectives. *Med. Teach.*, 29: 307-310. PMID: 17786742
- Sehrt, M., 2003. Digital divide into digital opportunities: E-learning in the developing countries. *UN Chronicle Online*, 4: 3-45.
- Vrasidas, C., 2004. Issues of pedagogy and design in e-learning systems. *Proceedings of the ACM Symposium on Applied Computing*, Mar. 14-17, ACM Press, New York, pp: 911-915. DOI: 10.1145/967900.968086
- Wautier, J.L., F. Vileyn and J.J. Lefrere, 2005. Electronic learning: Interactive learning in medicine or Socrates in electronic guise. *Transfus. Clin. Biol.*, 12: 150-152. PMID: 15894500
- Zhang, D., J. Zhao, L. Zhou and J.F. Nunamaker, 2004. Can e-learning replace classroom learning? *Commun. ACM*, 47: 75-79. DOI: 10.1145/986213.986216