

INFORMATION AND COMMUNICATION IN CHEMISTRY EDUCATION AT THE UNIVERSITY LEVEL IN CROATIA

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INTRODUCTION

In the last decade of the twentieth century Internet communication became indispensable tool in science, art, and humanities.

Moreover, every level of education is supposed to be closely connected to the use of WWW, while it is present in all segments of everyday use, as well. Experience, knowledge and science present undoubtedly the most important and basic component of human progress. Therefore, it is necessary for developing countries to establish the connection to the scientific and professional communication improved through a modern "knowledge industry", realised by Internet, as soon as possible. This is especially important for various levels of education.

Referral Centre (RC) of the University of Zagreb was founded 1967. Soon after another institution, the Multimedia Centre, as a part of RC, was established, and equipped with time-sharing computers; it was at the disposal free of charge to all Zagreb' secondary school pupils. After trying out the new experience with the modern technology, many of them decided to study mathematics, information, or some similar topics.

Although the computer technology continued with a very fast development and application in all areas of life, the use of computers and Internet access started in Croatia last ten years. The use of computer network developed first at the universities and the libraries.

This report will consider the education in the information science for the high study program. Now, the profiles: *the chemical engineers and second school teachers* at the Faculty of Science in Zagreb, and *the teaching profiles in chemistry and biology* at the Pedagogical Faculty in Osijek, are included in the program.

WHAT IS THE STATE OF ART IN CROATIA?

Many questions rise connected to the information communication level at the institutions devoted to the education:

(1) *Internet Access at the University:* Concerning the university level, only a few faculties improved their lecture rooms and studies with a complete computer network equipment connected to the *Internet*, and devoted for the students' service. The *Internet* implementation in the high school education for now is the best at the faculties teaching science and technology, and at the Philosophical faculty (partly).

Also, the scientific institutes are aware of the necessity of introducing the information tools into the organisation of researches.

(2) *Internet Access at the Libraries*: Accessibility of the library materials are available mainly from the Zagreb' university libraries, from the "Ruder Boskovic" (IRB) institute library, and from the National, University Library (NSK).

The most important professional libraries (mainly in Zagreb) already act as Information-Documentation centres.

(3) *Periodicals*: The links and hyperlinks are available for the journals and the books important in science and technology through Croatian databases.

(4) *Art Academies*: There is no very much data in the Croatian databases about the *Internet* access of the Croatian Academies. The problem rises how could today the Croatian artists be represented to the world community if there is no good institutional and individual *WEB*-sites, and even more, many are not very much aware of the situation.

TESTING THE STUDENTS

What is the result of students' tests about the information science?

STUDY PROFILES: IV. semester of Chemistry at the Faculty of Science in Zagreb

COURSE: "Documentation and information science" including the practical exercises in the *Internet*:

The students' population of 150 students expressed their opinion through a test. They consider that the most important problems are the following: the literature searching, the global connections, the big lecture room with the set of net-working computers, the teaching which is comparing the literature searching using "hard copies", and the literature browsing on the *WEB*. They also consider that it would be necessary to include such a course into the first year study program with more teaching hours devoted to the lectures. The students' opinion qualifies the course to be of crucial importance for the future scientists as well as for schoolteachers.

This example of the students' tests was shown that they are qualifying the *INTERNET* as the *SCHOOL OF TODAY*.

GOALS

The fundamental goal is to catch the global level of computer technology use in education, i.e., to implement the global standards of the information development to all education levels.

The objectives of the Croatian information program concerning the education at every level, might be emphasised in following topics: (i) *Internet* - a school of today, (ii) teaching for teachers, (iii) permanent education of teachers, and (iv) distance learning.

The teachers should be familiarised with use of computer programs, systems, and search engines; these items are supposed to be included into the teaching processes, and targeted to the use of the *Internet* in the wide fields of educational communication, i.e., the acquirement of the orientation to the current Croatian and global data bases, and *WEB*-sites.

APPLICATION

The new approach to the education instead of the conservative one will be the teaching for "*not to memorise a quantity of facts, but to know how to be able to find knowledge and to create the new quality.*"

The involvement the field of science, humanities, and arts to the global WEB is of crucial importance.

Besides, for the Art Academies, professional societies, and solo-performers, the involvement into the global connections is of great importance, as well. It is also of great importance for the state of Croatia, as well. A very good example could be an impact of the Croatian arts in the tourism; in addition, through such an approach to the international society the impact of the state of Croatia would be improved. It is no need to persuade anyone that the artists are the best ambassadors of their country.

Information and communication in the service of all mentioned activities brings a common progress to the long chain of occurrences. The link to WWW represents the connection of the country, and of the individuals to the global wealth, as well.

It is possible to perform such a program in a way:

- to perform permanent program for teaching of teachers,
- to organise the several days seminars,
- to open permanently the same school-rooms that we already have opened for teachers, also for the pupils,
- to organise the "distance learning" for everybody (pupils and teachers),
- to organise the permanently open computer-rooms at all faculties for their students.

METHODS THAT WE COULD INTRODUCE

The modern methods of learning require many improvements that have to be applied.

The old classical lectures (which are the basis for teaching) have to be additionally improved with the digital equipment, and the individual work on the *Internet*.

Lecture programs could be easily switched to the "distance learning" using E-schools.

Comparison of the classical approach to the digital media using the interactive approach, will give the new quality of multidimensional literacy.

In addition, the use of the literacy of the "information age" would improve the students' creative abilities.

Application of the search engines for the *WEB* based data [1, 2] using the approach to the virtual libraries (e.g., books, and periodicals), and institutes as well (e.g., museums, and governmental institutions).

The creation of the digital textbooks for students and for scholars, that could be available on the *WEB* and on the *CD-ROM*.

Permanent education of pupils and students includes the multimedia application of the "open" computer classrooms by: (1) the free use of the *Internet* search engines and addresses for the undergraduate students, (2) a free use of the computers and *Internet* browsers for the scholars.

RECENT RESULTS: EDUCATION FOR THE INFORMATION SOCIETY

The course in the information science started in 1961. at the Chemistry Department, Faculty of Science in Zagreb. The program of the lectures and seminars has been improved through years; particular improvement has been done recently.

Using the information tools did recent improvement: practical work with the *Internet* search engines.

Course in the information science includes, on average, 70 students *per* year at the University of Zagreb, (*chemistry engineers, school teachers*), and besides, and 12 students *per* year at the Pedagogical Faculty in Osijek (*teaching profiles in chemistry/biology*), which are involved into the teaching program of the data processing, and in addition, to the "*Internet* course".

The statistical data showed that only 10% of student's population, on average, already had some experience with the *Internet* browsers, mainly *Yahoo*. Moreover, none of them were acquainted with research databases.

Individual approach to the *Internet* is crucial for the *Internet* learning.

Main topics in our course, including individual practical approach to the *Internet*, are connected with the uses of search engines, e.g., *ALTA VISTA* mainly focussed on the names of institutions, and authors, digital books, and other related contents realised by links and hyperlinks, as well as *ERIC*, *INSPEC*, etc [3]. Students are taught how to perform search in the Croatian and global data bases using the system *OVID* for searching periodicals, the most important primary and secondary journals in the field, mainly from the data base *Current Contents* [2].

THE DIGITAL TEXT-BOOK IN PREPARATION

A new text-book "*Introduction to research and information science*" is now in preparation to be published in two media, and in three version, as well: the hard copy, and in the digital media: on *WEB* and on *CD-ROM*.

It could be supposed that it would be the first textbook in Croatia published in the digital medium.

EXPECTED RESULTS AND CONCLUSIONS

The results we are expecting applying such an approach to the education could be expressed as follows:

- * A very fast involvement of the information science to the education, and in addition, to many aspects of the everyday life.

- * Solving the problem of the communication in the education of young people, among many improvements it would be necessary to introduce (i) permanent education for teachers; (ii) open computer schoolrooms and workshops for pupils.

- * The question what we could pose now: "*How many teachers have a relevant knowledge to run all the computer programs included in the lecture plan, with the emphasis to Internet and the E-schools?*" would be neglected.

- * Qualifying the scholars, teachers, and students for the active learning by using *Internet* or *CD-ROM* [4], and in addition, stimulating the scholars for the interactive approach to the computer teaching. These goals will be achieved by introducing:

- (1) free multimedia centres,

- (2) free use of the computers and the *Internet* access for students and pupils,
- (3) teaching for teachers by organising the courses and workshops,
- (4) E-schools,
- (5) distance learning.

LITERATURNI IZVORI

- [1] <http://www.ovid.com> 06.09.2000.
- [2] <http://nippur.irb.hr/hrv/novosti.html> 08.05. 2000.
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