

# A Systems Approach to Implementation of eLearning in Medical Education: Five MEPI Schools' Journeys

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## Abstract

How should eLearning be implemented in resource-constrained settings? The introduction of eLearning at four African medical schools and one school of pharmacy, all part of the Medical Education Partnership Initiative (MEPI) eLearning Technical Working Group, highlighted

the need for five factors essential for successful and sustainable implementation: institutional support; faculty engagement; student engagement; technical expertise; and infrastructure and support systems. All five MEPI schools reported strengthening technical expertise, infrastructure, and

support systems; four schools indicated that they were also successful in developing student engagement; and three reported making good progress in building institutional support. Faculty engagement was the one core component that all five schools needed to enhance.

**T**his paper describes the experiences in implementing eLearning at Addis Ababa University, Kilimanjaro Christian Medical University College, University of Botswana, University of KwaZulu-Natal, and University of Zimbabwe—all participants in the Medical Education Partnership Initiative (MEPI) eLearning Technical Working Group.<sup>1</sup> In the case of eLearning implementation, the core components to be addressed are institutional support, faculty engagement, student engagement, technical expertise, and infrastructure and support systems.<sup>2</sup> These core components are essential, at both the macro and micro levels of decision making, to ensure sustainable implementation.<sup>2</sup> In Table 1 we provide a brief description of each school's main objective for implementing eLearning. Two common objectives were to increase the number of trained health care workers and to enhance the quality of the training. Because of the shortage of faculty, all five schools implemented eLearning solutions that offered faculty and students flexibility in accessing and reusing digital resources. For example, all schools invested in learning management

systems (LMS) as hubs for the online distribution of digital resources and their use within courses.

Central to the eLearning approach, described through the journeys of the five schools, is sustainability. Sustainable eLearning solutions require institutional buy-in, adequate infrastructure and support systems for faculty and students, and technical expertise to maintain stability and innovate to fully engage students and faculty. These components form a networked system that enables long-term sustainability. Much like any system, for the entire eLearning system to remain healthy, each component has to be supported. In the following section, each school describes how its eLearning system was formed and is being supported.

## Implementation of eLearning

### Addis Ababa University

To ensure an adequate supply of skilled health care providers in the country, the government of Ethiopia has emphasized enhancing the quality and efficiency of medical education through the use of appropriate information and communications technologies (ICT).<sup>3</sup> Within this policy framework, the MEPI-Ethiopia consortium was created in 2010 to better address the expansion of health service training.<sup>4</sup> In addition to Addis Ababa University (AAU), other members of the MEPI-Ethiopia consortium include Hawassa University, Haramaya University, and the Defense College of Health

Science. Given the government's mandate and a drastic leap in medical school enrollment nationwide, there was strong institutional support for implementing a robust eLearning solution. A full range of ICT tools and services were put in place at AAU to support and promote self-learning, create learning opportunities for large numbers of students on- and off-campus, and alleviate resource limitations of faculty and students.<sup>4</sup>

Keeping in mind that the eLearning implementation needed to serve all MEPI-Ethiopia consortium members, a key consideration was the existing expertise of ICT staff at AAU. Therefore, before selecting an LMS, the MEPI project office inventoried the internal technical expertise at AAU, and the Modular Object-Oriented Dynamic Learning Environment (Moodle)<sup>5</sup> was adopted as the LMS for MEPI-Ethiopia. To ensure smooth implementation of a sustainable eLearning program, AAU's ICT infrastructure was expanded to include a laptop loan service and the dispensing of tablet computers loaded with textbooks to incoming medical students.

Another major component of the MEPI-Ethiopia eLearning implementation was faculty and student engagement. An eLearning steering committee was established, composed of faculty from different disciplines and ICT personnel, to enhance two-way communication concerning the use and benefits of these technologies. Training workshops on

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Table 1

**Medical Education Partnership Initiative Schools' Objectives for Implementing eLearning (in Addition to Overcoming Faculty Shortages and Limited Infrastructure)**

| School                                                            | Main objective                                                                                                                                             |
|-------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Addis Ababa University School of Medicine                         | To create access to self-learning opportunities and resources to train a cadre of doctors and other health care workers in sufficient quality and quantity |
| Kilimanjaro Christian Medical University College                  | To increase access to learning opportunities to enhance the quality of teaching and learning                                                               |
| University of Botswana School of Medicine                         | To provide access to clinical and learning resources, support collaboration and communication, and enhance active and engaged learning                     |
| University of KwaZulu-Natal Discipline of Pharmaceutical Sciences | To increase postgraduate intake and throughput in the health sciences fields, especially in pharmacy                                                       |
| University of Zimbabwe College of Health Sciences                 | To promote high-quality education, better research capacity, and increased student intake                                                                  |

Moodle, instructional design, and use of the E-library platform eGranary were also held, and additional ICT support personnel were hired. The workshops enhanced the faculty and student skills in using the technologies; however, they also served as a means to engage faculty and students in conversations about their own specific instructional needs.

There are ongoing challenges to scaling up the eLearning program within the MEPI-Ethiopia consortium schools. Challenges include the varying degrees of infrastructure and ICT expertise within each school, faculty resistance to committing more time to the development of course content, and the absence of institutional eLearning policies. A consortium-level eLearning strategic plan is under development to address these challenges and operationalize the rollout of the eLearning program to all medical schools in the consortium.

**Kilimanjaro Christian Medical University College**

The adoption of eLearning at Kilimanjaro Christian Medical University (KCMU) College was undertaken primarily to address the demand of increasing student enrollment, which was outpacing faculty recruitment. Within this context and working closely with Duke University School of Medicine (DUSOM), the KCMU College–MEPI program conducted an analysis of different software that led to the selection of the Learning Content Management System (LCMS+) <sup>6</sup> which has been used for more than five years

by DUSOM and other medical schools in the United States and Singapore. The installation of LCMS+ at KCMU College in 2010 was accompanied by the renovation and expansion of student and faculty computer labs, and installation of campus-wide wireless Internet, audiovisual systems in lecture classrooms and wet laboratories, and a videoconferencing system. <sup>7</sup> Close cooperation of the ICT and LMS technical experts, including specialized training at DUSOM, resulted in LCMS+ becoming operational in June 2011. Since then, LCMS+ has been introduced to three consecutive classes of first-year students who also have been issued tablet computers to facilitate learning outside the classroom. Regular LCMS+ training and refreshers have been offered to the faculty and students. There were initial concerns that limited student and faculty ICT literacy would place extra burdens on the college's support staff, but training programs quickly brought faculty and staff up to speed.

Implementing LCMS+ as a hub for eLearning not only improved communications and organization within the college but also encouraged faculty engagement—for example, other faculties and programs at the college have asked to also use LCMS+. Although encouraging, this unintended development points to the need to make sure that implemented processes continue to be efficient as more departments seek to use them.

Besides being a method to distribute learning materials, LCMS+ has become the

obligatory examination platform for first- and second-year medical students and is now expanding to include third-year students. This has resulted in a substantial reduction in the workload of grading examinations for faculty. National Board of Medical Examiners exams are also given via LCMS+, which makes KCMU College the first in Africa to successfully administer these exams electronically.

**University of Botswana School of Medicine**

The University of Botswana School of Medicine was established in 2009 within a university that had already invested heavily in eLearning infrastructure and support systems. <sup>8</sup> Taking advantage of the university's existing ICT infrastructure and expertise, the school used MEPI funds starting in 2012 to bring additional technologies to the medical school. These included Internet access to off-campus clinical sites, tablets, video conferencing, interactive whiteboards, and clickers. The most significant investments were made at the clinical sites, where, in addition to technology, there was a need to outfit learning spaces with furniture and other teaching and learning tools. In addition, in collaboration with the university library, smaller libraries have been outfitted at three of the clinical sites where MEPI funds were used to provide computers and furniture.

The medical school employs a problem-based learning (PBL) <sup>9</sup> curriculum that includes elements of rural, community-based, and socially accountable training. As such, the school has selected technologies that have clear pedagogical benefits of supporting and enhancing the teaching and learning processes. The nature of the PBL curriculum drives the focus of the eLearning applications being implemented at the medical school by using technologies that enhance collaborative communication across dispersed sites, support active engaged learning, and provide easy and reliable access to information.

Ongoing training and support ensure that students and faculty realize the benefits of the adopted instructional technologies. Despite challenges inherent in procurement and insufficient support staff for the medical school itself, significant progress has been made in the implementation of eLearning projects since 2011.

## University of KwaZulu-Natal

As part of its strategy to become a research-led institution, the University of KwaZulu-Natal (UKZN) is striving to increase its postgraduate student intake by doubling the number of students in the programs.<sup>10</sup> UKZN-MEPI had also made postgraduate recruitment one of its key objectives. The Discipline of Pharmaceutical Sciences (one of the UKZN-MEPI subsections) faced a particular challenge: Because of the scarcity of pharmacists in the country, most of its graduates were in high demand in industry. These graduates were also well paid and therefore not inclined after a year of internship and another year of community service to return for postgraduate studies. Also, a large portion of them were the first graduates in their families, and their earnings supported other family members. With advances in eLearning, it became possible to offer these graduates additional training through distance learning. This allowed the students to participate in further studies without leaving their jobs, thus fitting the studies into their own schedules.

The ICT division of the university was already investigating eLearning systems when the pharmacy discipline began to consider similar implementation efforts in their programs. Like other African schools, we selected Moodle for our LMS, and we purchased a new server to host it. The university had a good ICT infrastructure and support system in place, thus allowing training for the academic staff in Moodle to be offered centrally. Even though institutional support and our eLearning implementation are closely connected, not only in regard to the infrastructure and support systems but also in relation to faculty engagement, uptake was still slow, as academic staff were not inclined to learn something new.

Despite this, we saw eLearning as an opportunity to meet the postgraduate enrollment targets. Online master of pharmacy and master of health sciences programs were developed and approved by the relevant internal and external structures, and implemented in 2011. All aspects of the programs were taught and assessed online using Moodle. The implementation of the online programs was opportune. The university was moving toward online registration of

students, which facilitated registration for this program. Several needs were identified during this time, such as (1) to develop an online password portal so students could change their passwords remotely, (2) to further develop online book resources and an online orientation student guide, and (3) to offer resources to students who were now required to use computers, access the Internet, and use word processing programs at home or at work. Through eLearning, these systems could be developed and improved.

Although our short-term goal was to assess the acceptability and uptake of the online master's program, our long-term goal was to increase postgraduate intake and throughput in health sciences fields. The connections that came to exist between ICT expertise, academics, and student engagement have made the online program more robust by creating the necessary support systems (such as improved off-campus library access and online registration systems). The online master of health sciences program has managed to increase the number of streams offered from one in 2011 to five in 2014, indicating that uptake is on the increase.

## University of Zimbabwe College of Health Sciences

The University of Zimbabwe College of Health Sciences (UZCHS) required eLearning to improve the quality of education and increase the number of students. A clear direction and institutional support were both key to informing eLearning implementation decisions. We installed a scalable, low-stakes ICT infrastructure, using high-capacity fiber-optic cable for Internet connectivity and Wi-Fi as the connection medium at the three UZCHS sites (Parirenyatwa Hospital, Harare Central Hospital, and Annexe Psychiatry Unit). Computer labs with desktop computers were also established at these sites. Through the implementation of ICT infrastructure and support systems, the three sites were also interconnected using a virtual private network that enabled access to online and Internet-based resources. More than 1,100 students and faculty members are registered and can access online and Internet-based resources freely.

Increased adoption of ICT services was a short-term goal for faculty engagement.

Scholars involved in the initiative were given laptops to access the network, and five portable multimedia projectors were made available for use during lectures. To meet the long-term goal of having a resilient ICT infrastructure that would meet the eLearning demands of students and faculty, we put strategies in place to increase awareness of the ICT services offered. When examining the usage data, we found that access to online resources over the past two years was high among students but less so by faculty. Faculty uptake is expected to increase in the future as we implement the eLearning strategy and increase faculty development activities.

The UZCHS-MEPI eLearning efforts implemented thus far have concentrated on making connections between the infrastructure and support systems, and engaging students and faculty in accessing digital resources. An enhanced eLearning faculty development program seems to be needed to address the challenges we have faced so far, specifically for faculty ICT literacy skills. However, for sustainability of our eLearning program, it is also important that institutional leaders engage in discussions with key government decision makers around faculty incentives to increase adoption and utilization of the eLearning resources. An example of a key development toward this goal was when the Ministry of Higher Education provided funding to purchase desktops and projectors and increase Internet bandwidth.

## Discussion and Conclusion

Implementing sustainable eLearning solutions for entire programs requires institutional investment for infrastructure, faculty and student support, staff, and time.<sup>2,11,12</sup> It also requires a realization that sustainable eLearning solutions are complex systems and that each core component has to be strong. Table 2 highlights the efforts of each MEPI school in relation to the core components: institutional support, infrastructure and support systems, technical expertise, and faculty and student engagement. The common thread among all schools is the intentional approach they have taken toward establishing sustainable eLearning systems. This intentional approach was guided by key drivers that established the

Table 2

**Efforts Taken by Medical Education Partnership Initiative (MEPI) Schools in Relation to Core Components: Institutional Support, Infrastructure and Support Systems, Technical Expertise, and Faculty and Student Engagement**

| Institutional support                                                                                                                                                  | Infrastructure and support systems                                                                                                                   | Technical expertise                                                                                                                                             | Faculty engagement                                                                                                                                                          | Student engagement                                                                                                                                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Addis Ababa University School of Medicine</b>                                                                                                                       |                                                                                                                                                      |                                                                                                                                                                 |                                                                                                                                                                             |                                                                                                                                                    |
| <b>Key driver: Ethiopian government's priority in increasing the number of health workers trained</b>                                                                  |                                                                                                                                                      |                                                                                                                                                                 |                                                                                                                                                                             |                                                                                                                                                    |
| Due to the drastic leap in enrollment there was strong institutional support for implementing eLearning to serve the MEPI-Ethiopia consortium.                         | A full range of information communication technology tools and services were put in place.                                                           | An eLearning steering committee was established and composed of faculty from different disciplines and ICT personnel to keep the flow of communication two-way. |                                                                                                                                                                             | A student tablet program was initiated and provided to each student; these tablets were loaded with medical textbooks.                             |
| <b>Kilimanjaro Christian Medical University College</b>                                                                                                                |                                                                                                                                                      |                                                                                                                                                                 |                                                                                                                                                                             |                                                                                                                                                    |
| <b>Key driver: Increasing student enrollment, which was outpacing faculty recruitment</b>                                                                              |                                                                                                                                                      |                                                                                                                                                                 |                                                                                                                                                                             |                                                                                                                                                    |
| First university in Africa to successfully administer National Board of Medical Examiners exams; this visibility enabled further investment by the institution itself. | Renovation of computer labs, development of campus-wide wireless Internet, audiovisual systems in lecture classrooms, wet lab, and videoconferencing | User training clearly explaining the applications and the time-saving advantages enabled increased adoption.                                                    | Improved communication and organization within the college enabled the introduction of resource-efficient teaching.                                                         | LCMS+ has become the obligatory examination platform. In addition, students are provided with tablets to be able to access the learning materials. |
| <b>University of Botswana School of Medicine</b>                                                                                                                       |                                                                                                                                                      |                                                                                                                                                                 |                                                                                                                                                                             |                                                                                                                                                    |
| <b>Key driver: PBL curriculum expansion to include rural, community-based, socially accountable training</b>                                                           |                                                                                                                                                      |                                                                                                                                                                 |                                                                                                                                                                             |                                                                                                                                                    |
| Collaboration with University of Botswana Library; four small libraries have been outfitted at all clinical sites.                                                     | Expansion of Internet access at the clinical sites, outfitting of teaching and learning spaces with furniture and instructional technologies         | Intentional in selecting technologies that have clear pedagogical benefits to the curriculum                                                                    | Ongoing and scaffolded training and support (student and faculty engagement) to take advantage of instructional technologies in teaching and learning                       |                                                                                                                                                    |
| <b>University of Kwazulu-Natal</b>                                                                                                                                     |                                                                                                                                                      |                                                                                                                                                                 |                                                                                                                                                                             |                                                                                                                                                    |
| <b>Key driver: To increase postgraduate student intake by doubling the current intake of postgraduates</b>                                                             |                                                                                                                                                      |                                                                                                                                                                 |                                                                                                                                                                             |                                                                                                                                                    |
| Use online systems to recruit students without necessitating leaving their jobs to fit their studies in their own time frames.                                         | University adopted LMS with training offered to support faculty.                                                                                     | Existing expertise at an opportune time in deciding which eLearning system to use                                                                               | All aspects of the program were taught and assessed in a fully online mode using Moodle.                                                                                    | Further develop online book resources and an online orientation guide for the students                                                             |
| <b>University of Zimbabwe College of Health Sciences</b>                                                                                                               |                                                                                                                                                      |                                                                                                                                                                 |                                                                                                                                                                             |                                                                                                                                                    |
| <b>Key driver: To improve the quality of education and increase the number of students</b>                                                                             |                                                                                                                                                      |                                                                                                                                                                 |                                                                                                                                                                             |                                                                                                                                                    |
| Ministry of Higher Education provided funding. Internal institutional support also was robust.                                                                         | Scalable low-stakes ICT infrastructure, with fiber as the backbone, and Wi-Fi as the connection medium at three sites                                | Digital resources implementation and ICT literacy skills training development                                                                                   | Focus has been on increasing awareness of the ICT services offered. Use of Internet and e-resources was particularly high among students, with a gradual uptake by faculty. |                                                                                                                                                    |

Abbreviations: ICT indicates information and communications technologies; LCMS+, Learning Content Management System; LMS, learning management system; MEPI, Medical Education Partnership Initiative; PBL, problem-based learning.

need for implementing eLearning, also outlined in Table 2.

Indeed, the decision to implement eLearning in the five schools stemmed from the need to increase the number of trained health care workers and/or enhance the quality of the training. All five MEPI schools reported strength in ICT expertise, infrastructure, and support systems. Four schools indicated that they were also strong in student engagement, and three reported strength in institutional support. Faculty engagement was the

one component that all five schools reported a need to enhance. This is not unsurprising. A key difference between the technical system components (ICT and infrastructure) and the social system components (faculty, student, institution) is that the latter necessitate functional collaboration across units/departments within an organization, to be viable in the long run. Cross-functional collaboration is not easy to achieve within organizational structures of varied perspectives and priorities among its constituents—faculty, students, and administrators. Indeed, “for

e-learning to transform, rather than sit uncomfortably alongside, institutional practice,”<sup>12</sup> the cross-functional boundaries need to be rethought, taking into account the institutional culture and possible faculty resistance to eLearning adoption.<sup>13</sup> Recognizing that faculty engagement is necessary for sustainability of eLearning systems, a strategic approach that tries to balance individual faculty needs and institutional direction is needed. The current eLearning efforts of the five MEPI schools, including other members of the eLearning Technical Working

Group,<sup>1</sup> are focusing on the completion of a strategic plan that addresses all system components and specifically the development of plans to implement faculty development programs on technology-enhanced learning.

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