ELECTRONICS SCIENCES

––––––––––––––––––––––––––––––

ELEKTRONIKOS MOKSLAI

The Designing and the Implementation of WWW-course "Electricity, Electronics and Environment"

L. Korpinen, M. Koskiranta, R. Lehtelä

Environmental Health, Department of Energy and Process Engineering, Tampere University of Technology,
P.O. Box 589, FI-33101 Tampere, Finland, e–mails: leena.korpinen@tut.fi, minna.koskiranta@gmail.com,
riitta.lehtela@tut.fi

M. Vesapuisto

University of Vaasa, Department of Electrical Engineering and Automation,
P.O. Box 700, FI-65101 Vaasa, Finland, e–mail: maarit.vesapuisto@uwasa.fi

K. Tepsa, H. Puro

Zento Oy,Kuninkaankatu 30B, FI-33200 Tampere, Finland, e–mail: zento@zentointeractive.com

Introduction

The number of women applying for jobs in technology is still not very high. Technology has always been considered a male industry and this is why women think it is very hard to choose technology as a career. Information technology, for instance, is considered the boys' world, which contributes to the fact that very few girls want to have a career in technology. One way to try to make technology more appealing to girls is to create web learning materials.

The Internet provides new learning opportunities. However, pure online learning also has certain limitations. According to Dodero et al., compared to pure virtual e-learning, hybrid learning encourages more student participation [1]. Hybrid learning is a mixture of traditional face-to-face learning and online learning. Hybrid learning has been studied and applied in several places [2–5]. Furthermore, comparing email and face-to-face communication, concludes that students tend to put more thought into e-mail communication with instructors than in face-to-face communication, females more than males [6].

WWW materials and courses to support teaching have been developed at Tampere University of Technology (TUT) Laboratory of Electrical Engineering and Health (LEEH) already for a few years. (Due to structural changes in TUT in 2008, LEEH is now known as Environmental Health, EnH). Since 1993, the research team has studied application of hypermedia and hypertext methods to different education and decision-making situations (for example, electrical network book, harmonics book, electric power engineering book, transformer book, production and consumption of electricity book, and an applet for solving arithmetic problems. The interactive WWW based education in electrical engineering has also been developed at TUT. Two courses have been developed *Electric Power Engineering Virtual Course* and *Environmental Issues of Electric and Electronics Industry*. All these courses are run under a learning environment developed by LEEH [7–8].

EnH has continued developing web-based learning solutions, for example, *Electric Power Engineering Virtual Course* and *Environmental Issues of Electric and Electronics Industry*. EnH has also run several virtual courses during the past few years. Some of them have replaced traditional courses and some have been arranged simultaneously with traditional courses. These courses include *Electric Power Engineering Virtual Course* and *Environmental Issues Electric and Electronics Industry*. One virtual course, *Electricity, Electronics and Environment*, has also been carried out in colleges. Usually, the courses have also contained three traditional lectures [9–10].

A three-year project *E-Girls – Towards Technology* has been underway since March 2004 in Tampere University of Technology (TUT). The goal of this project was to increase the number of female students in technology by making it easier for them to find their way, in particular, to the fields of electrical engineering and electronics. It also aims at promoting the girls' ICT skills and developing the policies of senior secondary schools and other schools in such a way as to promote the technical skills of girls. The project was funded by the European Social Fund (ESF), The State Provincial Office of Southern Finland, and the state of Finland. The other partners in cooperation are: Fingrid Oyj, Finnish Energy Industries, Nicefactory Oy, The Federation of Finnish Technology Industries, the educational development

services of TUT, the Student union of TUT, and eTampere -information technology program (until the end of 2005).

Aims

The aim of this paper is to describe the development of the course *"Electricity, Electronics and Environment"* and present experiences from using the course.

Development of the Contents

An electronic WWW-course: *Electricity, Electronics and Environment* has been designed and realized in pilot high schools during the project. The course concerns practical aspects of electric systems and electronic equipment together with their health and environmental issues. The students were able to take the course while still studying in senior secondary school, and if the student was to continue to study at Tampere University of Technology s/he would get credit for it in his/her study program. The course was also designed to be a part of the curriculum at TUT. The plan was to have the course remain part of the Open University education at TUT.

In the designing of the study material the subjects of interest of young women have been carefully taken into account. A practical way to approach the topics in the study material was planned. The project started in March 2004. Students and teachers from Pirkkala senior high school participated in the development of the course. Students were divided into groups of 5 and had to think beforehand what the topic electricity and environment should contain in May 2004, an introductory seminar was organized where the group work results were presented to the workers of the project. An autumn seminar took place in September 2004. TUT students presented the web exercises planned for the high school students. Working in groups, the students commented on the exercises and sorted them in order of superiority. The Pirkkala senior high school teachers of chemistry and physics participated in developing the content of the course and commented on the work throughout the project. A book was written to complement the material. First, a lesson topic was studied on the web, next the topic was read from the book, then an exercise was done from the book, and finally, understanding of the topic was tested in the web.

The course was first arranged at the Pirkkala senior high school during spring 2005. In November 2005, the project and the feedback from Pirkkala were presented to other schools at a seminar. In September 2006, a new seminar was given at the University of Vaasa. The following kick-offs took place in the spring of 2006 and autumn 2006.

Technical Development of the Course

The technical development of the course contained graphical and content design, implementation and testing.

The work was done by Zento Oy Ltd. The project started with logo and marketing material design. In the beginning there was an idea to use a mascot character, which would appeal particularly to girls, but also to young people in general. Some character designs were made. The logo design was inspired by symbols used in electric science. Feedback was collected from project participants. The final graphic design could be described as a fresh academic style as well as clear and minimalistic. Altogether the marketing material consisted of logo design, design concepts, stationary design and website design.

The concept design process started with Zento's design staff orientating themselves with existing study materials and plans for WWW–course material. Based on that material Zento produced a preliminary concept for the WWW–course and specification for technical platform. The preliminary concept and specification was evaluated and commented on by the E-Girls team from TUT. After that the concept was revised according to the evaluation results and final concept and technical specifications were produced based on that.

Overview of the functionalities described in the concept: E-Girls web course consists of WWW-lectures (including printable versions), exercises, students' own pages, news group, course calendar, seminar work, participant list, help pages and additional information (links and documents). All material can be searched with a simple text search (Fig. 1).

WWW-lectures and the exercises can be created and updated with a visual (WYSIWYG = What You See Is What You Get) –editor by the teacher. Statistical data regarding both general use of the course and student's personal progress is also available to the teacher. The course has a non-linear navigation model, allowing the user to accomplish lessons and exercises in a self-defined order.

The technical specification and implementation of the course was quite straightforward. The E-girls platform was implemented in a MySQL database and php and was run on an Apache server. The fact that the course was run by TUT on a TUT server, but the students weren't TUT students required particular arrangements in user management and in technical specification. An interface had to be built between the WWW-course and an authentication system used by TUT. That was probably the most challenging part of the implementation.

Test phase was divided into technical testing done by Zento and TUT's IT-department and in functionality and content testing done by Zento and E-Girls team from TUT. E-Girls team came up with an innovative idea on how to use the notes tool provided in WWW-course on collecting the test feedback. With the tool the test users were able to include their feedback comments in any material page or exercise page. Furthermore, the test users were able to send the comments to programmers and WWW-designers and they were able to see and print all the notes on one page (in chronological order), which speeded up the test phase remarkably.
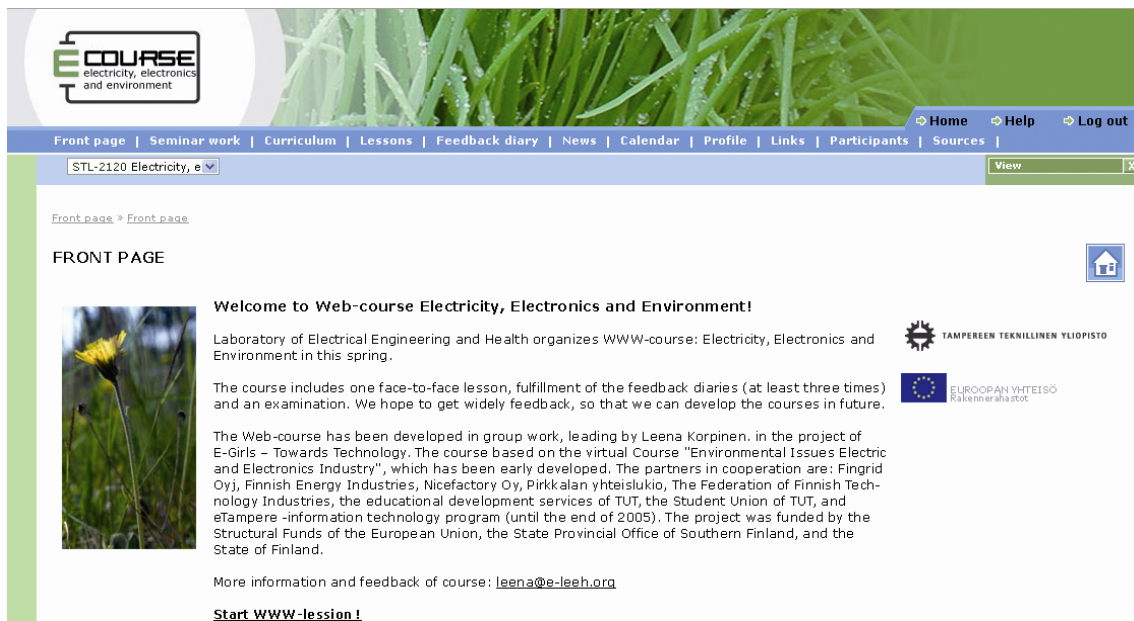
Fig. 1. Starting page of the web material

In the pilot phase Zento instructed teachers on how to use the teachers tools and start up with the lessons on the web. The actual piloting and pilot feedback was gathered by the E-Girls team. The pilot feedback mainly affected the practical arrangements of the course as well as the course material and content issues.

The first version of the E-Girls WWW-course was launched in spring 2005. After a year and a half's experience in use of the E-Girls platform the E-Girls team from TUT had collected the development ideas. The ideas were evaluated by Zento's design staff and final specification about the upgrade version's features was made together with the E-Girls team. The upgrade version consists of more sophisticated exercises and tools. The second version of the E-Girls platform was launched in February 2006. After that, E-Girls has been developed (in a project of E-girls in Vaasa region) even further during spring and summer of 2007. The technical platform was transferred to a new server and some new exercises and tool applications were designed.

Realization of the course

The course has been realized three times; in 2005 and twice in 2006. Students from all three classes in high school and as an experiment the last three comprehensive school classes have taken the course, since the course is not restricted to students of a certain year. In the spring 2005 the course was completed by 15 students (10 of which were female) from Pirkkala senior high school and one female student from the senior secondary school of Tampereen lyseon lukio. In the spring 2006 the number of participants totalled 65 (28 female), of which 54 (19 female) passed the course. In the spring 2006 the students came from five different senior secondary schools (Pirkkala, Eurajoki, Jalasjärvi, Valkeakoski and Hatanpää). In the autumn 2006 the number of participants totalled 58 (32 female), of which 38 (24 female) passed the course. The students came from five different senior secondary

schools and two comprehensive schools: the senior secondary schools of Pirkkala, Vaasa, Kauhajoki, Kyrönmaa, Teuva and the school Vaasan Rudolf Steiner and the comprehensive schools of Variska and Vähänkyrö.

The WWW-course: *Electricity, Electronics and Environment* is composed of web material and exercises. The web material contains text and pictures that are divided into sections or, in other words, lessons. The exercises include the memory game, crossword puzzle, tick-tack-toe combining of term, and multiple-choice questions. In addition, a book that was prepared especially for this course is used alongside the web material. The book contains further information about the lesson topics. Each chapter in the book ends with a hands-on task for the students to perform and to report about. The reporting is done via an electronic feedback diary, by which the students also give their comments and development ideas about the course.

Both the implementations of the course have begun with a traditional face-to-face lesson or a meeting with the students. After the meeting the students have independently studied the course material and completed at the minimum, three feedback diaries. Feedback was quite positive. There was a final exam at the end of the course.

Fig. 1 presents the starting page of the web material. The page contains links for example to the schedule, lesson material, feedback diary and personal profile. Each lesson begins with an introductory story, and continues with more profound information. The website is navigated using the arrows at the bottom of each page. The web material includes the memory game exercise, which the students can utilize in memorizing the study material. The students are meant to first study the web lesson and then continue with the corresponding chapter from the book. After this the students may test their learning by completing the web exercises. In addition, the subject in question will be examined in practice, as the students perform the hands-on exercise at the end of each chapter. The hands-on exercise

may, for example, go as follows: "Peruse your electricity bill. What information can be found? "

Discussion

From the web implementation point of view E-Girls has been a delightful and rare project because of the thorough design phase which was based on quality content material and plans as well as the determined development work done after the launch. The course was developed based on an existing TUT course, which made the development easier. The experience from earlier online courses with face-to-face parts was also utilized, for example, the importance of a face-to-face meeting at the beginning of the course. For practical reasons, one face-to-face contact with the high school students from geographically dispersed areas was considered to be the best practice. All in all, developing the course has been an interesting and challenging process. In this project attempts were made to take into account the differences between studying in high school, and on the other hand, studying at a university.

In a conclusion it can be said that this project was suitable for the course that it was intended for, since students found it useful. In the future, similar projects may also be developed for other courses.

References

1. **Dodero J. M., Fernandez C., Sanz D.** An experience on students participation in blended vs. online styles of learning // Inroads, the SIGCSE Bulletin. – 2003. – Vol. 35. – No 4. – P. 39–42.

2. **Garrison D. R., Kanuka H..** Blended learning: Uncovering its transformative potential in higher education // Internet and Higher Education. – 2004 – Vol. 7. – No 2. – P. 95–105.

3. **McCray G. E.** The hybrid course: Merging online instruction and the traditional classroom // Information Technology and Management. – 2000. – Vol. 1. – No 4. – P. 307–327.

4. **Rosbottom J.** Hybrid learning – A safe route into web–based open and distance learning for the computer science teacher // ACM SIGCSE Bulletin. – 2001. – Vol. 33. – No 3. – P. 89–92.

5. **Olapiriyakul K., Scher J. M.** A guide to establishing hybrid learning courses: Employing information technology to create a new learning experience, and a case study // Internet and Higher Education. – 2006. – Vol. 9, iss. 4. – P. 287–301.

6. **Lightfoot J. M.** A comparative analysis of e–mail and face–toface communication in an educational environment // Internet and Higher Education. – 2006 – Vol. 9, iss. 3. – P. 217–227.

7. **Korpinen L., Havunen I., Isokorpi J.** Self–study WWW Program for Teaching of Electric Power Engineering (in M. H. Hamza (ed.)) // Proceedings of the IASTED International Conference, Computers and Advanced Technology in Education. – Philadelphia, Pennsylvania, USA, 1999. – P. 46–49.

8. **Korpinen L., Havunen I., Kuusiluoma S.** WWW–Based Calculation Tasks for Teaching Support of Electric Power Engineering // International Journal of Electrical Engineering Education (IJEEE), 2002. – Vol. 39. – No 2. – P. 100–109.

9. **Keskinen M., Korpinen L.** E–Girls towards technology leads girls closer to Engineering // International Association for Development of the Information Society (IADIS) International Conference on WWW/Internet 2004. – Madrid, Spain, 2004. – P. 802–805.

10. **Kesti K., Latva–Teikari J., Långsjö T., Lehtelä R., Korpinen L..** Virtual course "Environmental Issues of Electric and Electronics Industry" // 19th EAEEIE Annual Conference. – Tallinn, Estonia, 2008. – P. 188–192.

L. Korpinen, M. Koskiranta, R. Lehtelä, M. Vesapuisto, K. Tepsa, H. Puro. The Designing and the Implementation of WWW-course "Electricity, Electronics and Environment"// Electronics and Electrical Engineering. – Kaunas: Technologija, 2010. – No. 6(102). – P. 75–78.

The goal of three-year-long E-Girls- Towards technology -project was to increase the number of female students in technology by making it easier for them to find their way, to the fields of electrical engineering and electronics. A web course, Electricity, electronics and environment, for senior secondary school students was designed and realized during the project. The course consisted of web material, exercises and a book written for the course. In the design of the web-course and the study material the interests of young women were considered. A total of 107 students completed the course, 54 of them being girls. Feedback was quite positive. The students found the course useful. Ill. 2, bibl. 10 (in English; abstracts in English, Russian and Lithuanian).

И. Карпинен, М. Коскиранта, Р. Лехтела, М. Весапуисто, К. Тепса, Х. Пуро. Особенности применения и внедрения дистанционного обучения при изучении курса „электроника" // Электроника и электротехника. – Каунас: Технология, 2010. – № 6(102). – С. 75–78.

Рассматриваются особенности дистанционного обучения технологических специальностей «Электричество» или «Электроника» целью привлечения учеников и студентов женского пола для более широкого привлечения девушек к техническим наукам одновременно с внедрением дистанционного обучения написан и учебник для абитурентов. При обучении из 107 учеников 54 были девушки . Общая оценка – положительная. Ил. 2, библ. 10 (на английском языке; рефераты на английском, русском и литовском яз.).

L. Korpinen, M. Koskiranta, R. Lehtelä, M. Vesapuisto, K. Tepsa, H. Puro. Elektros, elektronikos ir aplinkos nuotolinio mokymo kurso diegimo ir taikymo ypatybės // Elektronika ir elektrotechnika. – Kaunas: Technologija, 2010. – Nr. 6(102). – P. 75–78.

Apžvelgtos elektros, elektronikos ir aplinkos nuotolinio mokymo kurso diegimo ir taikymo ypatybės. Siekiant paskatinti merginas studijuoti technologijos mokslus, buvo įgyvendintas trejų metų trukmės projektas „E.merginos – technologijų link". Įdiegtas ir pritaikytas elektros, elektronikos ir aplinkos nuotolinio mokymo kursas vidurinės mokyklos aukštesniųjų klasių moksleiviams ir abiturientams. Nuotolinio mokymo kursą sudarė teorinė medžiaga, pratimai ir šiam kursui specialiai išleistas vadovėlis. Iš viso kursą baigė 107 moksleiviai, 54 iš jų buvo merginos. Gauta teigiamų atsiliepimų apie nuotolinio mokymo kursą. Il. 2, bibl. 10 (anglų kalba; santraukos anglų, rusų ir lietuvių k.).