

## **The Students' Feedback on WWW-course "Electricity, Electronics and Environment"**

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### **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 hesitate 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 and the amount of the female students in the technology fields in Finland has been quite small still in this decade [1].

The goal of this three-year-long *E-Girls – Towards technology* project, launched at the Tampere University of Technology in 2004, 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. The project created an Internet-based web course, *Electricity, Electronics and Environment*, for senior secondary school students, but it also became a section of university level study program at the Tampere University of Technology [2–4]. In addition, in the autumn of 2006 the course was accepted as a part of the instruction of the Faculty of Technology at the University of Vaasa [5–7].

In years 2005 – 2006 a total of 107 students in senior secondary schools completed the course, 54 (50 %) of them being girls. The web course *Electricity, Electronics and Environment* consisted of web material and assignments. In addition, a book written for this course was used. The students filled in a feedback diary in which they gave feedback and described how they had carried out the assignments. Feedback from the students was quite positive.

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 were: 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 compare between genders the students' feedback on the web course *Electricity, Electronics and Environment* for the senior secondary school. Also, the exam results were analyzed according to gender.

### **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 pilot 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 totaled 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 lesson topics are headlined as follows:

- 1) Introduction;
- 2) Health effects of technology;
- 3) Use of electric appliances;
- 4) Electronic waste and how to reduce it;
- 5) Electric systems;
- 6) Electricity production and its emissions;
- 7) Electric and magnetic fields and radiation.

The exercises include a memory game, a crossword puzzle, a 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 practical exercise for the students to perform and to report about. The reporting was 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 new students. After the meeting the students have independently studied the course material and completed at the minimum, three feedback diaries. There was a final exam at the end of the course.

Table 1 illustrates a suggested schedule for the weekly progression of the course in spring 2005. However, apart from the feedback diary hand in deadlines, the students may choose a studying pace suitable for them individually. The starting 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 students are meant to first study the web lesson and then continue with the corresponding chapter of 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 practical exercise at the end of each chapter. The practical exercise may, for example, go as follows: "Peruse your electricity bill. What information can be found? "

**Table 1.** Course schedule in spring 2005

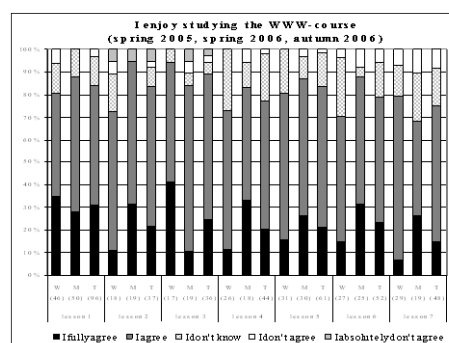
	15	16	17	18	19	20	21
Start up session	x						
WWW-lesson and book	1-2	3	4	5	6	7	
Feedback diary		x		x		x	
Practical exercise from the book	x	x	x	x	x	x	x
Exam							x

### Feedback from students

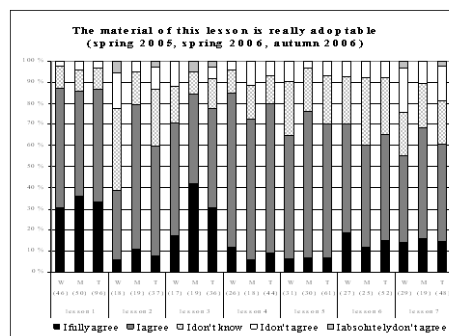
Giving feedback was one of the course requirements. Although submitting a feedback diary was possible after each lesson, only three submissions per

student were compulsory in order to pass the course. The feedback diary serves as a tool to collect student feedback containing their thoughts and feelings about the course as well as discovers ambiguities in the material and ideas for development. Furthermore, the answers to the practical exercises from the book were reported in the feedback diary.

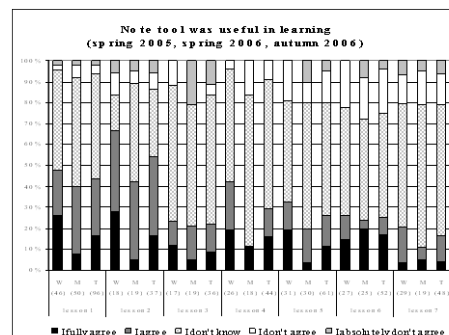
Each web lesson was accompanied by a feedback diary. For the feedback diary the students were requested to evaluate four statements: *I enjoy studying the WWW-course*, *The material of this lesson is really adoptable*, *Note tool was useful in learning* and *The number of exercises was sufficient*. The answer options were: *I fully agree*, *I agree*, *I don't know*, *I don't agree* and *I absolutely don't agree*. The answer distributions for the statements are schematized in Figs 1, 2, 3 and 4. The statements include results from spring 2005, spring 2006, and autumn 2006. The results are shown by gender.



**Fig. 1.** Student feedback when asked whether it was nice to study on the Internet, W = women, M = men, T = total



**Fig. 2.** Student feedback when asked about the difficulty level of assignments and exercises, W = women, M = men, T = total



**Fig. 3.** Student feedback when asked about the usefulness of the note tool, W = women, M = men, T = total

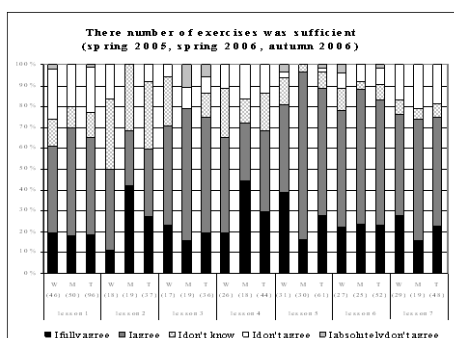


Fig. 4. Student feedback when asked about the number of assignments and exercises, W = women, M = men, T = total

### Results of the Exam in Autumn 2006

Let us now focus on one of the exams, namely the exam in Autumn 2006. At the end of the course there was an exam. The exam was in advance delivered to the different schools and held at the same time in all schools. The examination time was three hours.

The exam questions were as follows:

- 1) Explain briefly:
  - a. What are the environmental impacts of wind power? (2 points);
  - b. What are the Kyoto flexible mechanisms or Kyoto mechanisms? (2 p.);
  - c. The average annual radiation dose to persons living in Finland is around 4 millisievert. Of which factors this radiation dose consists of? (2 p.).
- 2) Explain briefly:
  - a. What are low frequency fields? Mention sources for the fields. (3 p.);
  - b. What is the difference between the protection against direct contact and indirect contact? Give some examples of both methods. (3 p.).
- 3) Explain briefly:
  - a. How do you economize on electricity (mention four ways) (3 p.);
  - b. In what is research of epidemiology based on? (3 p.);
- 4) Explain the different phases of Environmental Impact Assessment (EIA). (6 p.);
- 5) The most essential targets of environmentally oriented product development. (6 p.).

In the exam took part 37 students, 13 boys and 15 girls from senior secondary schools and nine (9) girls from a comprehensive school. The exam was graded so that a pass required 15 points (of the maximum of 30 points). If a student acquired 10 points, s/he received an extra assignment which compensated the missing exam points and thus could complete the course acceptably.

Table 2 presents how the results of all the senior secondary students were distributed in the exam, Table 3 the senior secondary girls and boys' results and Table 4 how much the results of senior secondary boys and girls differ from the overall senior secondary results. Table 5 presents the result of the Student's independent two-sample t-test.

Table 2. All senior secondary students' results

All results	Max.	Average	Standard deviation
Exercise 1	6,00	3,64	1,42
Exercise 2	5,50	2,59	1,16
Exercise 3	6,00	4,80	0,60
Exercise 4	5,50	2,05	1,74
Exercise 5	6,00	4,00	1,43
Points added	28,00	17,09	4,31
Grade	5,00	2,75	1,13

Table 3. Senior secondary girls' and boys' exam results

Girls' and Boys' results	Max.		Average		Standard deviation	
	Girls	Boys	Girls	Boys	Girls	Boys
Exercise 1	6,00	5,00	4,17	3,04	1,38	1,27
Exercise 2	5,50	4,00	3,10	2,00	1,04	1,08
Exercise 3	6,00	6,00	4,97	4,62	0,51	0,60
Exercise 4	5,50	4,00	2,27	1,81	2,02	1,44
Exercise 5	6,00	6,00	4,53	3,38	1,29	1,15
Points added	28,00	21,50	19,03	14,85	4,77	3,37
Grade	5,00	4,00	3,20	2,23	1,17	0,90

Table 4. Comparison of senior secondary girls' and boys' results to overall results

Girls' and Boys' results	Max.		Average		Standard deviation	
	Girls	Boys	Girls	Boys	Girls	Boys
Exercise 1	0,00	-1,00	0,52	-0,60	-0,04	-0,15
Exercise 2	0,00	-1,50	0,51	-0,59	-0,12	-0,08
Exercise 3	0,00	0,00	0,16	-0,19	-0,09	0,00
Exercise 4	0,00	-1,50	0,21	-0,25	0,28	-0,30
Exercise 5	0,00	0,00	0,53	-0,62	-0,14	-0,28
Points added	0,00	-6,50	1,94	-2,24	0,46	-0,94
Grade	0,00	-1,00	0,45	-0,52	0,05	-0,23

Table 5. Results of Student's t-test

All results	p-value
Exercise 1	0,0735
Exercise 2	0,0306
Exercise 3	0,2187
Exercise 4	0,5387
Exercise 5	0,0664
Points added	0,0353
Grade	0,0571

### Discussion

*Feedback from students.* According to the feedback received from the course the statements *I enjoy studying the WWW-course* and *The material of this lesson is really adoptable* got quite positive comments. As the figures show, almost 60 % of the students agreed or fully agreed with the statements. When comparing the answers from male and female students, they don't differ significantly. This can be seen in figures 1, 2, 3 and 4. In the statement *I enjoy studying the WWW-course* the biggest difference between the genders was in lesson 2 (*technology health effects*). Over 90 % of boys, but under 75 % of girls answered *I agree* or *I fully agree*. However, the amount of the answers was low for this statement. According to the feedback both boys and girls found the topics interesting and the content useful.

The statement *Note tool was useful in learning* got the highest number of *I don't know* answers from both boys and girls. However, positive feedback was also received. Both boys and girls thought that there were enough exercises. During the pilot all the exercises were

not yet available. In addition to the statement assessments, the students gave free feedback. They thought that the course was interesting and the themes were considered useful. The memory games and the true-false statements in particular were considered efficient from the learning point of view. On the other hand, some people had problems completing the course and they hoped for more assignments per lesson. Students were advised to follow the given schedule, shown in Table 1, to be able to complete the course in time. Of the different types of exercise, especially the memory game and the multiple-choice questions were regarded useful and important in learning. On the other hand, some students had difficulties in absorbing the information and asked for more exercises.

*Exam results of girls and boys.* The girls received better points from all the exam questions than the boys. The greatest difference was in questions 1, 2 and 5, where the differences of the girls' average minus the overall average are over half a point.

In questions 3 and 4 the difference is fairly small, approx. +0.2 points. Maybe the questions 3 and 4 are more electro-technical and practical, which interest boys. The other questions are more the kind of which require traditional memorizing.

The Student's independent two-sample t-test shows, that the assuming the distributions are different leads to probability of Type 1 error in value  $p = 3,53\%$ , when we examine the points added. This means that the difference of the distributions is significant. This conclusion can be confirmed by using kernel density estimation (or Parzen window method). The probability density function of girls' points added and boys' points added are quite different.

Of course, on the grounds of only one exam and a and fairly narrow number of students, more extensive conclusions cannot be made, but possibly the nature of the questions affect how girls and boys succeed in the exam.

## Conclusions

As a conclusion of the feedback and the exam results it can be stated that the girls did very well on the course. Their feedback was not as favorable as the boys' but nevertheless they thrived in the exam. Apparently the exam questions can be used to affect how well girls and boys succeed. Boys are seemingly more interested in the usage and operation of electrical appliances than girls, but also clearly technical subjects – like the electric systems – seem to interest girls.

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Received 2010 04 29

**M. Vesapuisto, T. Vekara, L. Korpinen, M. Koskiranta, R. Lehtelä.** The Students' Feedback on WWW-course "Electricity, Electronics and Environment" // *Electronics and Electrical Engineering*. – Kaunas: Technologija, 2010. – No. 6(102). – P. 99–102.

The aim of this paper is to compare between genders the students' feedback on the web course *Electricity, Electronics and Environment* for the senior secondary school. Also, the exam results were analyzed according to gender. The course has been realized three times; in 2005 and twice in 2006. As a conclusion of the feedback and the exam results it can be stated that the girls did very well on the course. Their feedback was not as favorable as the boys' but nevertheless they thrived in the exam. Boys are seemingly more interested in the usage and operation of electrical appliances than girls, but also clearly technical subjects – like the electric systems – seem to interest girls. Ill. 4, bibl. 7, tabl. 5 (in English; abstracts in English, Russian and Lithuanian).

**M. Весапуйсто, Т. Векара, Л. Карпинен, М. Коскиранта, Р. Лехтела.** Оценка отзывов дистанционного обучения дисциплины "Электроника" // *Электроника и электротехника*. – Каунас: Технология, 2010. – № 6(102). – С. 99–102.

Дана оценка отзывов студентов по дистанционному обучению. Определена успеваемость парней и девушек. Эксперименты, проведенные в 2005–2006 годах, показали, что парни лучше усваивают курсы электронного профиля чем девушки и дали более положительные оценки дистанционного обучения. Ил. 4, библи. 7, табл. 5 (на английском языке; рефераты на английском, русском и литовском яз.).

**M. Vesapuisto, T. Vekara, L. Korpinen, M. Koskiranta, R. Lehtelä.** Atsiliepiimų apie nuotolinio mokymo kursą „Elektra, elektronika ir aplinka“ įvertinimas // *Elektronika ir elektrotechnika*. – Kaunas: Technologija, 2010. – Nr. 6(102). – P. 99–102.

Analizuojami studentų atsiliepimai apie nuotolinio mokymo kursą "Elektra, elektronika ir aplinka". Egzamino balai įvertinti atsižvelgiant į lytį. Modulis buvo dėstomas tris kartus – 2005 m. ir du kartus 2006 m. Nustatyta, kad merginų galutiniai balai buvo gana geri, tačiau jų atsiliepimai nebuvo tokie palankūs kaip vaikinų. Pastebėta, kad vaikinai labiau nei merginos domisi elektros prietaisų taikymu ir valdymu, tačiau techniniais dalykais, pvz., elektros sistemomis – regis domisi ir merginos. Il. 4, bibl. 7, lent. 5 (anglų kalba; santraukos anglų, rusų ir lietuvių k.)

DOI: 10.5755/j02.eie.9365