TEACHING PHYSICS TEACHERS TO USE EDUCATIONAL RESOURCES ON THE INTERNET

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Abstract
Internet (International network) is initially developed as means for the exchange of data in CERN laboratories. Today, just 10 years after the beginning of its worldwide use, Internet has completely changed a way of creation and search for information. Although originated in the scientific community, Internet has very quickly become means for mass media and communication. In parallel with the development of the Internet, starts its use in education. Internet is today the biggest library and (virtual) laboratory in the world. Creative use of its resources can essentially improve quality of physics education.

Traditional physics lectures based on analytical solutions to known problems poorly reflects the professional activity of most physicists. They widely use computers in their research including search for data from the Internet. Use of Internet resources makes physics classes more attractive to students and gives them direction for lifelong learning. Besides, it enables activities that are not limited by class time.

Unfortunately, importance and all possibilities of Internet resources have not yet been fully recognized. Physics teachers should be trained to use educational resources from the Internet. It has to be part of university curricula, while in-service teachers can be thought at the seminars and meetings. One example of such activity will be given.

Introduction

Although it is recent phenomenon, the Internet and information technology in general have considerably changed our world. They made everyday life much easier and also opened new ways for the physics teaching. The different capabilities which the Internet makes available can be used to improve clarity and understanding in students, and to excite and inspire further exploration. It also helps students get acquainted with professional scientist's working methods making ever increasing use of computers, computer software and the Internet.

New forms of exchange of information through networks, e-mail, and the World Wide Web (WWW) fundamentally changed communication and could do the same for education. We are learning more and more about how students learn, obstacles to learning, and techniques to improve learning from the research in physics education. Internet and Internet related technologies could help overcome some of the observed difficulties.

Unfortunately, still many teachers are not aware of possibilities that Internet offers in physics classroom. Some teachers fear that the computer will displace the role of the teacher or some of them are preoccupied with technical problems because they are not familiar with the use of computers. There are also concerns about substitution of real experiments by computer simulations. Complaints about quality of the materials found on the Internet are sometimes justified, so careful evaluation is needed.

The basic problem is how teachers can be motivated to use educational resources from the Internet and then how to train them for that task. It is very important to demonstrate that Internet resources improve teaching. However, it is important to emphasis that is just a tool that should be use appropriately. The role of teacher in making that use effective is crucial.
Pre-service teachers training

Most of the pre-service teachers realize the importance of the use computer technology in their everyday teaching practice. However, they should be encouraged and appropriately trained for that task. University curricula should include courses on the use of online resources as a research, teaching, and collaboration tool; creation of homepages; and integration of technology into teaching practice.

At the University of Zagreb there are one-discipline studies for prospective physics teachers and interdisciplinary studies in the following combinations: mathematics and physics, physics and chemistry, physics and polytechnics with informatics, physics and informatics. Prospective physics teachers and teachers of physics and polytechnics with informatics have two courses on computers in first two years that include introduction to operational systems (MS-DOS, Windows NT, Linux, Unix), use of programs for text, graphics, solving mathematical and physical problems, users’ libraries; work on the Web, computers in physics education, simulation of physical processes. Weekly schedule is given in the Table 1.

<table>
<thead>
<tr>
<th>Year</th>
<th>Name of the course</th>
<th>Winter semester (h/week)</th>
<th>Summer semester (h/week)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Computers and operational systems</td>
<td>0+0</td>
<td>2+1</td>
</tr>
<tr>
<td>II</td>
<td>Computer lab</td>
<td>1+2</td>
<td>0+2</td>
</tr>
</tbody>
</table>

Table 1. Computer courses for prospective physics teachers and teachers of physics and polytechnics with informatics. Number of hours per week is given for lectures and lab work respectively.

Prospective teachers of mathematics and physics have computer lab during one semester of the third year with 2+4 hours/week. Prospective teachers of physics and chemistry do not have any courses on computers. Prospective teachers of physics and informatics have many courses on computers and some of them specially regard Internet and Internet related technologies.

Overall, the coverage of this issue is not adequate, especially for some university curricula. Only program for the prospective teachers of physics and informatics cover whole range of possible use of Internet in physics education. Taking into account difficulties in organization of interdisciplinary studies, some changes have to be done to cover basics in all programs. Emphasis should be on the use of the computers and Internet in physics teaching and learning.

E-school of physics is project which aims to the improvement of physics education. It enables communication between teachers, students and scientists. Some prospective physics teachers are involved in mini-projects developing computer simulations and modeling.

In-service teachers training

Internet also provides ways and means for further education for in-service teachers. The first step is to motivate and prepare them to use computer and computer-related technologies [1]. However, it is not always easy, especially with traditionally oriented teachers. Landmarks can be put at the meetings and seminars, for example, national annual meeting of physics teachers. One example of such activity is given here. Nevertheless, workshops are best suited to receive intensive computer technology training and explore diverse issues in the use of the Internet resources.

Motivation: How the Internet can be used in the Physics Classroom?

As already mentioned the first step is to motivate and encourage teachers and show them different ways of using Internet in physics education. The Internet provides medium to receive and give information and the World Wide Web is the essential tool for this process. How can it be used in physics teaching?
Short review of possible use of Internet in physics teaching and learning was given to in-service teachers.

- Internet is valuable source of information

Internet provides access to a depth and range of information that traditional methods rarely provide [2]. Teachers and students can find information on virtually all topics related to their subject. Teachers can get new ideas to improve their physics classes. Students can use Internet to gather information for their reports and projects. However not all web sites are reliable. Critical attitude towards information found on the Internet should be developed in students.

- Internet provides multimedia materials

Today students are excited to learn through interactive media. Internet offers new alternative to traditional learning methods with its images, movies, interactive simulations. Teachers should carefully choose multimedia materials to be shown in the classroom. Interactive simulations are particularly useful for illustrating things that cannot be observed directly, e.g. the motion of particles in a gas [3]. “Virtual” laboratories allow experiments that would otherwise be impossible due to the lack of the equipment or safety reasons (e.g. radioactive sources). However, Internet can not replace hands-on experience of the real physics experiment.

- Internet can help to test of students’ knowledge

Diverse physics quizzes and tests can be found on the Internet that students use to self-test. However, it is desirable that teacher make tests adapted to her/his students. Students can be encouraged to create their own online tests.

- Internet provides free “publishing space”

Teachers and students can create their own web sites where they can put their lecture notes, physics simulations, tests, project reports, etc.

- Internet provides interactive communication with students and colleagues (WWW, e-mail, etc.)

- Internet offers resources that enhance the “fun” of learning physics (physics humor, e.g. magnetic levitation of the frog, etc.)

- Internet extends the classroom environment into the students’ homes allowing more time-consuming activities

Simple beginning

It was emphasized that is not difficult to start using educational resources from Internet. All that teacher need is:

- Computer connected to the Internet

Every school in Croatia has at least one computer with the Internet connection. Usually it is not in the physics classroom but it is available to physics teachers. Many schools have computer room for students where some activities can take place.

- Available time

Teachers can use time available for preparation and non-teaching activity.

- Basic knowledge of English language

Unfortunately, there are not so much Internet resources on physics education in Croatian, so basic knowledge of foreign languages is needed. Of course, most of the material is in English, but there are also many good sites in other languages. For the use of some materials, as animations, the knowledge of the language is not necessary. There are also some language tools that sometimes can be helpful, for translation, for example (Fig. 1).
Although it might seem trivial, first steps in using Internet, as starting Web browsers and Search engines, were addressed because some teachers were not familiar with the use of the computers. Some examples of simple search by keywords and advanced search were given (Fig. 3).
Conclusion

The role of the Internet is not to replace teachers, the labs or the textbook, but to augment and improve understanding and clarity of the teaching. Much of the curriculum can be taught using the Internet but there are some topics that can be especially enriched by the use of Internet resources. It is important to note that due to different learning styles and levels of understanding, different options are better suited for some students than for others. Pre-service and in-service physics teachers should be trained for the adequate use of the Internet in the physics classroom.

References

[2] Hammond R 2002 Using the Internet to teach physics Physics Education 37(2) 115-117
[3] Clinch J and Richards K 2002 How can the Internet be used to enhance the teaching of physics? Physics Education 37(2) 109-114