TXT AS A VEHICLE FOR SERVICE LEARNING

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Abstract

Service-learning is a method of teaching, learning and reflecting that combines academic classroom curriculum with meaningful service throughout the community. As a teaching methodology, it falls under the philosophy of experiential education. More specifically, it integrates meaningful community service with instruction and reflection to enrich the learning experience, teach civic responsibility, encourage lifelong civic engagement, and strengthen communities for the common good.

Technology for everybody (TXT) is an association of people from the computer science and telecommunication schools at UPC. The main goal is to share our knowledge in Information and Communication Technology to communities that may benefit. In the last few years we have seen how technology has changed our everyday life and became an inner part of a modern society. Lack of access to this knowledge enlarges the distance between communities. In this context, people in TXT aim to narrow the gap by providing technical knowledge to non-governmental social institutions where this information could be useful.

Another important task for TXT is building student's community awareness of international and local cooperation. The association tries to engage students into taking civil responsibilities, at the same time their learning experience are enriched. To that aim TxT runs the reuse workshop (among other projects); this initiative is managed by the Center of Cooperation and Development (CCD) the Technical University in Catalonia (UPC) and the association Technology for Everybody (TXT). It is a hands-on session where participants learn how to repair a computer.

Workshop Topics
Human scale engineering; The role of emotions in learning

I   INTRODUCTION

Service-learning [1] is a method of teaching, learning and reflecting that combines academic classroom curriculum with meaningful service throughout the community. As a teaching methodology, it falls under the philosophy of experiential education.

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TXT seeks to reinvigorate the civic mission of higher education and instill in students a sense of social responsibility and civic awareness through the development of teaching and learning opportunities. For that reason TXT cooperates closely with the Technical University in Catalonia (here and after UPC). This interaction is crucial to develop teaching and learning opportunities and it benefits both parties.

First, from the educational point of view, opportunities to integrate and relate theory to practice are created, the academic theory is experimented in a real world context and new education techniques are promoted. The University finds in the community a teaching environment and academic and professional capacity of students is increased. In addition, the practical aspect in education has gained importance since the European Higher Education Area (EHEA)[3] has drawn the attention into the learning process from the student perspective, evolving from "teaching" to "learning how to learn".

Secondly, community benefits from the service, issues vital to social, civic and political society are explored and the civic and personal capacity of students is enriched. And finally, University receives feedback from the community; the real world problems learned from the active participation in the community can influence the university adapting its program so that university can teach what is required by society.

Concerning Human-scale engineering, it is clear that by its very nature engineering is bound up with society and human behaviour, and it implies responsibilities that every school of engineers needs to keep in mind. Through TXT and the projects the

association is involved in, the University gets closer to society at the same time society highs its opinion of the university.

The goal of the paper is to present TXT as a vehicle for service learning. We will give a short overview of the organization, its tasks, objectives and the activities the organization is involved in. We will reflect on whether High Education Institutes (HEIs) are able to cover the needs of their individual students as well as the global society. For that purpose, we will review the educational objectives, and introduce the Reuse Workshop. Finally, we will discuss how TXT offers the opportunity to have new active experiences that contribute to students' learning.

II   SERVICE LEARNING & TXT

To imagine a different world we need: (i) to consider the required and generated knowledge in each society; (ii) to understand the relationship between scientific and other forms of knowledge; (iii) and to address ethic values properly so that they become an inherent force behind Higher Education and its contribution to positive change.

These topics were discussed on the last GUNI [4] conference in Barcelona ("Higher Education in the World. New Challenges and Emerging Roles for Human and Social Development") [5]. During the conference many questions were raised concerning the challenges that HEIs should face. In this paper we will focus in one of the topics: Do HEIs cover the needs of their individual students and the societies in which they are located?

We believe that the Service learning activities at TxT could be a starting point to build some sort of partnership between the university and civil society. Service learning is a vehicle to better understand and address the problems in society and do practical work and research on these problems. At the same time, the whole experience is taken as a key element of the learning process.

For example, many NGOs and initiatives require different levels of Information Technology (IT) support. This support can range from personal computers to complex information systems to improve performance in their resource management.

Rajesh Tandon, President of the Society for Participatory Research in Asia (PRIA) [4], believes that the different civil society actors should be considered as legitimate sources of knowledge and university should work together with them because here is a lot of analytical reflection and educational work outside the university. Rajesh also suggests that universities need to re-design their curriculum to include practical work as an element of learning and pointes out the lack of internal incentive structure for professors and researchers to include civic engagement and co-production of knowledge with civil society.

From civil society point of view, university can contribute with the following values: knowledge, expertise and support. Although the first two are accomplished, there is a lack of support. TxT aims to bridge this gab with its work on international cooperation and computer donations.

Globalization implies important opportunities; however it also poses serious challenges: to reduce poverty and the disparity in wealth distribution, to achieve international justice; global equity, inclusion and human rights; intercultural understanding; peace; global citizenship and governance; sustainable development. It is essential to explore solutions to global problems and even to bring about a paradigm shift for reconstructing society. Higher Education should reflect on its contribution, in terms of its mission and the social commitment of knowledge [5]

We believe the activities related to the Reuse Workshop are strongly connected with the global problems: the electrical waste problem is discussed in the classrooms and the students (future responsible of informatics departments) have to see how the increasing acquisition of personal computers does not help to reduce this problem.

III   EDUCATIONAL OBJECTIVES

The European Higher Education Area (EHEA) [3] will bring about great changes in the new Bachelor and Master degrees in Computer Science throughout the European Union. The recommendations for designing the new degree are based on the definition of the professional outcomes that a student should acquire to arrive at the definition of the educational goals of the subject, and from there to design the contents of the subjects.

Adaptation of the current degrees to EHEA requires an educational effort to change the educational paradigm: (i) the student not the teacher is the protagonist; (ii) the base is not the educator's teaching but preparing the student for life-long learning and (iii) evolves from "teaching" to "learning how to learn".

ECTS [6] is the unit of measurement of the academic activity in the EHEA. It quantifies the student's work, not the teacher's based on the effort that an average student must make to pass the subject. ECTS integrates theoretical and practical studies, tutor-marked academic activities, and the student's personal work. The volume of a student's work during a complete academic year is a maximum of 60 ECTS credits, where one ECTS credit is equivalent to 25-30 student work hours.

Developing non-technical skills has become one of the main goals of the new engineering technology programs, and the target of several workshops and papers [7][8][9]. The educational objectives of the subject presented in this paper include the acquisition of non-technical skills without decreasing the technical content assimilated by students.

III.1 Classification of Educational Objectives

According to Nichols [10], the intended educational student outcomes are descriptions of what academic departments wish students to know (cognitive), think (attitudinal), or do (behavioural) when they have completed their degree program. Any given subject must contribute to some of these outcomes. This is done by the use of educational objectives, which have a finer grain than outcomes.

The educational objectives of a subject must express clearly what the student should have learned when the subject is finished. According to the educational objectives, contents are elaborated, the most appropriate methodology and educational strategies for every subject are defined, and the methods of evaluation are established.

Bloom's taxonomy [11] distinguishes six levels of competence in the definition of educational objectives: knowledge, comprehension, application, analysis, synthesis and evaluation. At every level, two classes of educational objectives can be defined: general and specific.

Educational objectives can also be classified according to their orientation [11], as: Technical: related to the technical contents of the studies. They refer, in our case, to computer engineering. Transversal: Related to abilities and aptitudes. And deontological: Related to attitudes, values and regulations. They refer to the personal positioning of the student with regard to society.

III.2 Engineering Educational Objectives

In [13] a list of eleven core outcomes for engineering is defined, as well as the references used in drawing up the list of attributes. This list contains cognitive, attitudinal, and behavioural outcomes. These outcomes can hardly be acquired in only one subject, and are the following:

1. Ability to apply knowledge of mathematics, science, and engineering.
2. Ability to design and conduct experiments, as well as to analyze and interpreter data.
3. Ability to design a system, component, or process to meet desired needs.
4. Ability to function in multidisciplinary teams.
5. Ability to identify, formulate and solve engineering problems .
6. Understanding of professional and ethical responsibility.
7. Ability to communicate effectively .
8. The broad education necessary to understand the impact of engineering solutions in a global and social context.
9. A recognition of the need for, and an ability to engage in life-long learning.
10. A knowledge of contemporary issues.
11. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

A complete list of outcomes for computing engineering based on ABET criteria [14] can be found in the Computing Curricula drawn up by the ACM and IEEE [15]. The reuse workshop stress outcomes 5, 6, 8 and 10, where 6 and 8 are especially difficult to teach.

Institutional support is required for developing this kind of initiatives. For instance, our University has a program STEP 2015 (Sustainability, Technology and Excellence Program) in order to introduce the "Sustainability and Social Compromise" skill in the new degrees adapted to the EHEA directives. As the University supports TxT and the reuse workshop, it's easy to involve students in a hands-on laboratory, following the principles of Problem Based Learning, and offering deep learning to the students.

IV   THE REUSE WORKSHOP

Two subjects share the lab to carry out the reuse workshop: "PC Architecture (PCA)" and "Free Software (FS)". The main PCA goal is to provide the students with knowledge about the past, present and future of Personal Computers and their components. However, some other objectives are also defined in this subject: improvement in critical thinking, the ability to manage information, decision-making and gathering and integrating information. The course is based on master lectures, and students should develop and present a project during the course, which can be related to technical issues or 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 a further possibility as opposed to traditional and closed software. It is common to create round-tables to discuss contemporary issues and the students' future professional and ethical responsibilities.

The workshop consists in PCA students repairing and fixing broken and old-fashioned PCs and FS students installing free software adapted to the final users' requirements on them. The final users are projects in solidarity (for instance, schools in developing countries). To carry out this lab, we need the collaboration of the University, the School and a group of volunteers.

The lab session lasts for four hours and is divided into two parts. The students analyze the computers, repairing them when possible, or removing all the parts that still work (for repairing other computers) and separating the broken parts, which will be recycled. When computers work properly, free software adapted to the final recipient and user are installed.

At the beginning of the lab, the students are informed about the final destination of these computers, so they can adapt the computer to the receiver needs. They work in

highly constrained conditions, and they discover that rejected equipment can still be useful. The students are also aware of the social and environmental responsibility of using resources properly. Finally, students' personal satisfaction from this lab is high, because they know that people will benefit from their efforts.

Members who cooperate with the program gain experience in fixing computer equipments, which is useful for everybody who works with computers on an everyday basis. At the same time participants get to know the association and those who are interested can get deeply engaged with TxT. Our experience shows that students get motivated. They not only get involved in the subjects but also want to develop this brand-new ability further in order to change the current state of things. Students enrolled in PCA often enrol in FS the following term (and vice versa), and some of them develop their Bachelor or Master thesis in solidarity projects, mostly using PCs similar to those they have helped to prepare.

The reuse workshop started in 2003 and is held twice a year. Up to July 2008, more than 700 computers have been repaired, installed and handed over to 102 solidarity projects. We expanded from 6 projects involving 20 computers in 2003 to 15 projects and 118 computers in 2007 (the statistics for 2008 are not yet available). People from 17 foreign countries have received 450 computers (Angola, Algeria, Bolivia, Burkina Faso, Colombia, Cuba, Ecuador, Equatorial Guinea, Gambia, Guatemala, Morocco, Mozambique, Paraguay, Peru, Senegal, Togo and Haiti). 250 computers have also been donated to schools and social organizations in our country, Spain.

Moreover, the most important point is the growing number of students who wish to collaborate in preparing computer networks, teaching courses or analyzing the needs (just doing engineering work) in these countries during their school holidays. Moreover, about 30 students have developed or are developing their Bachelor or Master Thesis in solidarity projects. For instance, the software that controls the irrigation system in the Chancay-Huaral valley (Peru), or the software used in the child vaccination program in the UN Western Sahara refugee champs (Algeria), have been developed by our students as a Master Thesis.

Ultimately, the reuse workshop makes computer jobs of computer scientists more sustainable.

V   INTERNATIONAL PROJECTS ON COOPERATION

The association is involved in other projects. For the purpose of sustainable development most of the projects have an educational component. TXT organizes and teaches basic courses in informatics, such as word processing, data bases, web page design among others. The association's activities include also network and software design and providing technical support to non-profit organizations for any other kind of development project.

Below we outline the most recent projects TxT has been involved in:

1. Improvement of facilities and technologies of the Casa Guatemala Orphanage. Guatemala, UPC 2007-08.
2. Installation of a network of computers for training at the University Hospital "Royal Victoria" Gambia. UPC. 2007-08.
3. Study of viability and development of tools to support for conservation of Indian languages in Guatemala. Guatemala. UPC. 2007-08.
4. Computer rooms in Senegal. Senegal. UPC. 2007-08.
5. Improved access to ICT in rural communities of Tinejdad and Ait Ourir Marrakech. Morocco. UPC. 2007-08.
6. Implementation of software tools to aid in the education of college Pasos Adelante. UPC. 2007-08.
7. Facilitate the introduction of ICT in schools in Sucre and the rural community of Mendoza, Bolivia. UPC. 2008
8. ICT for the coordination of farmers in Peru. Perú. 2007-08
9. Education for new opportunities: effective use of ICT in the Educational System. Bolivia. UPC 2006-07.
10. Many others [16][17][18][19][20][21][22].

VI   CONCLUSIONS

In this paper, we have introduced TXT and how does it serve as a vehicle for service learning. We have discussed the educational objectives and how TXT working in tight collaboration with the University narrows the gab between HEI and society. It helps HEI to cover the needs of their individual students as well as the global society. We have emphasized that a tight collaboration with the University is essential to accomplish this purpose. Finally, based on our experience we want to summarize the advantages of doing service learning from students and teacher point of view.

Students benefit because they imbricate themselves into the fabric of the university, they establish contacts with teachers beyond the treatment of the subjects, they feel part of a group that is establishing mechanisms to make more sustainable society, they do experienced research focused on Sustainable Human Development, they are able to perform high-quality volunteer to the Third Sector and Environment and they expand the number of acquaintances in college and in the third sector.

At its turn, teachers introduce the component of education for sustainability into their courses, they do research on the education for sustainability, they contribute to the Corporate Social Responsibility of the college, they increase the civic, academic, personal and professional capacity of students through experiential learning, they create opportunities to integrate amd relate theory to practice, improve the efficiency of teaching (ie: the reuse workshop can afford one computer for each student) and last but not least they improve students motivation.

REFERENCES

1. National University of Ireland Galway, CKI Community Knowledge Initiative, DOI=http://www.nuigalwaycki.ie/menu.asp?menu=3

2. Technology For Everybody Organization, DOI=http://txt.upc.es/index.php

3. The Bologna Declaration of 19 June 1999, DOI=http://www.bologna-berlin2003.de/pdf/bologna_declaration.pdf

4. GUNI was created in 1999 by UNESCO, the United Nations University (UNU) and the Technical University of Catalonia (UPC), which hosts its secretariat and presidency. It was founded after UNESCO's World Conference on Higher Education of 1998 to give continuity to and facilitate the implementation of its main decisions.

5. Higher Education in the World: New Challenges and Emerging Roles for Human and Social Development,GUNI, Vol. 3, 2008.

6. European Credit Transfer and Accumulation System DOI=http://ec.europa.eu/education/programmes/socrates/ects/index_en.html

7. Baillie, C., Sharpe, L., and Catalano G.D. "Engineering and Social Justice, Part II: Looking Inward", Special session at 36th Frontiers in Education Conference, San Diego, CA, oct. 2006.

8. Danielson, S., Hawks, V., and Hartin, J.R. "Engineering Technology Education in an Era of Globalization". 36th Front. in Education, pp. S1C 20-25, San Diego, CA, oct. 2006.

9. Thain, D., and Poellabauer ,C. "Experence With A Literate Approach to Computer Science", 36th Frontiers in Education, pp. M1H 8-13, San Diego, CA, oct. 2006.

10. Nichols, J.O. "The departamental guide and record book for student outcomes assessment and institutional effectiveness", New York: Agathon Press; 1991.

11. Bloom B.S. et al., D.R. "Taxonomy of educational objectives", Handbook I (cognitive domain), New York: Longman 1956.

12. Sánchez, F. and R. Gavaldà, R. "Propuesta de objetivos formativos para el primer curso de las ingenierías informáticas y de algunas estrategias docentes para conseguirlos", Novática no 175 June-July 2005, pp 31-35.

13. Besterfield-Sacre, M., Shuman L.J., and Wolfe H., "Defining the outcomes: A framework for EC 2000", IEEE Transactions on Education, Vol. 43, No2, May 2000, pp 100-110.

14. ABET criteria http://www.sie.arizona.edu/ABET/criteria/abetcriteria.html

15. IEEE http://www.ieee.org/portal/site

16. ICT Literacy in the center of disabled Pasos Adelante Educational Services in Lima. Peru, UPC, 2006-07, DOI=

http://www.upc.edu/ccd/CATALA/Memoria% 202006-2007catala.pdf, P. 97-98.

17. Research and training resources for the development of ICT in primary school, Colombia. UPC, 2006-07 DOI=http://www.upc.edu/ccd/CATALA/Memoria% 202006-2007catala.pdf, p.56-57.

18. Education for development, Bolivia, 2005. UPC, 2005-06. DOI=http://www.upc.edu/ccd/CATALA/MemCCD% 20Cat06.pdf, P. 49-50.

19. Support for the setting up of classrooms • telematics for schools in Pichincha and Tungurahua, Ecuador, 2003. http://www.upc.edu/ccd/CATALA/Memoria% 202003% 20catala.pdf, p.77.

20. Promote the use of the Internet as a training tool, Cooperation project with Morocco, UPC, 2003, DOI=http://www.upc.edu/ccd/CATALA/Memoria% 202003% 20catala.pdf, p 78-79.

21. A LAN to Chefchaouen, Cooperation project with Morocco, UPC, 2002,DOI=http://www.upc.edu/ccd/CATALA/Memo2002catala.pdf, p 54-55.

22. Training and cooperation in the province of Tangier, Morocco. UPC, 2002. DOI=http://www.upc.edu/ccd/CATALA/Memo2002catala.pdf, p.51-52 2001.

ACKNOWLEDGMENTS