Reconfigurable weblabs based on the IEEE1451 Std.

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Abstract— Technology plays a double role in Education: it can act as a facilitator in the teaching/learning process and it can be the very subject of that process in Science & Engineering courses. This is especially true when students perform laboratory activities where they interact with equipment and objects under experimentation. In this context, technology can also play a facilitator role if it allows students to perform experiments in a remote fashion, through the Internet, in a so-called weblab or remote laboratory. No doubt, the Internet has been revolutionizing the educational process in many aspects, and it can be stated that remote laboratories are just an angle of that on-going revolution. As any other educational tool or resource, the i) pedagogical approach and the ii) technology used in the development of a remote laboratory can dictate its general success or its ephemeral existence. By pedagogical approach we consider the way remote experiments address the process by which students acquire experimental skills and link experimental results to theoretical concepts. In respect to technology, we discuss different specification and implementation alternatives, to show the case where the adoption of a family of standards would positively contribute to a larger acceptance and utilization of remote laboratories, and also to a wider collaboration in their development.

Keywords: E-learning, Remote experimentation, Remote laboratories, Reconfigurable weblabs, IEEE 1451.0 Std..

I. INTRODUCTION

The process of learning through technology is contributing to social changes. The size of available information for consulting has been imposing some pressure towards people, since they are now obliged to be constantly updated to avoid cultural and social isolation from the remaining society. Higher education has a big influence over this trend and must encompass current technological changes, so it may provide all means to satisfy people requirements by creating new educational resources. This has been happening since the 80's with the appearance of PCs and interactive CDs with multimedia contents. More recently, in current digital era, information circulates freely through internet and everyone have access to it, using PCs or mobile devices. This has been improving the learning process with the several educational tools developed, and technology is now viewed as fundamental to complement the traditional classroom. While at the beginning educational tools only covered traditional lectures, today the huge advances of internet services (larger bandwidth, many communication tools, etc.), have being promoting the adoption of learning technologies in the Sciences and Engineering (S&E) courses, namely in the laboratorial work, through the so-called weblabs.

This paper starts with some considerations about the problems and the added value that technologies are bringing to education. Focusing in the S&E courses, section III presents the relevance of experimental work, and section IV compares different laboratory environments. Section V describes the emergence and proliferation of weblabs, and the problems now faced by this educational technology. In this same section some infrastructural problems are pointed out and a reconfigurable weblab infrastructure, based on the IEEE1451 Std., is proposed.

II. TECHNOLOGY IN EDUCATION

In our present era, technology has been changing the way knowledge is acquired, facilitating students' access to information by lowering barriers once difficult to overcome due to social and economical restrictions. However, there are too many resources available, like books, journals, etc. that may contribute to information fragmentation, leading to an incoherent learning. This requires sense making to interpret, organize and link information to make it coherence. A critical attitude towards the learning process is fundamental, since not all the disseminated information is trustful (some are from specific entities, with credits in a specific area, and others are from individuals that can disseminate wrong information). A constructivist attitude is required, as students are building their knowledge based on information created by others.

Today skills are acquired not only inside a classroom but also outside, which requires an educational role based on two principles: i) traditional and ii) emergent. While traditional principles focus on pursuing ideals for influencing education to transform society with equality and democracy for all, following well defined theories and learning methods; emergent principles must defend a reaction of education to the technological trends, by adjusting theories and learning methods to influence students. This will be achieved by understanding students' needs and embracing their tools and skills, so it becomes possible to speak their languages and motivating them to learn, as already defended by theorists like Maslow or Herzberg's [1][2]. It is fundamental to look at education as a global process that may be improved through technologies. Spite the *Social Development Theory* presented by Vygotsky [3] focused on connections between people and the socio-cultural context in which they act and interact by sharing experiences, it does not pay attention to a social context characterized by the existence of social networks, which provides even more interactions between people and