Chapter 8
Internet–Based Remote Laboratories as a Part of a Blended Learning Environment

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ABSTRACT

Blended learning is a mixture of online learning and face-to-face activities. Online learning suffers from a lack of practical and laboratory work which is mandatory for learning in many specific fields. Adult training is also mainly focused on knowledge related to specific useful competencies and practical skills so practical training is an inseparable part of adult learning and training. Web laboratories with remotely controlled laboratory experiments should provide a necessary practical component in the concept of online learning. There are many different classifications, implementations and usages of web laboratories. This chapter deals with web laboratories, trying to define a framework for the development of web laboratories, to define pre-requests, architecture and software realization of web based laboratories and to find the right blend. This chapter also presents the contribution of web laboratories in blended learning and other possible benefits for the concept of blended learning for adults.

INTRODUCTION

Blended learning is a popular term in modern education and learning with it is ambiguity about what it actually means. Graham (2006) offers a definition of blended learning which recognizes some combination of virtual and physical environments. Other authors Mason (2006), Driscoll (2002) included other aspects such as a blend of various pedagogical approaches, combination of any form of instructional technology with a face-to-face instructor-led training and a mixture or combination of combined instructional technology

with actual job tasks. Oliver (2005) placed the definitions of blended learning cited in the literature into seven categories: Mixing E-learning with Traditional Learning; Mixing Online Learning with Face-to-Face; Mixing Media; Mixed Contexts; Mixing Theories of Learning; Mixed Learning Objectives; and Mixed Pedagogies. These and further researches are important because they have helped overcome a gap and a strict division between face – to – face and online learning. It is clear that all definitions of blended learning cover a combination of online and face-to-face instruction. E-learning can involve a greater variety of equipment than online training or education, for as the name implies, "online" involves using the Internet or an Intranet. The integration of Information and Communication Technologies (ICTs) and the Internet into education is most commonly achieved through the following methodologies:

- Developing a course website to centrally house various online functions and facilities for course management.
- Creating a remote laboratory where multimedia animation or simulations are provided to replace physical experiments.
- Developing a web-based laboratory that enables students to set up parameters and undertake experiments from a remote location.

The main disadvantage of online and e-learning is the absence of laboratory work and practical work. Multimedia animations or simulations cannot bridge this gap. The only possible solution to ensure practical work as a part of the concept of distance learning is the implementation of web laboratories that consist of remotely controlled experiments with video feed-back. Besides, web laboratories with remote control of experiments could be used as a very useful educational tool in classical or blended (mixture of classical and e-learning approaches) learning environments. The underlying fundamental promise of Internet based

laboratory approaches lies in trainees' abilities to connect to a computer-controlled laboratory setup of interest at anytime from anywhere, thus sharing existing limited resources in a more efficient manner than is possible with the traditional on-site laboratory approach (Barrero, 2008). The idea of having a remote web-based laboratory corresponds to attempts to overcome different constraints and may be the next step in remote distance learning (Forinash, 2005; Gallardo, 2007).

Experimental work has a special role in the domains where high theoretical challenges and the need for abstraction must be combined with professional applicability and real-world needs both on an academic level and on a level for lifelong learning. Adult training mostly refers to the acquisition of knowledge, skills, and competencies as a result of the teaching of vocational or practical skills and knowledge related to specific useful competencies, the meaningful blended learning environment must incorporate practical training as well as preparation for practical work. Adults simply need to test their learning as they go along, rather than receive background theory. It is clear that the practical experience provided to trainees through lab work, along the entire course, is necessary. During those exercises, trainees solve practical problems and gain experience and practical training needed for their future career. Therefore, experimental work is necessity for a number of educational fields.

The focus of this chapter will be on web based laboratories as part of an on-line component of blended learning. There are a number of questions that should be answered in the creation of blended learning programs. It is important to define the right balance of online and face-to-face activities (Osguthorpe, 2003). This balance of course varies for different fields of learning as well as different courses. It is important to blend the right staff and define the right usage of remotely controlled experiments and the web laboratory in on line learning. It is important to define educational requests, demands, architecture, advantages, and limitations

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