Chapter 11

Learning by Playing: Development of an Interactive Biology Lab Simulation Platform for Educational Purposes

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ABSTRACT

The practical training of students and employees in laboratories containing scientific instruments constitutes an educational challenge. Laboratory equipment is by definition sensitive, costly and requires specific safety rules for its use. Therefore, students do not have the opportunity to make improper use of the equipment and get trained by “trial-and-error”. The educational process becomes even trickier when students are many and training takes place simultaneously within the same laboratory; damages to instrumentation and accidents are possible and as a consequence, the effectiveness of learning is greatly limited. For such purposes, an adventure-style computer game -Onlabs- has been developed to provide an interactive simulation environment of a biology laboratory where students may experiment and make several harmless mistakes and where no time or space restrictions are imposed on them. This chapter describes how Onlabs was developed to serve a real need for a remote tool for familiarization and safe experimentation within the laboratory space.

INTRODUCTION

Experimenting in wet laboratories can be interesting, exciting, and rewarding; however, it can also involve risks for both participants and the laboratory equipment. A typical day, during a practical...
workshop in a teaching laboratory, tends to be densely populated with large numbers of individuals with limited experience in the hazards of a science laboratory, including hazardous organisms (for example, microbes and pathogens) which much be properly handled. Numerous common procedures conducted in a teaching laboratory may include aerosols’ creation when preparing liquid buffers and mixing chemical solutions, sources of contamination coming from improper sterilization of microbiological resources or spills, use of centrifugation and micro-centrifugation techniques, use of bead beaters or shearing blenders, pipetting, handling of contaminated animal bedding or culturing and manipulating human cancer cells and tissues and/or analysis of several biological fluids. Each of the mentioned procedures involves various risks and requires specific precautions (Miller, Witherow & Carson, 2011; Molecular Biology, 2010).

Personal alert and proper safety precautions should be taken at all times when the trainees are actively conducting and observing experiments in the lab. Unsafe practices may endanger other trainees and the expensive lab equipment as well. The responsibility for maintaining an enjoyable, instructional, and safe environment in the biology laboratory requires extensive training and familiarization with all safety rules governing practical workshops that cover various and complex experimental methods (Furr, 2000; Committee on Anticipating Biosecurity Challenges of the Global Expansion of High-Containment Biological Laboratories, 2011).

Laboratory instructors put their efforts to offer careful counseling to increase student awareness of potential biosafety risks and educate students in good laboratory practice to minimize any possible risk factors. Workshops’ initial courses always consist of learning the laboratory safety rules and of guided tours through the premises and the procedures to be performed. The purpose is to smoothly familiarize the trainees with the expensive and sensitive laboratory equipment and the consolidation of the rules to be respected for their personal safety, before they switch to the hands-on experience.

Distance education, where trainees lack the ability of a constant contact with the laboratories, apparently requires additional training to improve understanding of the rigorous experimental methods and of how better address the educational outcomes. There is an emerging need to explore innovative educational practices for newly introduced trainees for both distance laboratory education and special courses comprised with the use of very expensive and precise modern lab technology. A common issue that is raised is to gain laboratory experience, to assimilate with the technology to be used by (potentially distantly) interacting with the experimental apparatuses and to operate safely and consistently in the laboratory environment. Such preliminary lab education could reduce the amount of time actually required of trainees to be present in laboratory areas and the costs of failed experimental efforts, and might increase familiarity with safety rules, providing a more mature and constructive use of laboratory equipment.

To obtain the potential benefits and educational outcomes of how to make appropriate use of the laboratory equipment and how to conduct successful experiments, we have developed and applied an interactive virtual game representing the biology laboratory at the Hellenic Open University, namely Onlabs. The newly introduced trainees to the lab environment, using Onlabs from the convenience of their own premises, may explore the laboratory area, interact with the instruments in many permitted ways and unlimitedly experiment and visualize their results with various combinations of the laboratory instruments. As the current generation of students and junior employees are familiar with online games since childhood, one expects that such game-like learning platforms would be, in principle, a good bet.