Abstract - Traditionally, engineering studies have focused on preparing students technically and given little importance to social or ethical aspects, nor the ability to work in multi-disciplinary teams. Currently though, these skills are an added value and have been included in most prestigious centre’s curricula. As a result, they have become a subject of study for the education community and the focus of numerous papers. Correspondingly, the Barcelona School of Informatics has developed a hardly explored initiative in order to inculcate these values and help students acquire these skills. This initiative gets them involved in what we call solidarity projects, where both students and professors get administrative and subsidized support to create cooperative work that will provide a solution to specific problems on developing countries and poor local areas. These projects may be introduced in some courses and during Bachelor and Master Thesis and have contributed towards the professional skills development of both students and professors involved.

Index Terms - ABET Criteria, professional Skills, Solidarity.

Motivation

Traditionally, engineering curriculums focused mainly on technical knowledge. Nowadays, demands of society have changed so that engineers should display positive attitudes in relation to ethical, social and environmental issues, and an ability to work in multi-disciplinary teams, as well as to, -of course- demonstrate their technical knowledge. Indeed, it is thus needed that we guide our IT engineers in what society expects us to do. These engineers must know their ethical and professional responsibilities which will definitely be important for their successful careers.

These competences are defined and classified in the ABET Criteria Skills, which are extremely important to achieve the US curriculums quality accreditation. There are too other lists and classifications like the ones available for the European Higher Education Area (EHHEA) [1]. In our work though, we use the ABET Criteria since they are more explicit,older and thus more complete.

ABET criteria can be divided in two categories [2]: hard skills and professional skills. The skills in the hard category are technical abilities; what it has been taught traditionally. They include the following abilities: to be able to apply mathematics, science, and engineering knowledge (Criteria 3.a); to be able to design and conduct experiments, as well as to analyze and interpret data (3.b); to be able to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability (3.c); to be able to identify, formulate and solve engineering problems (3.e); and to be able to use the techniques, skills, and modern engineering tools necessary for engineering practice (3.k).

The professional skills not fully developed in most engineering curricula, include: an ability to function in multi-disciplinary teams (3.d); an understanding of professional and ethical responsibility (3.f); an ability to communicate effectively (3.g); the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context (3.h); a recognition of the need for, and an ability to engage in lifelong learning (3.i) and a knowledge of contemporary issues (3.j).

The difficulty of introducing (and evaluating) professional skills in an engineering curriculum is high, especially since the Technical University of Catalonia has no previous, real experience on this: we educate engineers, architects and mathematicians focusing on hard skills. However, a group of teachers in the Barcelona School of Informatics have been developing different strategies to introduce professional skills by engaging students in what we call solidarity projects. We think there are several ways to introduce these skills in our students’ curricula, but solidarity projects pose an interesting and motivating, few times explored [3] and discussed [4] way to achieve this. Our solidarity projects are non-profit schemes that may be understood here as “cooperation projects” whose main goal is to provide a deprived area with the technical resources that will allow them to self-manage their own development.

In the next section, we will introduce the environment and the strategies we use to achieve the professional skills, and how we plan to evaluate these strategies. Once data is gathered from our experiences, we will want to export these ideas and concepts to the whole of our University.
THE ENVIRONMENT

In our University, the solidarity movement has started to gather strength and important support from the institutional framework. The Cooperation to Development Centre, (CCD, Spanish acronym), was founded in 1992 with the objective to centralize all the University’ solidarity initiatives. As an example, all Non Governmental Organizations born at the University in the last few years are legally and economically supported by the CCD. The institution also collects funds from voluntary donations from students, administrative and academic staff to support the University members’ initiatives like the Computer Science University development at Burkina-Faso. Our school in particular founded the Technology for All NGO which participates in several projects around the world.

ACHIEVING THE PROFESSIONAL SKILLS

Our idea was to take profit of the entire solidarity environment in our University to teach our students the ABET professional skills. In our opinion, we can offer our students professional and personal growth by getting involved in solidarity projects.

While students still work on core technical subjects, or hard skills, we also aim to develop strategies to introduce the professional skills in our School. However, they’re still pilot tests we could implement only if they prove successful.

Firstly, we have been testing our approach in two elective courses open to students from other schools: “PC Architecture (PCA)” and “Free Software (FS)”. The PCA’s main goal is to present the Personal Computer and its components’ past, present and future. However, some other objectives are defined in this subject too: improve critical thinking, managing information, decision making and information gathering and integration. The course is based on master lectures and a project developed during the course that can be related to ethics and solidarity (i.e. “Interfaces and devices for disabled persons” or “The One Laptop per Child Project”). The FS course main goal is to present Linux and Free Software as an opposed possibility to the traditional close software. The students work on multi-disciplinary teams made of members of different schools. In addition, they usually create round tables to discuss contemporary issues and the students’ future professional and ethical responsibilities. Both subjects share a lab activity consisting in repairing and fixing broken and old-fashioned PCs (PCA students) and installing free software (FS students) adapted to the final users’ needs. These computers are ultimately used in solidarity projects and delivered to schools in countries like Bolivia, Morocco, Mali, Ecuador and Gambia, among others.

There is also a group of professors that studies the projects that arrive to the CCD and decides which can be a Bachelor or a Master Thesis project. Then, students develop these projects financed by the CCD, which will pay the cost of sending the computers and the student traveling costs to install the equipment and teach the end users.

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As an example, one student developed the software currently used for the children vaccination program in the United Nations Western Sahara refugee camps.

The solidarity projects offer the possibility to work in real and multi-disciplinary groups (doctors, other engineers, architects, social workers), offering the possibility to learn other realities of the world. These projects help students acquire professional skills, and offer a good testing ground for their hard skills because more often than not they have to work with limited resources in difficult environments.

EVALUATION PROCESS AND FUTURE WORK

Despite having been working on the proposed activities for years, the proposal is so complex that we still are in a primary state. Our next step though, will be to evaluate the proposals’ effectiveness and observe whether we achieved the previously defined goals (the professional skills) and extend these practices to the rest of the University. Furthermore, there is another important element to be considered in future: How we will mark the professional skills achieved by our students during the course, just as we currently mark their hard skills.

We will also survey the students to evaluate their thoughts on their own professional skills development during the course. Students will be surveyed about these professional skills to compare how their opinions mature throughout their degree and how much they think these are valued in the real world. We will also survey former students to find out if the professional skills are useful in their working environments and whether they think they achieved them while at University or while at work.

It is necessary that the School and the University introduce this kind of activities or similar to achieve these professional skills if we want our students to attain them as well as the hard skills. Our idea with this work in progress is to show the community that solidarity projects are a good, complementary method that helps our students achieve the ABET skills (both hard and professional).

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