Chapter 23
Labshare:
Towards Cross- Institutional Laboratory Sharing

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ABSTRACT

Conventional undergraduate teaching laboratories are valuable in terms of their contributions to students learning but are generally costly to develop and maintain and often have extremely low overall utilization rates. These issues can be addressed through cross-institutional sharing of laboratories. This is, however, limited by the overarching requirement that students are physically co-located with the laboratory apparatus. In this chapter we will describe the nature of the challenges with regard to cross-institutional sharing and the potential benefits that can be achieved if a solution can be found. A possible solution is the use of remote laboratories that can be accessed across the internet with a suitable model for laboratory sharing that promotes both institutional and individual engagement. We describe the characteristics that such a model should have and show how the Labshare project is providing a nation-wide model within the Australian Higher Education context.

INTRODUCTION

Laboratories are a well-accepted and an integral component of educational courses in many disciplines. There has been surprisingly scarce research on the role of laboratories within the educational process. There is however almost universal acceptance of their value (Feisel & Rosa, 2005). Early work by ABET (Feisel et al., 2002) analyzed and categorized the various intended learning outcomes from engineering laboratories – resulting in a useful taxonomy that highlights why engineering and technology educators employ and support experimental laboratory learning.

Having accepted the educational value of laboratories it is worthwhile to consider the challenges associated with their utilization and support. Laboratories are usually expensive to develop and maintain. Further, the specialized nature of many laboratories means that they often have limited utility beyond specific courses and hence have very low utilization levels (various space utilization surveys have indicated that it is often well below 10%). This low utilization rate (with the associated costs) could be addressed by sharing labs. This is however inhibited in traditional engineering laboratories due to the requirement for students to be physically present in order to interact with equipment. The result is a major logistical challenge to financially challenged laboratory-based disciplines. Alarmingly, this scenario has the potential to create circumstances detrimental to learning outcomes for students – laboratory infrastructure which is expensive (in terms of acquisition and maintenance) and under-utilized may become targeted within institutions for replacement by computer-based simulation tools.

The emergence of remotely accessible laboratories that enable physical laboratory equipment to be monitored and manipulated remotely provides a potential avenue to address these issues (Corter et al., 2007). Most groups developing or researching remote laboratories acknowledge that this form of laboratory is not expected to replace all current laboratories. Nevertheless they do represent a valid alternative for some laboratories and a useful complement to others (Amigud, Archer, Smith, Szymanski, & Servatius, 2002; Corter, Nickerson, Esche, & Chassapis, 2005; Gustavsson et al., 2009; Machotka, Nedic, & Nafalski, 2009). Importantly, these laboratories open up the possibility of substantial sharing of facilities since internet-accessibility is a defining characteristic. This concept has recently begun to attract increasing interest with a number of sharing initiatives being either funded or proposed.

For cross-institutional laboratory sharing to be effective various components need to converge. Firstly, laboratories that are suitable for shared remote access must be identified, developed, positioned within relevant pedagogic frameworks, and supported with relevant learning and teaching resources. Secondly, the underlying technology must support appropriate functionality related to: equipment management; user accounts; student and/or staff collaboration; and experimental data handling amongst other elements. Finally (and possibly most importantly and most difficult) a suitable organizational model must be developed that ensures that the laboratory sharing is handled in a way that is sustainable and maintains quality outcomes. The first two of these components are the focus of significant ongoing research. The last, however, has received little consideration but is potentially the most challenging.

In this chapter we will first describe the context of existing remote laboratory initiatives. Next we will describe a set of objectives that can underpin successful remote laboratory sharing. We will then go on to describe the organizational model that has been developed for Labshare, and which will underpin laboratory sharing within Australia.

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