WEB-ACCESS TO PRACTICAL EXPERIMENTS IN SCIENCE AND ENGINEERING — LESSONS FROM THE PEARL PROJECT

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Abstract

PEARL (Practical Experimentation by Accessible Remote Learning) is a three-year project funded by the European Commission under the IST (Information Society Technologies) programme. In general terms, PEARL provides access to remote experimentation facilities in selected areas of science of engineering, namely biochemistry, fundamental physics, automatic visual inspection and digital electronics. Following a development phase that took place over the first two years, validation trials were carried out with students in Portugal, England, Scotland and Ireland. The focus of this paper is on the lessons learnt from the trials carried out at the University of Porto, particularly in what concerns the assessment of the learning effectiveness and the cost / benefit aspects of real experimentation versus simulation. The trials referred in this paper addressed the digital electronics area, but the conclusions drawn are valid for remote experimentation in general, and were consistent with the data gathered at the other institutions in the PEARL consortium.

Introduction

Computer-mediated education has been around ever since computers (in their various forms) became available. It is interesting to look back into Skinner's work in the 1950s [1], whose work led to the development of numerous "teaching machines", providing the technological support to implement several types of teaching approaches, including various forms of instructivist (tutor-centered) and constructivist (exploratory) learning models [2]. The current role of technology is essentially to support teaching as mediated learning, an area where information and communication technologies became the cornerstone of many groupware platforms [3]. Computer supported cooperative working (CSCW) and computer supported collaborative learning (CSCL) are nowadays important research areas, where major international conferences emerged during the 1990s.

Learning activities based on groupware applications will normally be referred to as *collaborative learning*, while working activities based on similar applications are grouped under the umbrella of *cooperative working*. The distinction between *collaborative* and *cooperative* is normally dictated by the overlapping (or not) of activities: a group studying together will carry out the same tasks, going through the same subjects and procedures to achieve a certain level of skills (*collaborative learning*). On the other hand, a group working together will normally split tasks and carry out complementary activities in order to produce a certain deliverable (*cooperative working*). Useful as any classification may be, we should keep in mind that there are areas where it makes little sense to draw this type of