

Remote Laboratories: Sharing Resources and Sharing Expertise

David Lowe

Professor, School of Information Technology
University of Sydney

David Lowe is Director of the Labshare Institute and the Associate Dean (Education) of the Faculty of Engineering and Information Technology at the University of Sydney. Prior to mid-2012 he was the Director of the Centre for Real-Time Information Networks at the University of Technology, Sydney. He has active research interests in real-time control in the web environment and remote laboratories. He has published widely including over 150 papers and three books (most recently *Web Engineering: A Practitioner's Approach*, McGraw-Hill, co-authored with Roger Pressman). He is also the President of the Global Online Laboratory Consortium.

Intended audience and degree of expertise/past experience required

This workshop is aimed at those who would like to gain an understanding of the role that can be played by remotely-accessed laboratories in supporting enhanced access to teaching laboratories - either within the higher-education sector or in supporting science education in K-12. No previous expertise is necessary, though an involvement in laboratory-based SET education and an interest in technological innovation is beneficial.

Statement of objectives for the workshop

Laboratory experimentation is generally considered central to science- and engineering-based education. Logistical constraints can however place significant limitations on the ability to provide and maintain high-quality science laboratory experiences and equipment. One potential solution is the use of remotely accessible laboratories. These laboratories allow students and teachers to use high-speed networks, coupled with cameras, sensors and controllers, to carry out experiments on real physical laboratory apparatus that is located remotely from the student. Research has shown that when used appropriately this can bring a range of potential benefits, including the ability to share resources across multiple institutions, support access to facilities that would otherwise be inaccessible for cost or technical reasons, and provide augmentation of the experimental experience.

This workshop aims to provide participants with:

- An understanding of the challenges associated with supporting laboratory-based science and engineering education;
- The opportunities represented by the use of remote laboratories;
- The pedagogic, technical, and logistical challenges associated with developing, maintaining and sharing remote laboratory infrastructure;
- The opportunity to see a range of remote laboratory apparatus in operation;
- The opportunity to become involved in subsequent follow-up activities and remote laboratory trials.

Detailed description

The workshop will incorporate the following elements:

- A general introduction, by the presenter, to the concepts, pedagogies and technologies of remote laboratories;
- A demonstration of a range of laboratories from the UTS remote laboratories system;
- An open forum Q&A session focused on exploring ways in which remote laboratories can best be utilised.

References

- Lowe, D., Newcombe, P., & Stumpers, B. (In Press). Evaluation of the Use of Remote Laboratories for Secondary School Science Education. *Research in Science Education*.
- Lowe, D., Conlon, S., Murray, S., Weber, L., Villefromoy, M. D. L., Lindsay, E., Nafalski, A., et al. (2012). LabShare: Towards Cross-Institutional Laboratory Sharing. In A. Azad, M. Auer, & J. Harward (Eds.), *Internet Accessible Remote Laboratories: Scalable E-Learning Tools for Engineering and Science Disciplines* (1st ed., pp. 453-467). Hershey, PA, USA: IGI Global.
- Lowe, D., Villefromoy, M. D., Jona, K., & Yeoh, L. (2012). Remote Laboratories : Uncovering the True Costs. *REV2012 - Remote Engineering & Virtual Instrumentation* (p. In Press). Bilbao, Spain: IAOE.
- Lowe, D., Bharathy, G., Stumpers, B., & Yeung, H. (2012). Laboratory Lesson Plans : Opportunities Created by Remote Laboratories. *REV2012 - Remote Engineering & Virtual Instrumentation* (In Press). Bilbao, Spain: IAOE.
- Tuttle, S. W., Lowe, D. B., & Moulton, B. (2011). A Survey of Issues and Approaches to Remote Laboratory Adoption by Teacher-Academics. In J. Morgan, A. Pears, S. Burkett, J. Froyd, E. T. Caro, & M. M. Ciampi (Eds.), *FiE 2011: 41st Frontiers in Education Conference* (p. GOLC1). Rapid City, SD, USA: IEEE.
- Lindsay, E., Murray, S., Lowe, D., Kostulski, T., & Tuttle, S. (2010). Derivation of Suitability Metrics for Remote Access Mode Experiments. In M. Auer & G. Karlsson (Eds.), *REV 2010: 7th International Conference on Remote Engineering and Virtual Instrumentation* (pp. 204-210). Stockholm, Sweden: Kassel University Press.
- Lowe, D., Murray, S., Lindsay, E., & Liu, D. (2009). Evolving Remote Laboratory Architectures to Leverage Emerging Internet Technologies. *IEEE Transactions on Learning Technologies*, 2(4), 289-294.
- Lindsay, E., Murray, S., Liu, D., Lowe, D., & Bright, C. (2009). Establishment reality vs maintenance reality: how real is real enough? *European Journal of Engineering Education*, 34(4), 229-234.