Clinical engineering online courses for Africa

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Clinical Engineering Online Courses for Africa

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Abstract— **In this paper is described one of the most interesting new projects of the Clinical Engineering Division of the International Federation for Medical and Biological Engineering (IFMBE/CED). This project is denominated "Electronic courses (E-courses) for developing countries". The aim of this project is to train people living in developing countries on the activities involving medical equipment maintenance and management, using a virtual learning system for the lectures. The main outcome is the development of a strategy that can support training of Clinical Engineers as well as Biomedical Equipment Technicians. A system that can, at low price, develop training courses in several parts of the world, using distant and local expertise, not limited to language barriers. The E-Course project design began in late 2015. The initial focus has been put on three African countries: Gambia, Zambia and Mozambique. Today the project has designed two main streams for 2017 and 2018. The challenge is now keeping involving the tar-get countries to be sure to fit and fulfil their needs. A desirable goal is the creation of a sort of "experts bank", involving many of the IFMBE structures such as divisions and committees, to have a dynamic list of professionals that can be consulted or asked to travel to specific destinations. This will be an important outcome that will facilitate the passage from this pilot experience to a project addressed to other developing countries all over the world.**

Keywords— **Clinical Engineering, E-Courses, Developing Countries, Africa**

I. INTRODUCTION

The International Federation for Medical and Biological Engineering (IFMBE) is the only international professional federation that has a Clinical Engineering Division (IFMBE/CED) focusing specifically on the life cycle management of healthcare technology and embracing all those who professionally practice in the clinical engineering field, whether in academic institutions, health care facilities, industry, business, voluntary sector, or government. [1]

Among the goals of IFMBE, the following two are very much related to worldwide education and training:

- to function as the leader in representing the international community of medical and biological engineering
- to foster the creation, dissemination and application of medical and biological engineering knowledge and the management of technology for improved health and quality of life

When, in the second half of 2015, we started designing the CED action plan for the triennium 2016-2018, the CED board members have been ask to send project proposals to cover all the IFMBE goals and the CED mission statements, highlighting objectives, methods and outcomes. In particular, looking at the IFMBE/CED statements [2], one proposal was focused on the following:

- to advance worldwide learning, research, knowledge, deployment and communication of healthcare technology management (HTM) within the clinical engineering (CE) community and its understanding by other stake holders.
- to encourage, through education and training, CE practices and processes worldwide.

This project proposal was denominated "Electronic courses (E-courses) for developing countries". The aim of this project is to train people living in developing countries on the activities involving medical equipment maintenance and management, using a virtual learning system for the lectures. The main outcome is the development of a strategy that can support training of Clinical Engineers as well as Biomedical Equipment Technicians. A system that can, at low price, develop

training courses in several parts of the world, using distant and local expertise, not limited to language barriers.

II. THE E-COURSE PROJECT

The E-Course project design began in late 2015. The initial focus has been put on three African countries: Gambia, Zambia and Mozambique. Nevertheless, this pilot project will function as a pilot project for more e-courses to be designed and delivered for other developing countries in the following years.

The rationale behind this project is that medical devices maintenance and its management play today a key role for the health system in general. Such activities can be done either by internal service or external groups, but not many African countries have a structured regional maintenance and management team. Some of them have to rely on the vendor's repair and preventive maintenance system or international services companies, even for basic tasks. On-site training courses for CEs and Biomedical Engineering Technologists/Technicians (BMETs) may help quite significantly the health system in such countries but can also be expensive and result on trained people abandoning the country to seek better salaries.

With the widespread of e-courses, mainly exploiting the possibilities offered by the increasing access to the Internet, on site courses are no longer a practical teaching tool and can become quite inexpensive to be applied.

This project, aimed to train people living in Africa on the activities involving medical equipment maintenance and management using a virtual learning system, involves many CED board elected and collaborators members. Some of them are also members of the IFMBE/Working Group on Developing Countries. The project leaders are Mladen Poluta, Anna Worm and Shauna Mullally. Other project team members are (in alphabetical order): Saide Calil, Anthony Chan, Tobey Clark, Yadin David, Antonio Hernandez, Fred Hosea, Ernesto Iadanza, Tom Judd, Ledina Picari, Mario Forjaz Secca, Elliot Sloane and James Wear.

III. THE METHOD

The method can be summarized in the following items:

1 – Use experts already working within in developing regions to raise the need regarding medical equipment training and Management. Ask for WHO assistance to identify regions not only in need but interested to receive training.

2 – Set the appropriate subjects for training, specific for each region.

3 – Search for professionals for the theoretical training according to their knowledge about the subjects and language of the region to be trained.

4 – Search for professionals for the practical hands on local training according to their knowledge about the subjects and language of the region to be trained.

5 – Identify people working within the academia, that can help in the translation of the training material and possible teaching activities according to the region.

5 – Search for material already produced and either translate and/or develop what is required for the training.

6 – Find the available resources in the region to identify how and where the course can be administered.

7 – Use local resources (Government, Associations, WHO offices, etc.), to advertise the E-course and call for candidates

8 – Select and enrol the candidates

9 – Use free software for learning support (such as Modular Object-Oriented Dynamic Learning Environment-Moodle or EADbox) for the theoretical training.

IV. THE PROJECT PLAN

The project has been broken down in activities and tasks as in Table 1 below:

Table 2 E-Course project plan

Activity	Task
1. Finalize project scope and admin	- Request cost estimates per module/video from partners - Agree on outstanding issues listed in project proposal - Review sample e-course formats to provide guidance on preferred to contractors - Based on cost estimates, develop priority list of modules/videos - Determine best platform to host content - Determine how to include/engage WHO content and Indian CC - Draft and finalize MoUs with partners - Coordinate payments to partners
2. Develop pilot e-course module(s) and video(s)	-Develop 1-3 pilot e-course modules -Coordinate development between responsible - Develop 1-3 pilot e-course videos for same devices
3. Solicit feedback on the pilot	- Develop feedback questionnaire for pilot e-course modules and videos - Test 1-3 pilot e-course modules and videos and provide feedback - Capture feedback and use to refine future modules/videos (activity 4)
4. Develop additional e-course modules and videos	- Validate content in lectures - Convert priority lectures to e-course format - Coordinate development between responsible - Develop videos for priority devices - Coordinate development between responsible - Manage online content
5. Disseminate additional e-course modules and videos and support those using them	- Advertise through African associations, WHO CCs, etc. - Review and update content twice a year (!?) - Provide support to those taking the courses - Send hard copies of materials to those without good Internet access
6. Deliver e-course	- Develop qualification requirements and selection criteria - Advertise e-course for 1st offering - Select participants for 1st offering - Teach 1st offering - Advertise e-course for 1st offering - Select participants for 1st offering - Teach 1st offering - Advertise e-course for 3rd offering - Select participants for 3rd offering - Teach 3rd offering - Advertise e-course for 4th offering - Select participants for 4th offering - Teach 4th offering
7. Solicit feedback at end of project	- Develop feedback questionnaire - Fill in questionnaire - Share results to disseminate lessons learned

V. ADVISORY BOARD

An Advisory Board has been formed, with the main purpose of ensuring quality and giving a competent help to the project. The members are Antonio Hernandez, James Wear, Mario Forjaz Secca, Thomas Judd and Mladen Poluta.

The main tasks of the Advisory Board can be summarized as follows:
1 quality control of training materials
2 potentially mentor students and trainers
3 create and or review feedback forms

4   potentially selection of participants based on CVs/motivation

5   review feedback

6   monitoring and evaluation of the courses quantitatively (numbers, location, gender of participants) and qualitatively (feedback forms)

7   provide advice and opinion to E-Course leadership

VI. Discussion and conclusions

Today the project has designed two main streams for 2017 and 2018.

The first one consists of an asynchronous online e-course that will be based on material licensed from the University of Vermont (agreement under definition) and taught by Prof. Tobey Clark. The course (expected 20-25 students per course) will have a length of 45 hours in total, typically taught over 15 weeks with a 3-hours per week commitment from the students. Pilot course for Gambia, Zambia and Mozambique students will start in the second quarter of 2017. The course will utilize web-based content including text, photos, diagrams, flow charts, other figures, video, audio, links to other websites, interactive tools, and other web attributes to deliver content to students. It will provide an introduction into advanced medical equipment systems – background, application, safety, problem resolution, maintenance and management – and will include topics such as Imagine, Telemedicine, Electronic Health Record, Clinic Lab, Surgical Systems and Physical Therapy Equipment.

The second stream is dedicated to Continuous Professional Development (CPD) and will address equipment intended use, troubleshooting, and preventive maintenance for medical devices most typically found in hospitals in developing countries. The highest priority has been assigned to common technologies such as Blood Pressure measurement, Pulse Oximeters, Infusion Pumps, Physiological Monitors, Fetal Heart Monitors and more.

Many content providers have already been selected and most contracts have been signed to obtain distribution licenses and technical platforms.

The challenge is now keeping involving the target countries to be sure to fit and fulfil their needs. A desirable goal is the creation of a sort of "experts bank", involving many of the IFMBE structures such as divisions and committees, to have a dynamic list of professionals that can be consulted or asked to travel to specific destinations. This will be an important outcome that will facilitate the passage from this pilot experience to a project addressed to other developing countries all over the world.

Conflict of Interest

The authors declare that they have no conflict of interest.

References

1. IFMBE at http://2016.ifmbe.org/organisation-structure/divisions/
2. IFMBE/CED at http://cedglobal.org/organization-and-teams/

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