

## Two cases how to raise attractiveness of electrical engineering studies

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## INTRODUCTION

The attractiveness of electrical engineering studies at the University of Oulu has declined from the top years when telecommunication industry was booming in Finland. There are multiple reasons for this but the reputation as bad employment situation has not diminished from public image. In addition the lower number of students with good

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mathematics skills at the university recruiting area adds competition between of students with e.g. engineering, natural sciences and medicine degree programs.

The need for young electrical engineers who can master electronics, telecommunications and related topics is higher now than in years before. After the decline of mobile phone development in Oulu region the employment situation has returned to the same level as it was before the decline. One big change is though that the age of the engineers working in high tech has increased and in near future there will increase. On national level the Ministry of Education has shown interest to increase the student positions in electrical engineering which brings pressure to degree programmes to recruit more students.

How to increase the attractiveness of electrical engineering? Before major marketing campaigns we have we have done some low level marketing at local level for students at Oulu area. This has been done in addition to general study marketing which the University of Oulu handles. This paper presents two campaigns which have been developed to rise student interest to electrical engineering and to get them familiar what studying is like at the University. Also one major question for students are life after university studies for which we wanted to familiarize the students to typical work life situations.

First case presents an electrical engineering course for high school students. This voluntary course was made in co-operation with a local high school as an extra physics course. The course has now been arranged first time in autumn 2015 and the second time is now planned for this autumn. The second case presents summer work campaign where 20-30 youth from age 15 to 18 were able to come to work at former Departments of Electrical Engineering and Telecommunication Engineering. The summer campaign has been arranged annually from 2012 and there is plan to arrange a new campaign in the summer of 2016.

## **1 CASE 1: ELECTRICAL ENGINEERING COURSE FOR HIGH SCHOOL STUDENTS**

The course for high school students was arranged as co-operation with Pateniemi High School which is located less than three kilometres from University of Oulu. The course contained two parts; face-to-face teaching at the university and learning diary which was reviewed by the high school teacher. The size of the course in high school credits was 0.5 while the typical courses at the high school are one full credit. To gain the full high school diploma the students need to study at least 75 credits.

The students were second and third year high-school students with the age gap from 16 to 18. Their background in electronics and engineering was quite minor. Some of the students had not even studied electricity in physics yet at high school. Couple of students had two electricity and magnetism courses passed at high school. This fragmented background gave some challenges to the course developers but the small number of students eased the teaching.

The course was graded as pass/fail and requirements for passing the course was attendance at the face-to-face sessions at the university and returning the learning diary to the high school teacher.

To keep the course in some decent level we kept the maximum number of high school students to ten students. Finally we got eight students interested to the course and the course was finished by seven students.

The expected impact for the course was to raise awareness of electrical engineering studies at Pateniemi High School and also other high schools at Oulu region. Also

adding knowledge about university studies to high school students lowers the threshold of students to come and study engineering at the university.

### 1.1 Course structure and content

The course for the high school students had five face-to-face teaching and each session lasted for four hours. Making total of twenty hours of face-to-face teaching. The topics of the sessions were:

- 1) Basics of electronics and electrical devices
- 2) Sensors
- 3) Wireless communication
- 4) Crystal radio
- 5) Principles of electrical measurements

The topics were collected from four different research units from which were the teaching was also given. Each of the teaching session included some theoretical teaching but also hands-on work was introduced to support the learning.

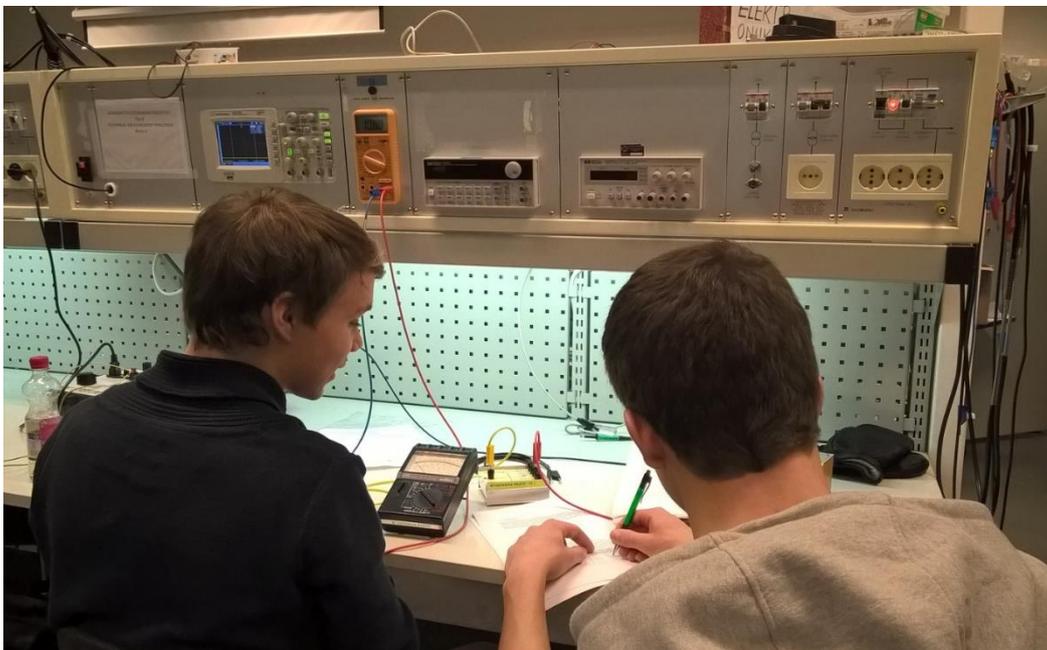


Figure 1. High-school students learning principles of electrical measurements.

As an example in the sensors part we introduced various sensing technologies as basis of the theory. The theory was handled lightly, mainly presentation of various sensing technologies. The more concrete theory came when different sensors were presented and discussed with students. Also for sensing the same physical phenomenon with different sensors increased the understanding on sensor fundamentals. On the hands-on session on sensor the students built a resistive pressure sensor which controls current to a led. The sensor was based on velostat (viite) and conductive fabric which were glued together to make a sensor suitable for clothing. After the sensor and the simple circuit were built, we discussed the sensing method and how the material can be the basis for sensing.

## **1.2 Workload for teachers**

The amount of work load of university teachers was estimated. In addition to the four hour face-to-face teaching the teachers had to prepare the sessions. The aim was to base the teaching on existing courses so not that much new material was not required to create. The estimation was that for preparing the teachers required the double amount of time for preparing which makes about eight hours. The total time for teachers was then about twelve hours per teacher. In addition some work was left to the high-school teacher whose responsibility was the overall coordination of the course and checking the learning diaries.

## **1.3 Feedback of the course**

From the students the feedback was mainly positive. Students enjoyed hands-on when they were building electronic devices. Some students enjoyed learning totally new things; for example some students tried soldering for the first time in their life. Some of the taught substance was too difficult but this was because the university teachers lack of knowledge on their background.

The university teachers enjoyed working with the high-school students. The teaching brought was different than with the engineering students which also brought some new elements to their own courses. In addition the university teachers got some clue what kind of knowledge the students have before they start their university studies. This also helps design of their own courses for younger students. The high school teachers were also satisfied for the teaching. The learning diaries brought out the positive learning experiences and the high school teacher was right away interested to continue the tasks in next year.

## **2 CASE 2: SUMMER TRAINEE PROGRAM FOR 15-18 YEAR OLD YOUTH**

The summer trainee program for youth at Oulu region has been arranged in the years 2012-2015 and currently there are plans for arranging a new program at broader level. Each year we had about thirty summer trainees working on electronics. The summer trainee program lasted for two full weeks and the trainees got a small salary from their work.

The tasks for the trainees was to build electrical devices that could demonstrate the electrical engineering studies. For example they build microcontroller based devices, printed electronic devices, robots etc. For guiding the trainees on the first two years we recruited staff from the research groups to lead the work. In later two years we hired 1st year electrical engineer students to first develop the demonstrators and after to guide the work.

There were a lot of applicants for the positions but the requirements were quite open. We wanted trainees who were interested in university level engineering studies. We made a web-based application which included some questions about electrical engineering sciences and when applicant was able to answer to the questions right they could submit their trainee application.

The expected impact from the summer trainee program was to gain low level information about electrical engineering studies at the University of Oulu and also we made news releases to local and national press to inform about opportunities on electrical engineering.



Figure 2. Summer trainees and their supervisors during summer 2015

### **2.1 Summer trainee program structure and timetable**

The basic timetable for the trainee program was that the trainees worked two weeks and six hours daily from nine to three. The work days included lunch break and short break in the afternoon.

In the year 2015 the trainees were grouped into three different groups and they had three different tasks during the two weeks. In each task they had a job to develop, design, program and/or implement electronics devices. The tasks were:

- 1) Build a device that reacts to sound with light
- 2) Build a game with Python programming language
- 3) Build and program a line detector robot

Each task lasted for three days. This left one day extra in the two weeks trainee program which was used to even the first and last work days, and also other activities as university research presentations and a company visit. Every year the trainee program included a visit to a local company which develops electronics related technology in Oulu area.



Figure 3. Trainees designing a PCB and their implemented device.

## 2.2 Workload for teachers

During the first year the summer trainee campaign was arranged almost purely by university staff but it was noted that the managing of the trainees requires continuous supervision. All the time the trainees require assistance e.g. on using professional software which they are not used to. If concentration is lost because not knowing how to proceed, the trainees usually tend to do something else that is not that productive. This meant that there should always have been at least one staff member available for the trainees.

After learned lessons from the first year, engineering students have been hired to run these summer trainee programs. In 2015 for each three different tasks first and second year students were hired to run the trainee program for the youth. The work included also designing the tasks for the students. The engineer students work period was two months; of which the first month was given to designing the tasks and ordering the tools and components. The first two weeks of the second month was used for the trainee program and the final two weeks were used for reporting and also some extra work for as research assistants.

## 2.3 Feedback from the trainee program

The feedback from the summer trainees has been encouraging. Almost all the students were appreciating highly the opportunity to come and work on totally different summer work. Many have said that their friends were for example in grocery stores where the task were different in many ways.

The positive feedback from the trainees was connected to the trainees own motivation for the tasks. If the trainee was not interested of the tasks, they easily got bored to the subjects. And this caused to feedback as 'boring tasks' etc. This is why the call for trainees has been improved annually that only motivated youth were accepted to the trainee program.

The supervisors of the trainees were excited to work with the youth. Typically university teachers are used to engineering students who are older and not that childish anymore. Younger people are different to supervise and give different challenges. Also the

supervisors thought that *this summer trainee program is probably the most effective way to get youth to be interested in electrical engineering.*

### 3 CONCLUSIONS AND FUTURE WORK

Increasing the attractiveness of electrical engineering studies is an ongoing task for the degree program. The number of new students with adequate mathematics and physics knowledge is decreasing around the recruitment region. But in the same time the need of the highly educated engineers in electronics and telecommunications is stable or even increasing. First time in the history of electronics and telecommunication industry in Oulu region employees are retiring which also creates a higher need for fresh blood to the business.

Study place attractiveness is a sum of multiple varieties. One of them is the image of the industry – huge layouts and negative atmosphere of the key companies affects negatively to the study place attractiveness. Positive news, as high employment rate, do not get the same media attention as the negative news so their impact is not that high.

Studies [1] suggest that the main reasons for choosing the study place are:

- Location
- Reputation of the University / Degree Programme
- Degree Programme content
- Friend suggestions
- Parent suggestions
- Other (relative etc.) suggestions

With these two cases we tried to raise the attractiveness to the studies by increasing the students' knowledge of the studies and also the work life after the engineering studies. This increase knowledge of knowledge is planned to have impact on students own opinion of the reputation of the degree program. But also they are experts among peers about the electrical engineering studies. Also the students can affect to their peers opinions on the possibility of choosing electrical engineering as their study place.

The experience on both of the recruiting campaigns has been so positive that we are continuing the work. The work has now been extended to support the faculties all three degree programs; Electrical Engineering, Computer Science and Engineering, and Information Processing Sciences. In June 2016 the summer workers are coming to Oulu University FabLab to work with electronics, programming and device building. Also in autumn 2016 FabLab will take major role on giving a course in electronics and information technology to high school students from Oulu region. The course will be supported with an ESR-funded project which tries to lower the threshold for university studies.

In future we will try to implement these actions as part of the standard marketing operation for the degree program or faculty. Extending the actions to other northern Finnish towns is also reasonable option for gaining greater impact for the actions.

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