

## SPECIAL ARTICLE

## ELECTRONIC LEARNING AND OPEN EDUCATIONAL RESOURCES IN THE HEALTH SCIENCES IN GHANA

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## SUMMARY

**Objectives:** To determine whether a group of Ghanaian students are able to easily use electronic learning material and whether they perceive this method of learning as acceptable.

**Setting:** The University of Ghana Medical School (UGMS) and the School of Medical Sciences (SMS), Kwame Nkrumah University of Science and Technology (KNUST)

**Participants:** One hundred and fifty third year medical students at SMS and nineteen fifth year medical students at UGMS

**Methods:** Two e-learning materials were developed, one on the polymerase chain reaction and the other on total abdominal hysterectomy and these were distributed to selected medical students. Two weeks after the distribution of the programmes, a one-page, self-administered questionnaire was distributed to the target groups of students at the two institutions.

**Results:** Ninety three percent (139) of respondents at KNUST and 95% (18) at UG report having access to a computer for learning purposes. All of the UG students viewed the TAH programme; 82% (130) of the KNUST students viewed the PCR animations. All students who viewed the programmes at both institutions indicated that the e-learning pro-programmes were “more effective” in comparison to other methods of learning.

**Conclusion:** Computer ownership or availability at both medical schools is sufficient to permit the distribution and viewing of e-learning materials by students and the medical students considered both programmes to be very helpful.

**Keywords:** E-learning, open educational resource, health sciences, Ghana

## INTRODUCTION

The training of health professionals in Ghana has not kept up with the increasing needs of the population. There are currently 2,442 physicians practicing in the country resulting in a physician density of slightly more than 1 physician per 10,000.<sup>1,2</sup> Densities for nurses, midwives, and community health workers are similarly inadequate, and the shortage of health manpower at all levels is considered to be a major contributor to higher mortality rates and to inadequate provision of health care services.<sup>3,4</sup> As in other Sub-Saharan Africa nations, the emigration of locally-trained health professionals to industrialized nations has substantially aggravated the health infrastructure problem.<sup>5-8</sup>

Ghanaian health science colleges are struggling to keep pace with the increasing demand for new graduates and the loss of human resources by “brain drain.” However, our universities are burdened by class sizes that strain the available resources for competent teachers, space, and learning resources. As one possible strategy to ameliorate this crisis, two Ghanaian health science colleges have joined in a consortium with the University of Cape Town (RSA), the University of the Western Cape (RSA), and the University of Michigan (USA) to adopt two new paradigms in health education efforts – electronic learning (e-learning) and open educational resources (OER).

E-learning involves the conversion of selected aspects of scientific or clinical training to a multimedia format that can be viewed on any recent generation of laptop or desktop computer. The programmes consist of interactive text, lectures, photographs, videos, or animations, all of which have been designed, executed, and produced by Ghanaian faculty members during the past 18 months.

The programmes focus on curricular subjects that faculty members have deemed especially problematic to deliver. E-learning has been shown to be an effective method for imparting some elements of the health science curriculum in other regions of the world.<sup>9-11</sup> While acknowledging that certain aspects of training are still best delivered by direct faculty-learner interaction and patient-based experiences, authoritative reviews of e-learning experience in the health sciences conclude that this modality is at least as effective as most other methods for delivering knowledge content.<sup>12,13</sup>

Locally-developed e-learning materials could have some advantages over traditional learning. These materials may: 1) be targeted to supplement elements in current curriculum that are particularly difficult to learn using current methods; 2) relieve students of the pressure to absorb information imparted in one traditional lecture by allowing them to review important concepts as often as necessary; 3) supplement a relative lack of personally-owned textbooks or library print resources in certain subject areas; 4) make some procedural demonstrations easier to appreciate when traditional teaching to very large groups may make them difficult to see clearly; and 5) improve the understanding of complex biochemical or physiological processes with sequenced images or animations.

For faculty members, e-learning may: 1) reduce the amount of repetition of lectures to multiple groups of learners; 2) make lectures more efficient; and 3) improve the quality of contact time with learners, who will have already acquired some familiarity with the assigned content via e-learning. Finally, e-learning materials of high quality may be transportable and used in different educational contexts or in different institutions. Since this type of instructional material is easily shared, the best examples can be adapted wherever they are needed, across levels of training from novices to post-graduates, and even across international boundaries.

Clearly, all of these assertions need to be examined and confirmed by educational research in Ghana. So, to begin this assessment, a series of targeted e-learning programmes were produced for use in various elements of the health science curricula (Table 1).

The programmes are web-based modules that consist of interactive cases, videos, and animations. Since they use HTML programming, the common language of the internet, they can be viewed on all computers that have a web browser such as Internet Explorer or Firefox installed. The programme files are relatively small so that the entire programme (website) can be copied onto disks or pen drives and be distributed to personal computers where they can be viewed without a connection to the internet.

To date, the acceptability of two such programmes to our students from our two institutions have been assessed.

## METHODS

At the School of Medical Sciences, Kwame Nkrumah University of Science and Technology (KNUST), two narrated animations that explain the polymerase chain reaction (PCR) were distributed to 3rd-year students enrolled in Human Biology III (Clinical Microbiology). This topic was chosen, because so many students indicated that they did not fully comprehend this procedure based on other sources, including a lecture. The animations were part of a larger work-in-progress including videos of microbial staining and microscopic procedures and other animations depicting serologic tests

Table 1 Completed E-learning Programmes, by Field of Study (and Institution)

### OB/GYN

Examination of the Pregnant Patient (KNUST)  
Total Abdominal Hysterectomy (UG)  
Caesarean Section (UG)  
Episiotomy and Repair (UG)

### Internal Medicine

Buruli Ulcer (KNUST)  
Sexually-transmitted Diseases (UG)  
Interpretation of Automated Blood Counts (KNUST)  
Clinical Chemistry: Glucose Tolerance Test (KNUST)

### Microbiology

Clinical Cases in Microbiology (KNUST)  
Laboratory Methods in Microbiology (KNUST)  
Introduction to Virology (KNUST)

### Psychiatry

The Mental State Examination (KNUST)

The e-learning programmes were evaluated by students at both medical schools. An anonymous, self-administered questionnaire was distributed to students who received these materials. The questionnaire was designed to assess the students' access to computers, their use of the programmes, and their assessment of the value of the materials.

## RESULTS

Questionnaires were returned by 73% of the target class of 150 students at KNUST and all (100%) of the 19 students who received CDs at UG. Regarding the availability of computers for educational purposes, 93% (139) of respondents at KNUST and 95% (17) at UG reported having access to a computer for learning purposes.

At KNUST, 67% own their own personal computer, and an additional 24% share a computer with another student.

At UG, 17 students (89%) own and one student shares a computer. One-third of the computer owners at KNUST and 16% at UG report using the computer laboratories at school.

All of the UG students viewed the TAH programme; 82% of the KNUST students viewed the PCR animations. Only 4 of the 20 KNUST students who did not view the programme reported that the electronic media could not be played on their computers. In contrast, 98% of those who did view the programme indicated that it was as easy to use as any other programme. Whether the students used the programme at KNUST was not predicted either by their computer ownership or by their past experience with e-learning materials. A majority of the students who used the programme acquired the program either by copying from a circulated master CD or from a friend's copy (i.e., through the "grapevine"); 28% viewed the programme in the computer lab without ever making a copy.

Students at both institutions were asked to rate the usefulness of the respective e-learning programmes using a 0 to 4 point scale; 4 = "extremely helpful," 3 = "helpful," 2 = "neutral," 1 = "not helpful," and 0 = "unnecessary." The average rating for the PCR animations was 3.5; and the average for the TAH videos was 3.6. No student rated either programme as "not helpful" or "unnecessary." And only one KNUST student rated the programme "neutral." In a separate questionnaire item, all students who viewed the programmes at both institutions (100%) indicated that the e-learning programmes were "more effective" in comparison to other methods of learning.

Finally, students were asked to identify the learning modality that most contributed to their understanding of the content material. Options included e-learning materials, lectures, notes or illustrations, textbooks, discussions with peers, or in the case of the TAH, "observing the procedure in the theatre." At KNUST, 87% identify the e-learning animations as the most important contributor to their understanding of PCR. At UG, 11 students (58%) identify the e-learning video program as instrumental in their learning about TAH, whereas 37% identify observing the procedure in the theatre as most important. However, all UG students agreed that the e-learning programme improved their understanding of the procedure when they subsequently observed it in the theatre.

## DISCUSSION

This survey shows that medical students in Ghana have access to computers and are able to effectively use e-learning material, which they find to be very helpful to their learning.

### E-learning activities in the Health Science colleges

Both UG and KNUST are currently engaged in production of additional materials for use in the medical schools and in other health science curricula. Beginning in February 2009, a series of workshops were held at both institutions with the purpose of engaging interested faculty members in these activities and eventually in providing hands-on training with some of the programming tools used to produce e-learning materials. At present, the numbers of engaged faculty are small, but as evidence mounts for the utility of these teaching materials, it is expected that a significant interest will develop throughout the college. At both institutions, technical media specialists have been identified to assist our health science faculty in the ongoing production of these materials.

At UG, this expertise is being provided by the university library and by a specialist who was specifically engaged for these activities. At KNUST, an alliance has been formed between the Health Science College and the College of Art, where Communication Design is taught as part of the undergraduate curriculum. Students and faculty members from this academic unit will be participating in the production of health education materials. Ultimately, many of the materials that are produced may be re-structured as continuing medical education modules for distribution to practicing physicians in Ghana or elsewhere.

### Open Educational Resources (OER)

Unlike printed textbooks and other fixed learning resources, the power of an electronic educational resource lies in its ability to be distributed at little or no cost via the internet or on simple storage formats, such as pen drives or CDs. This allows for formal education to leave the classroom without becoming less personalised or effective.

The two institutions agreed not to restrict the flow of the locally produced educational materials but to disseminate these using electronic media. The free dissemination of learning material is the principle behind the concept of open educational resources (OER).<sup>14</sup>

Open Educational Resources are learning materials that are free for personal use, distribution, and modification. The copyright of the materials will remain with the Ghanaian institutions and the authors; however, materials are to be made available under the terms of a Creative Commons license.<sup>15</sup>

All of these licenses allow for secondary distribution and modification of the materials for use by individuals or in other educational institutions, but there may be conditions of use imposed by the copyright holders which are posted clearly within the electronic content.

These conditions may include 1) attribution to the original source of the materials in any redistributed version of the work; 2) redistribution of any modified version of the work under a similar Creative Commons license, or 3) a restriction on the re-use of the materials for commercial purposes, i.e., selling the content. Any combination of these conditions may appear on the work, depending on the Creative Commons license that appears on the title page of the programme.

Both UG and KNUST have drafted institutional policies that will permit and endorse the distribution of e-learning materials as OER. The policy will include mechanisms for peer-review of e-learning materials and academic credit to faculty members who produce them. Our two Ghanaian institutions are already engaged with two universities in South Africa and with the University of Michigan in the USA in an active exchange of ideas and learning materials through the auspices of a grant from the William and Flora Hewlett Foundation. The authors are confident that by freely sharing educational resources with minimal constraint on their use, this example will motivate other African institutions of higher learning to do the same. It is hoped that building a network of like-minded faculty members and institutions who share educational resources on a continental level will enhance education both in Ghana and elsewhere.

## CONCLUSIONS

1. Computer ownership or availability at both medical schools is sufficient to permit the distribution and viewing of e-learning materials by students.
2. Students considered both programmes to be very helpful.
3. KNUST students thought that the PCR narrated animations were the most important element contributing to their understanding of the process.
4. The TAH video programme added value to the OBS-GYNAE clerkship at UG. Most students reported having acquired a better understanding of the procedure from the e-learning programme than from viewing the surgery in the theatre.

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