Section D “Technologies for Learning and Teaching”

Introduction

Elena Sassi, Matilde Vicentini

In the previous Sections A, B and C several references have been made both to the role of experiments in teaching Physics and the use of ICT tools.
The latter are becoming more and more common, in several countries, because of their powerful features and potentialities. Laboratory work and ICT based approaches may intersect in the class practice; they share, from the viewpoint of teachers’ acceptance and experience, some common problems. These problems are related to a sort of inertia in adopting and practicing lab-work and ICT based-activities. Likely this fact is due to the lack or scarcity of experience or preparation of the teachers, in particular when they do not have a degree in Physics or have not been exposed to such approaches in their pre-service education (in Italy, for instance, many of the secondary school teachers are Mathematics graduates). Other possible reasons for this inertia may be the scarcity of experimental apparatuses or ICT tools in the schools and, in particular for the lab-work, the use of recipe types of laboratory activities the teachers have been exposed to in their University courses and the unawareness of the possibility of organizing experimental activities with no-cost and low-cost material.

The intersection between the laboratory and ICT-based activities is, of course, related to the computer based lab-work which requires some familiarity with very basic technologies. Here a pitfall has to be stressed, no matter how many times this has been said: teachers should avoid the temptation of replacing lab-work with computer simulations (real risk when the resources are scarce). Such a replacing hides the difference between real experimental work and its reproduction in a virtual environment. The competences acquirable by the students are different and complementary. For instance, the experimental work is more “dirty” and usually more time consuming than a software reproduction. “Unforeseen” events happen and can be powerful situations to exploit for clarifying physics contents. In virtual activities only what has been programmed in the software will happen.

Nowadays there are approaches about teaching at distance which take substantial advantages from ICT. It has also allowed the development of a computer-based activity, the so called “Virtual Laboratory” where the students interact with an experimental apparatus remote from them and that has not an immediate physical reality.

The Section title “Technologies for Learning and Teaching” stresses the vastness of the theme. Four essays are presented; they show the possibility and richness of the intersection amongst different uses of ICT and its mix with lab-work.

The first essay by R. Lambourne on “Physics and Distance Education”, discusses, on the basis of the well established experience of the U.K. Open University, the motivation for and the nature of distance education in general and the particular challenges of physics. Then, the case of the course The Physical World is presented. Finally the benefits and opportunities of distance education are analysed.

The second essay “The virtual laboratory and interactive screen experiments” by P.A. Hatherly, presents the role and the contributions of this particular approach to experimental activities. First, the definition of virtual laboratory is discussed, then some of its advantages and benefits, together with a number of criteria for an effective learning. Finally, reflections about the future for this type of lab are presented.

With the third essay “Effective learning environments for computer supported instruction in the physics classroom and laboratory” by Ron K. Thornton the stage is the real class practice where students and teachers are interacting via computer-supported learning activities using on-line sensors based experiments. The essay presents the use of ICT tools for conceptual learning with examples of computer supported curricula guided by Physics Education Research results. The rationale is based on peer learning and real-time data-logging and display. Some examples of computer-supported curricula are presented.

We remain in the real class practice with the last essay “Aims and strategies of laboratory work” by E. Sassi and M. Vicentini (as general editors we decided to address this topic after other possible authors declined their involvement). The authors look at the experimental work from two perspectives: the communication to students of the role of experiments in research in Physics and the didactical use of the laboratory. Examples of different pedagogical approaches are presented.

Experimental work may then be seen as a main focus of the Section. It is left to the interested teachers and all other readers the evaluation of the intersection amongst the presented viewpoints.