# Virtual Reality, Web and Grid Technologies for e-learning in Chemistry

**Editors: A. Laganà and A. Riganelli**

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## Preface

The impressive development undergone by computer and information technologies is having a tremendous impact on education, expecially at high (university) level. In particular, this is radically changing the way chemical knowledge is stored, processed and handled to the user.

The present publication collects some reports from the laboratories involved in the "Multimedia in teaching and learning in chemistry" (Mutalc) working group of the European Chemistry Thematic Network (ECTN)[*] and in ELCHEM (ELCHEM: a Metalaboratory to develop e-learning technologies for Chemistry)[†] working group of the D23 (METACHEM: Metalaboratories for complex application in chemistry)[‡] COST in Chemistry action. Contributions from other European (INCOMED II[§]) and national (IchemLab[**] and VS-C[††]) projects are also considered.

The action of these working groups is articulated into three main lines:

*a.* The creation of a repository of data, tools and chemical knowledge accessible from internet
*b.* The preparation of specific teaching and learning units to be utilized on the web
*c.* The implementation of a Chemical Virtual laboratory

The main aspects of these development lines are illustrated in some detail in the present publication that collects the contributions of a group of European laboratories cooperating in developing e-learning technologies in Europe. In the present publication accounts of the activities of the group (assembled in a bottom up fashion as in the best tradition of the COST in Chemistry initiatives) is also given.

[*] http://www.cpe.fr/ectn
[†] http://www.unil.ch./cost/chem/docs/D23/d23-05-01.htm
[‡] http://www.unil.ch/cost/chem/
[§] TEMPUS JEP 12236-97 and TEMPUS JEP 14461-99
[**] http://www.ichemlab.at
[††] http://www.vs-c.de/

## E-learning guidelines from the PROMETEUS project[‡‡]

A. Riganelli, A. Laganà

## 1. Introduction

European education ministers, through the Bologna declaration [1] followed by the conclusion of the Prague Meeting on May 19th 2001, affirmed the ir commitment to establish a European higher education area by 2010.

In a knowledge-based society, the explosive growth of economic and social factors (such as globalization and demographic changes) as well as the pressure coming from the labour market and the need for a continuous training of the workforce, make the European higher education system, universities in the first place, actively rethink its role and mission.

Students who are going to enter the labour market need to access further education and training since technological changes continuously create new knowledge and make obsolete part of the existing one.

Complex problem like school resignation and effective teaching to minority or geographically isolated communities need also to be solved [2].

The three key objectives of the already on-going process of redesigning the European Higher education system are:

*a.* Quality
*b.* Access
*c.* Opening up to the wider World

A key factor of this process is a new conceiving of pedagogy in a context pushing for innovation and competitiveness. In this context e-learning, the electronic approach to teaching and learning based onI nformation and Communication Technology (ICT) infrastructures, i.e.,

[‡‡] This contribution is based on a new elaboration of the materila used for the final SIG (Special Interest Group) report in higher education of the PROMETEUS project. (A. Riganelli, A. Soeiro eds., SIG HIGHER Final Report – September 1999-July 2002)

broadband networking, concurrent computing, as well as multi- and hyper-media tools will work as the fly-wheel of the process.

Although European national education systems have realized the potentialities of the undergoing process, e-learning has not yet become a commonplace in higher education (the European Community adopted the e-learning initiative in May 2000 followed by the e-learning Action Plan in March 2001).

At the moment, several European projects are being implemented and some of them will be examined in this paper. In particular we shall refer here to the PROMETEUS project and related initiatives.