EDUCATION FOR ENGINEERING STANDARDS, PRODUCT DEVELOPMENT AND QUALITY CONTROL: CASE STUDY

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ABSTRACT

The purpose of this paper is to provide insight on the role of youngsters’ education about engineering standards, product development and quality control for the development of industrial literacy and a qualified workforce.

The empirical part of this paper will be developed according to the case study approach methodology and grounded on the hands-on project Think Industry New Generation (TING) in one particular activity - “Education about standardization” (EaS) for the 2013/14 edition. It encompassed more than 700 youngsters with an age range from 12 to 17 years old this out of school project, in a voluntary base.

The concepts on metrology and quality control are part of the industrial literacy skills and are explored according to a pedagogical learning script starting on the subject of standardization.

Everlasting mentality shift must begin at tender ages using methods with meaning for the target public.

Keywords: standardization, quality control, industrial literacy.

INTRODUCTION

The lack of qualified engineers and technicians, and consequently the lack of a qualified workforce have been on the agendas of governments and countries worldwide. It’s recognized that industry and re-industrialization are the ground bases for evolution, fairness and economic prosperity. The industrial sector is unable to inspire and motivate sufficient young people to enter engineering programs or technical training paths related to industry and technology related careers. Future predictions show a significant fall in meeting business and industrial needs (RAEng, 2007, Halstead et. al, 2009; Kupfer, 2011). According to previous studies youngsters tent to choose “easier” paths and careers with another public image and recognition (Fernandes & Rocha, 2010). Various researchers have studied students’ attitudes towards “industry”, “science” and “technology”. Researches shown that youngsters often have stereotypical images and that those images affect their attitudes toward science, industry and technology (Berdsee and O’Dowd, 1961; Brush, 1979; Chambers, 1983; Fernandes and Rocha, 2007; Finson et al., 1995; Flick, 1990; Mason et al., 1991; Mead and Metraux, 1957; Palmer, 1997). It appears that if a youngster can see himself/herself in a career, then, the likelihood of that person pursuing an educational program to prepare him/her to that career increases (Smith and Erb, 1986). Metrology and quality control are two important assets for industry competitiveness, and are some of the best starting points to get youngsters to give new meanings to the different life spheres and adopt these concepts in everyday life and in future working settings.
THINK INDUSTRY NEW GENERATION

TING is a hands-on project designed to cope with three main problem dimensions previously identified: a) traditional image for the industry, b) withdraw between youngsters in school ages and industrial activities and careers, c) Training choices and market integration heavily influenced by commerce and services. The target public is youngsters between 12 and 17 years old.

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<th>Main Problem Dimensions</th>
<th>Specific Targets</th>
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| Traditional image for the industry | • Develop a positive vision of the industry  
• To link industry with positive values and attractive careers |
| Withdraw between youngsters in school ages and industrial activities and careers | • To make youngsters and industry closer (and vice-versa)  
• Evolve youngsters and industry in mutual approximation processes |
| Training choices and market integration heavily influenced by commerce and services | • Make youngsters aware of industrial careers in short term  
• Motivate youngsters to carry on their studies on technological areas |

TING is a wide project, that this technological center runs since 1995 and it encompasses several different stakeholders such as: general citizen, parents, youngsters, technological centers, universities, polytechnics and research institutes, industry and professional bodies, education and training providers, national and local government, government agencies.

To cope with the specific targets’ achievement there are several modalities and activities encompassed, has shown in table 1. The activities were clustered in 3 big categories: i) tech TING, ii) lab TING, and iii) distance TING. The activities developed under the TING scope, generally tent to promote the understanding of different settings of the industrial value-chain, e.g. “simulation games” that represent management actions and functions, and “technology laboratories” that correspond to the manipulation of equipment’s related to the industrial activity and the underneath technologies applied in several industrial processes such as robotics, hydraulics, energy consumption, environment, mechanics, milling, lathe operations, standardization application, metrology, etc.. So to say, applying engineering principles on product and activities’ development.

Lab TING activities are designed for groups (approximately 20 students) from the formal teaching system that every two weeks come to CATIM for a session (global length 24 hours). The activities vary from simulation games (e.g. Tiai) to field trips and to laboratorial activities encompassing several “industrial themes” such as robotics, alternative energies, metrology, and computer numeric control (for all the intervention areas see figure 1). Distance TING’ activities were thought of for all those youngsters that cannot go physically to CATIM (e.g. geographic distance). Using the internet and accessing a Learning Management System (LMS), youngsters can learn industrial concepts, apply engineering
principles and do some experimentation. Distance TING encompasses two presentational sessions facilitated by one tutor. The activities vary from simulation games, to on-line contents exploration to practical experiment (e.g. assemble a solar energy kit or a fuel cell kit). Tech TING’ activities are exactly the same as the ones in Lab TING, but it’s an intensive program. There are also groups of 15 students that come to CATIM for 4 hours every day during two weeks, normally during the Easter or summer holidays.

![Fig. 1 - TING project activity clusters](image)

The education on standards activity is designed in 3 phases: i) give knowledge and tools for rationalization; ii) pedagogical learning script application – hands-on; iii) Rationalization of impact – every day and future life.

**DISCUSSION**

The pedagogical learning script and the pedagogical approach for the activity “education about standardization” had has main objectives: a) to develop a positive vision of industry; b) to link industry with positive values and attractive careers; c) to make youngsters and industry closer; d) to make youngsters aware of industrial careers in short term; e) to motivate youngsters to carry on their studies on technological areas; f) increase public awareness about Standards importance for daily life.

The first approach is to give knowledge and tools so that youngsters can learn about standardization and quality control aligned with its’ global role on everyday life routines either is work or leisure time. According to the International Standard Organization (ISO) a standard is a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose (ISO, 2015). Standards ensure that products and services are safe, reliable
and of good quality. For business, they are strategic tools that reduce costs by minimizing waste and errors, and increasing productivity. They help companies to access new markets, level the playing field for developing countries and facilitate free and fair global trade. Approaches like the ones on figure 2 help tutors to give tools to youngsters for apprehending standardization principles.

![Fig. 2 - Standards @ play (CEN/CENELEC, 2015)](image)

On the second phase, activities were designed according to hands on and self-learning principles. Youngsters were confronted with the learning scripts and had to perform the activities. The activities are several, e.g. USB (http://www.usb.org/home) connections, Paper sheets format (ISO 216:2007, DIN 476), and at the final part of the activity quality control had to be performed by youngsters. At first sight the pedagogical script might appear “complicated”, but this barrier was mainly pointed by adults (professors) and not by youngsters.

The third phase and concerning the “education about standardization” context, there are two main moments for the exploration of the concepts: prior to the experiment and post the experiment. After performing the experiences, an all set of new questions and approaches arise from youngsters. This last phase allows the rationalization of choices in everyday and future life’s anchored on standardization and quality control activities.
We can firmly notice that prior to the experiences, youngsters gave generic and imprecise answers to the questions, but post-experiences/field trips answers were more precise, youngsters shown awareness for quality control and standardization issues and made the link of their actions with technology applications, engineering principles, industry, everyday-life and future careers.

CONCLUSIONS

Industry, namely manufacturing has huge potential for generating wealth, jobs and better life-quality. Sensitization for engineering and technological principles must begin in tender ages.

This works rests on the belief that the promotion of engineering and technical skills, namely metrology and quality control skills are important tools for education in consideration for sustainable industrial development and the promotion of industrial literacy.

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