

# PEARL

## Practical Experimentation by Accessible Remote Learning



**Access to a flexible, high quality learning experience in science and engineering for all**

**This project, led by the Open University, has the main objective of providing high quality learning experiences in science and engineering education by bringing the teaching laboratory to the students, giving flexibility in terms of time, location and special needs. The project aims to develop a system to enable “real world” teaching experiments to be undertaken by students working collaboratively over the Internet. A key objective is improving access to science, engineering and mathematics courses for students with disabilities, where the provision of practical elements is frequently inadequate, which means that their participation in practical work is often passive or they are excluded altogether.**

PEARL will also have more general implications for campus-based and distance teaching and learning in these subjects and also Web-based educational services provided by museums and libraries. The provision of the practical elements of science and engineering courses for students with disabilities is frequently inadequate. PEARL presents an opportunity to widen access to real experiments that might otherwise only be offered to those able to get to a suitably equipped laboratory. Access to laboratory equipment might be restricted for such reasons as geographical location, resource restrictions in an institution, inflexible scheduling, or because it is judged impossible to offer the facility to students in a safe way.

The project will provide flexibility for studying in terms of time, location, or special needs by bringing the teaching laboratory to the students and give students access to expensive and safety critical experimental facilities. It will also provide Internet-based solutions that allow students to collaborate at a distance while conducting experiments to facilitate the learning of science as a process using Computer-Based Learning (CBL) systems.

### **Experimental work and collaboration over the Internet**

Experimental work is a vital component of science and engineering teaching at all levels. The increasing use of multimedia packages or “virtual science” has much to offer in terms of teaching scientific facts and principles, but does not generally focus on teaching the process of scientific enquiry or engineering practice. The system being developed in the PEARL project will deliver practical experimentation where students will have the opportunity to work together over the Internet (or campus intranet), interact with the remote experiment, change parameters and in some cases modify and design experiments. Students will also be able to discuss their actions and expectations of the results of the experimentation, as well as observing and analysing the results.

The remote laboratory created will have a common control and communications channel for all components and experimental elements. It will have standard modules from which much of a particular installation/experiment will be constructed and be able to rapidly integrate new items of equipment. All features of the system can be made available through the students' and tutors' PCs and are fully accessible using single switch control only with any visual/ audio interfaces being each fully sufficient on their own. The project's educational software can be readily integrated into Web-based courses (with Instructional Management Systems compliance).

### Partnership in educational technology

The Open University (UK) leads the project, represented by the Institute of Educational Technology, the Knowledge Media Institute and the Faculty of Science. They contribute expertise in the areas of pedagogy and evaluation of educational technology, and the development of educational software and user interfaces to support effective learning. PEARL will also involve:

- > The Department of Applied Computing at the University of Dundee (Scotland) co-ordinates the system developments and the user interface design in the project. They have prime responsibility for the server architecture and the integration of the collaborative learning environment;
- > The Computer Science Department at Trinity College Dublin (Ireland) has a key role in the system development within the project and in the integration of the remotely controlled modules into the laboratory server. It will host an experiment in manufacturing engineering designed to facilitate the training of engineering undergraduates and line engineers in remote locations;
- > The Department of Computers and Electronic Engineering, Faculdade de Engenharia da Universidade do Porto (Portugal), has prime responsibility for developing the remote laboratory infrastructure, integrating the chosen control and instrumentation protocols. FEUP will host an experiment in electronic engineering where students will be able to construct and test a range of digital circuits on a remote digital electronic bench;
- > Zenon, SA (Greece) is the industrial automation company which will be responsible for the development of the remote laboratory;
- > Open University Worldwide (UK) has its expertise in marketing innovative distance learning materials to both the general public and professionals in the fields of education and training. The OU currently provides a series of experiments at the residential schools for its popular foundation science course. PEARL students will access this equipment remotely to test, record, analyse and interpret data.

**Project No:**  
IST-1999-12550

**Duration:**  
36 months

**Economic Sector:**  
Educational Media for Education in Science and Engineering

**Action Line:**  
The Flexible University

**Full Title:**  
Practical Experimentation by Accessible Remote Learning

**Project Type:**  
Education and Training Research

**Start Date:**  
01/03/2000

**End Date:**  
28/2/2003

**Project Objectives:**  
Enable students to conduct real-world experiments as an extension of computer-based learning and distance learning systems

**Target Audience:**  
Students in science and engineering, in particular from disabled groups

**Keywords:**  
R&D, computer-based and distance learning systems

**Technology:**  
Campus intranet

**Project Co-ordinator**  
Mr Martyn Cooper  
The Open University  
KMi  
Walton Hall  
Milton Keynes MK7 6AA  
United Kingdom  
Tel: +44-1908-655729  
Fax: +44-1908-653169  
E-mail: m.cooper@open.ac.uk  
URL: <http://kmi.open.ac.uk/projects/pearl>

**Project Participants**  
The Open University Worldwide (UK)  
Faculdade de Engenharia da Universidade do Porto (PT)  
Trinity College Dublin (IE)  
University of Dundee (UK)  
ZENON SA - Industrial Automation (EL)