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NEW TOOLS FOR TRAINING THE SKILLS OF STUDENTS IN THE PROCESS OF THE ACADEMISATION IN THE EDUCATION OF ENGINEERING DEGREES: A TESTIMONY WITH APPLICATION TO METROLOGY FROM THE DEMOCRATIC REPUBLIC CONGO

Leo P Van Biesen [1], *Jean Lukwesa Kaindu* [2], *Joséphine Mpole Boyokame* [3]
[1] Vrije Universiteit Brussel, Department ELEC, Brussels, Belgium, lvbiesen@vub.ac.be
[2] ISTA, Laboratoire de Télécommunications, MO for IMEKO, Kinshasa, Democratic Republic of Congo, jeanlukwesa@gmail.com
[3] ISTA, Laboratoire de Télécommunications, MO for IMEKO, Kinshasa, Democratic Republic of Congo, mpoleboyokame@gmail.com

Abstract – The academisation process of the engineering degrees in ISTA (Kinshasa, DR Congo), is reported. The focus is laid to the training of skills of the students in defining the new curricula in the domain of ICT and electrical engineering, that stem from practical laboratory work sessions, where the students design and develop relatively complex circuits with low cost off the shelf equipment. Emphasis will be laid to the conceived measurement set-ups and the relation to metrology.

Keywords: project driven education, engineering curriculum building, low-cost laboratory measurement set-ups for practical works in electrical engineering education

1. INTRODUCTION

The Bologna declaration of 1999 has led to the process reviewing completely the higher education system in Europe [1]. At the end of the first Bologna decade the new two- or three-cycle degree system (Bachelor – Master – Doctoral degree) has been adopted by the majority of the signatory countries [2], [3]. The European Credit Transfer and Accumulation System (ECTS) has triggered many interest in other major continents [5], [6], e.g. in the U.S.A. [7], [8], while the U.S. education system is bench marked against the European one in some studies [9]. Also in Africa many education systems have been completely altered since the beginning of this century. Some countries, such as Rwanda, have tried to better integrate in the concerned region and changed the education system and teaching language from French to English in joining the East-African community. Others, like DR Congo and Burundi, have chosen to keep the French language for education, and therefore in transforming their current degree system by academisation, they have been inspired by the examples of institutions in Europe that successfully completed the Bologna process. And hence, the inspiration was adopted from French or Belgian engineering schools, polytechnics or universities having engineering faculties when engineering degrees have to be concerned.

In this paper, first shortly the process of academistaion of the engineering degrees towards the three-cycle degree LMD (License-Master-Doctoral degree) will be addressed. Next, attention will be drawn towards the implementation of the objectives that will enable to evaluate and measure the skills of the students according to the Dublin descriptors [4]. This process required the redefining of the new curricula in engineering in DR Congo. Development cooperation projects have been set-up since 2007 between the Flemish Interuniversity Council (VLIR [13]) and ISTA in that field allowing the smooth transition by academisation towards a better adapted engineering degree program to serve the needs of the local industry in DR Congo.

The set-up of a new laboratory for the project based education and training of students in electrical engineering and the elaborated measurement set-ups will be illustrated focussing on metrology. ISTA became the IMEKO Member Organisation for IMEKO from the Democratic Republic of Congo since the IMEKO General Council held in September 2014 in Benevento, Italy.

2. ACADEMISATION OF THE ENGINEERING EDUCATION SYSTEM IN DR CONGO TOWARDS THREE-CYCLE LMD PROGRAMME

In this paper the education needs in engineering for Central Africa will be shortly addressed [10], [11], [12] and confronted to the willingness to set-up state education system open for all. The process of academisation of engineering degrees in development countries is often a difficult exercise because of the drastic change in habits embedded in the system from the past and of the high impact in the culture that is assumed to take place in achieving the objectives that have been proposed. Such changes are e.g. the obligation that a lecturer should prepare excellent course material and the willingness to post the notes on an educational platform where it can be consulted and down loaded by registered students. Another change in culture is the implementation of assessment tools allowing the students to provide feedback on the courses, including the practical work, examination etc. The implementation of an internationally recognized credit system offers the advantage of enabling more efficient mobility of students across the region and even worldwide.

The formulation of project proposal of the academisation process at ISTA, the largest engineering school for the

formation of professional engineers in de DR Congo, has been conducted using the Project Cycle Management tools [14]. The academisation process had benefited from the experiences that were gained at the Engineering Faculty of the Vrije Universiteit Brussel in Brussels when the engineering degree system was altered there to meet the accreditation standards required after the completion of the Bologna process [15], [16].

In rebuilding the curricula, next to ensuring that the objectives of the Bologna process will have been met, interaction with local industry has enabled to identify and to confirm on the skills and abilities that engineers should acquire in their education. The paper will report on the requirements of skills in ICT and telecom and will illustrate that the training of students in practical problem solving can be set-up even when the budget for academisation of the education is severely limited.

3. DESIGN OF LOW BUDGET PRACTICAL TRAINING SET-UPS FOR ELECTRICAL AND ELECTRONIC ENGINEERING

The main contribution of this paper is treated in this section. Several practical exercises and experimental laboratory set-ups will be treated where bachelor engineering students work in small teams to solve practical problems in the field of ICT and telecommunication. All set-ups have been designed to fulfil the requirement of problem solving education based on the realisation and demonstration of working prototype units based on low-cost modules. The load in measurement efforts in the work of the projects of the students is important and, therefore, in the paper attention will be put to address in detail the choses methodology.

The moto of the XXI IMEKO World-Congress of 2015 is “Measurement in Research and Industry”. The main contribution of the paper is situated in the scope of TC1, and hence of the education of measurement science and metrology. However, the latter should be regarded as the basis to implement metrology in a sound and scientifically correct way in research and industry. The learning outcomes of the academic programmes of bachelor and master in engineering science, ensure that the engineers have acquired the skills to design and conduct measurements in a correct way, i.e. including the generation of the uncertainties of the measurements and respecting the internationally recognised vocabulary on metrology [17].

4. CONCLUSIONS

The original abstract of this paper has been submitted and accepted for the joined TC1-TC7-T13 Symposium in Funchal, September 2014. However, the final paper was not submitted to be presented at that IMEKO Symposium, due to the fact that the first generation of engineering students that have made use of this new lab did not finish their work by the final submission date of the paper. For IMEKO XXI, the authors are submitting the modified abstract again, taking into account the comments of the previous reviewers in focussing more on the metrology aspects in the education.

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1) VLIR Micro project DR Congo (MPRDC)/2006/2 in 2007: Mission to explore the cooperation with ISTA;

2) VLIR-UOS: ZRDC2009EI001 (2009-2014) : Contribution to transforming ISTA into the Technological University of Kinshasa in renovating the educational and research capacities in the field of Information and Communication Technologies (original title is in French: Contribution à la transformation de l’ Institut Supérieur des Techniques Appliquées (ISTA) en Université Technologique de Kinshasa (UNITEK) par la rénovation des capacités d’enseignement et de recherche dans le domaine des technologies de l’information et des communications (TIC))

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