

PHYSICS WEB FOR EVERYBODY

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ABSTRACT

It is the purpose of this contribution to provide basic information about the creation and first period of running of a web for the support of physics education and about some problems we have met during this work.

Our web (<http://fyzweb.mff.cuni.cz>) should be a place where everybody can find up-to-date and relevant information from the world of physics and explanations of various physical phenomena. Moreover, it also should be a lively place where students, teachers, specialists and other people can virtually meet. A place, where they can share their knowledge and experiences and work together on solving different physics problems (students) or on creating various teaching materials (teachers).

Our web is different from the majority of other sites produced by various technical universities and science faculties. They are quite often oriented to recruit new students. Our web should be used for the popularisation of physics as a whole and for everybody.

KEYWORDS

web site, web pages, educational web, virtual community, communication, Internet, physics education, physics understanding, teaching physics, physics studying, popularisation of physics

1 INTRODUCTION

The demand for appropriate and worthwhile electronic educational materials and web places which are easily accessible on the Internet has been recently rapidly increased. This is a consequence of rapid developments in computer equipment, better Internet connections at schools and in houses and also of the changes in school systems and teaching methods all over the world. These electronic educational materials and web places are expected to provide interesting and up-to-date information and space where students, teachers and specialists can virtually meet and share knowledge and experience. The materials on the Internet are not only helpful to studying and teaching but can also be a powerful tool for popularisation of physics and can increase students' motivation and interest in physics. Therefore they should be not only easy to access but also easy to understand for pupils. Among others it means they should be in native language and contain materials from children's surroundings.

There are lot of sites offering entertainment and commercial information, but there are only a few good sites for education. This indicates that the development of educational materials is much more difficult. Not only must their authors follow the rapid progress of modern technologies but by making the development they also set up new didactical methods not yet proved by many years of experience of previous generations.

2 WHAT WILL OUR WEB BE USED FOR

We try to:

- Offer reliable and worthwhile information to students and pupils that are interested in science, mainly in physics. We already have contacts to a lot of them. They visit our faculty on open days, attend lectures given by members of our faculty for the public, solve correspondence seminars (for example Fykos: <http://fykos.mff.cuni.cz/>) or physics Olympiad (<http://www.uhk.cz/pdf/katedra/fyzika/Olympid/>) and take part in physics summer students camps (for example camp lead by Leoš Dvořák, see <http://fyzweb.mff.cuni.cz/tabor/>).
- Bring verified physics information, news and reports from current affairs to teachers who are interested in, propose suggestions for lessons, etc.
- Enable teachers to present their inventions, work with students and pupils and tips for others (as is once a year done in Fair of Inventions of Physics Teachers, see <http://kdf.mff.cuni.cz/pub/Veletrh/>).
- Create a space where teachers, students and pupils can look for answers to their questions and problems from the field of physics. The Page of answers is already working at our server (<http://fyzweb.mff.cuni.cz/FyzWeb/Odpovedna/>).
- Popularise and bring physics closer to all who are interested in it if only passive, marginally or occasionally. Those people can be teachers, students and pupils and the public as well.

In future we would like to:

- Create a place where teachers will communicate and work “shoulder to shoulder”.
- Create a place which will enable active work with students and pupils. This means various physical competitions, games, work in children physics clubs and so on.

Last but not least we want to:

- Present work and outcomes of Czech teachers to people abroad.
- Use Physics Web to enhance international collaboration.

3 WHY DID WE DECIDE TO CREATE THE EDUCATIONAL PHYSICS WEB

As in many foreign countries also in the Czech republic the interest of people in physics is decreasing. Therefore we decided to use the Internet, which is nowadays very popular especially among young people, as a medium for popularisation of physics.

Teaching physics is not easy. In contrast to many other subjects physics teachers have to do many different physics experiments – both demonstrations and experiments which pupils do on

their own. For that a lot of ideas, experiences and aids are necessary. Teachers meet at conferences and seminars. (Information about one such teachers' meeting, The Fair of Inventions of Physics Teachers, can be found at <http://kdf.mff.cuni.cz/pub/Veletrh/home.htm> on pages made by the authors of this article. These pages contain also photo documentation of this event, which was made during it as on line news.) But unfortunately not every teacher can attend the seminars or conferences and such events do not take place very often. Thus we are creating a place, where teachers can virtually meet during all school year to share ideas, experiences, ask each other for help and so on. Later we would like to initiate the creation of virtual teachers' community that will connect all teachers and physicist that are interested in improving physics education and that will influence teaching of physics in our country.

Physics teachers should try to keep in touch with current developments in science. But many teachers, especially from countryside schools, do not have access to modern journals and to scientific libraries. However in the near future they all will have access to the Internet and can search for new information there. But information on the Internet are mainly in English and many teachers have difficulties to understand it. It is also not necessary for teachers to read and try to understand long scientific articles. So we plan to find, choose, translate, comment and explain important physics news. The Faculty of Mathematics and Physics, Charles University, Prague is a suitable place for such a broadly set up Physics web because it covers all branches of physics – from elementary particles to astronomy, from solid state physics to meteorology and geophysics and, say, from theoretical physics to physics education (see web pages of the School of Physics of our faculty at <http://www.mff.cuni.cz>).

We would like to use the Internet to present the work of Czech teachers and schools. In November 2000 the physics teaching fair Physics on Stage was held in CERN, Geneva, Switzerland. The authors of this article took part on it together with other ten participants from the Czech Republic. During the conference we were often asked whether the materials and experiments our expedition was showing are available on the Internet. That convinced us that we should do an English version of some parts of our web.

3.1 THE SITUATION IN CZECH REPUBLIC

Most high schools have already been connected to the Internet and many elementary schools are being connected presently. Teachers and students start to learn using the Internet in teaching and studying. It goes slowly because usually there are not enough good computers in schools and schools' Internet connections are insufficient. But the process had already started and therefore it is just the time to prepare for them relevant Internet materials about physics.

There are various dispersed isolated pages with physics content in the Czech language available on the Internet. They have very different quality and it is not always easy to find them. There are also some diploma theses that treat different physics phenomena for presentation on web. But a site containing overviews of them and information about their relevance is missing.

There are some sites produced by various technical universities and science faculties. But they are quite often oriented to recruit new students so they offer, for example, collections of examples for preparation for entry exams and are not meant for explanations of physics for the wider public. Our web should be used for popularisation of physics as a whole and for everybody.

3.2 THE CHANGING ROLE OF TEACHERS

There are no doubts nowadays that the role of teachers will change under the growing influence of information and communication technologies within society. Multimedia is widely used in educational processes but they are not able to replace a teacher. Students will always need a guide who can help them to find their own ways of learning that are appropriate to their abilities and needs. A teacher should become a manager of knowledge, a mentor who helps to choose the right study materials and who controls and corrects the correct understanding of studied phenomena. Therefore we would like to create a place where teachers can find help and information which facilitates them in preparing for their new role in teaching physics.

3.3 THE BACKGROUND AND EXPERIENCES OF AUTHORS

The main creators of our web are Jitka Houfková and Leoš Dvořák. The basic idea and first concept of our web was formed by Jitka Houfková and widely supported, influenced and enlarged by Leoš Dvořák. Jitka Houfková is responsible for development and running of our web and Leoš Dvořák cares for its physics correctness. Jitka Houfková is a high school teacher now doing her PhD studies at the Department of Physics Education, Faculty of Mathematics and Physics, Charles University, Prague and Leoš Dvořák is the head of this department. Both of us have experience in using the Internet in teaching and creating our own web pages for our teaching and for other uses. As an example we can mention informational pages about the fifth year of Czech teachers' conference The Fair of Invention of Physics Teachers (<http://kdf.mff.cuni.cz/pub/Veletrh/>) or Czech web pages of the programme Physics on Stage (<http://kdf.mff.cuni.cz/pub/PhysicsOnStage/index.htm>) and the reportage from its finale, physics teaching fair (<http://fyzweb.mff.cuni.cz/posfoto/>). Leoš Dvořák created the intranet of the Department and basic web pages presenting it on the web (<http://kdf.mff.cuni.cz/>) and web pages of summer students camp (<http://fyzweb.mff.cuni.cz/tabor/>). Jitka Houfková works on pages for the High School Teachers Programme at CERN (<http://teachers.cern.ch>) and is a webmaster of school pages of Basic School Červený Vrch, Prague (<http://www.zscvrch.cz>).

To guarantee the high quality of physics content of our web a council composed of highly experienced physicists is being developed. Some of them are not only going to review new contributions but also add their own texts to our web.

To maintain all technical and editorial work – such as preparing texts for web publishing, checking old links and searching for new ones, doing some translations, etc - we set up an editorial team composed of undergraduate and postgraduate students of our faculty, futures physics teachers and physicists. They are good in physics and they have also necessary computer skills so it is sufficient to teach them only few things about making web pages.

4 OUR WEB

4.1 THE DEVELOPEMENT OF OUR WEB

The development of our physics web is planned in four main steps each of which includes and updates previous ones.

In the first step the web is only a commented list of links to sites with physical content. The main target groups of our effort are pupils and students and elementary and high school

teachers from our country. Therefore we have emphasised sites that are written in the Czech language but links to foreign sites are also at the list.

The second step is to build a collection of texts about physics and descriptions of various physical experiments, for school, self-study and free time, with instructions how to make them.

In the third phase we plan to create something like an Internet journal for physics fans, with up-to-date information and interesting topics from physics and its teaching. Specific topics, for example a topic of the month or current problems from teaching and news from physics, will be discussed in e-mail conferences. Children and students will be motivated and guided on their experimental work and we will encourage and support them in solving physics problems.

In the last step we would like to initiate the creation of several virtual communities: a community of teachers, a community of children and students and a community of various people interested in physics.

As it is clear from previous paragraphs that there are many different components planned to be a part of our web. Some of them are only in a phase of planning, some of them are already in progress and few of them are already running.

4.2 THE COMPONENTS OF OUR WEB

4.2.1 THE PAGE OF ANSWERS

The important part of our web, which is working from the first days of its existence, is the page of answers. It is possible to e-mail questions about physics there and the questions are answered by physicists. The answer is sent by e-mail to the questioner and published on the page of answers. All questions with their answers are archived on this page so everybody can see what others have already asked.

4.2.2 THE PAGE OF CHILDREN'S PHYSICS CLUBS

Children's Physics Clubs are school clubs for children with an interest in physics. Children are motivated and guided by doing experiments and are encouraged and supported in solving physics problems. The Clubs are led by students from the Department of Physics Education, future physics teachers, and coordinated by the Department of Physics Education. For the support of clubs' leaders and for communication between all participants a page of children's physics clubs is used. Because of its test running the page is accessible only for students who lead children physics clubs at present but its opening to the wider public is planned in the future. The page should motivate the formation of more new children's physics clubs and support and inspire work in already existing clubs. It could also be used by children themselves just to find ideas and instructions for their own experimental work.

4.2.3 LIST OF LINKS

Our list is divided into two main parts. The first one contains links that point to pages in the Czech or the Slovak language (the Slovak language is easy to understand for Czech people). The second list of links points to pages in other languages. In both these categories the links are further sorted into links to pages with explanatory texts, pages with descriptions of

experiments, pages with applets and simulations (virtual labs), pages with remote sensing or remote control experiments, etc.

Each link is checked and a short description and our comments are added to it. To some pages we also add suggestions for its use in lessons. We plan to do the same for more links.

In order to maintain our list of links, which work and point still to appropriate materials, it is necessary to check them regularly. This work, as well as searching for new links, is now done by our students, future teachers of physics.

4.2.4 TRANSLATIONS AND LOCALIZATIONS

Nice web pages with physics content are already available on the Internet but they are mainly in English. Because the cultural background is different in each country it is easily seen that just to translate educational material would not be enough. Especially for younger pupils it is necessary to “localize” it to their surroundings. A very nice example of such work is one diploma thesis (http://hp02.troja.mff.cuni.cz/~urbanova/bizarni_kramy.htm) defended last spring in our faculty. Its author translated selected parts of nice pages called Bizarre Stuff You Can Make In Your Kitchen (<http://freeweb.pdq.net/headstrong/>) but not only that. She also made those experiments with aids, which are available in our country and added her own comments and recommendations to them.

4.2.5 CURRENT AFFAIRS AND REPORTAGES

Another inseparable part of our web is information about current affairs from the world of physics and its teaching and reports from them. To make these reports more interesting and obvious we add as many pictures and photos as possible. From the events we take part in we try to make on line news.

4.3 COLLABORATION WITH AUTHORS OF SIMILAR SITES

First of all we are starting to collaborate with people and institutions from our country that build sites with physics content. That means mainly various technical and science faculties that make sites to recruit new students or to present their work, results and outreaches, and physics teachers from different kinds of schools. Teachers have already started to send us annotation to their own web pages, which sometimes contain collections of examples or experiments and lists of links, and links to interesting web sites they want to share with other colleagues.

Since November 2000 we have been collaborating with the Physics Department of European School Net (<http://physicsnet.asn-graz.ac.at/>).

Because of the language which is easy to understand for Czech students, we would like to start collaboration with people from Slovak Republic in the near future.

4.4 TECHNICAL INFORMATION ABOUT OUR SERVER

The name of our server is KDF-LS. It is placed on academic network karlov.mff.cuni.cz, so its full address is: kdf-ls.karlov.mff.cuni.cz. It has two possible aliases: fyzweb.mff.cuni.cz and phys4all.mff.cuni.cz (which is planned for English version of FyzWeb).

Our server is a PC with an Intel Celeron 466MHz processor and 128 MB RAM (256 MB swap). There are 10 GB of disk space reserved for web, additional space is used for system. The PC is connected by 100 Mbit Fast-Ethernet network card to the main network of Faculty of Mathematics and Physics, Charles University, Prague.

The operating system is RedHat Linux 6.2CZ with HATTP server Apache 1.3.

5 OUR TASKS AND PROBLEMS

It was in the spring of 2000 when we made a step forward and instead of producing only separated web pages aimed at various physics phenomena we decided to build such complex site as we tried to described above. We had a relatively clear idea of what we would like to have in our site. Anyway, at first we investigated what all is available on the Internet and what would be interesting for teachers and what for students and pupils and what we were able to offer them. We spent some time by rethinking our plans and by talking to physicists and teachers. Afterwards we had still a lot of problems to solve. For example which type of web pages to choose ("classical" static pages or databases and automatically generated pages), or which software to use for making pictures and animations, how to put the mathematical formulae into the text, or how to provide sufficient update of the pages etc.. Some of these problem we have solved, some of them were postponed for the meantime.

Our recent biggest task is to look for appropriate graphical design and intuitive navigation through our pages. Because our web is addressed not only at teachers but also at children, this means a group with widely dispersed age, experiences and expectations. We would therefore like to find solution that is acceptable for most of them.

Another big task is to check older links and to find new ones. This means a lot of routine work, because web pages are changing, arising and expiring so quickly. It is therefore not possible to rely upon the links and their descriptions for long periods. This work is nowadays done mainly by undergraduate students.

6 CONCLUSION

It was the purpose of this article to present our project Physics Web for Everybody, which should be used for physics education and popularisation of physics. The rapid progress of information and communication technologies and contemporary trends in education opened free space for educational web sites. But to create a useful educational web site and fill it with worthwhile electronic learning material in a language which is easy to understand for its users (in our case that means the Czech language) needs a lot of effort. It is necessary to structure texts in a different way than in paper textbooks and to rethink correlations between various parts of the curriculum. Also the ways of building and maintaining virtual communities are quite new and we have to learn a lot about it. Thus the authors also need to learn more about programming, graphics, didactics and psychology and it is necessary to work in a team of specialists. All that causes the creation of educational web to be a big challenge.

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