New introductory courses and teacher tutoring
Keys to an efficient beginning for university studies in engineering

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ABSTRACT

Becoming a university student is a big transition for a college student. Everything is new; places, practicalities, regulations, and the ropes have to be adopted quickly. At the same time, the requirements of working life and need for better generic skills after graduation have been elevated to general discussion.

To meet these challenges, the orientation and beginning of studies in Tampere University of Technology were renewed in 2013. In Faculty of Computing and Electrical Engineering, we tried to achieve better study experience for our students, better study success during first year studies and further bachelor's degree. Our methods were to adopt systematic teacher tutoring and to focus on co-working in smaller student groups as well as combine generic skills to technological skills in two new introduction courses in the beginning of university studies. The courses were planned to give as much support in generic skills development as possible.

Our results have been very promising so far. The amount of ECTS credits as well as passing rates of compulsory courses during the first year have improved. Also the student feedback of the courses has been very good.

INTRODUCTION

University students have lot of information to learn and assimilate during their academic studies. In addition to learning the fundamentals in core subjects, the students' need support for "learning to learn" at university [1]. There is a big gap in the needed level of self-direction abilities of students between high school and university studies. It has been found that the first-year university students in Finland both request and require guidance, scheduling assistance, and assistance in finding the most appropriate learning methods [2]. In order to meet these requirements, it is of great importance for students to have a fast, effective, and motivating start to their university studies. A students' first year of studies at university has a significant effect on their later studies and even to their decision whether to continue their studies in the university [3,4]. Due to the importance of the topic, several studies have been made concerning this so-called first-year transition [e.g.4]. Since most of the studies have focused only to the students' first study year, we are planning to investigate how new introductory courses for first-year students at university affects their academic success during their three-year bachelor's degree.

For universities, it is important to remember that work life after a Master's degree requires also other kinds of skills beyond just science and technology skills, which are the core of the curriculum throughout the studies in engineering. These other very important skills can be named as generic skills, and they include skills such as teamwork skills, writing skills, and oral presentation skills. Developing these skills is often a forgotten element in university courses, which are primarily focused on subject-related topics [5,6]. The integration of the generic skills and knowledge into the university curriculum is very important.

Previous studies [e.g.7] have suggested an institutional commitment to student learning, proactive management to student transition fostering students' social engagement, emphasizing the students' first year experience and systematically monitoring and evaluating student achievement.

1 INTRODUCTORY COURSES AND TEACHER TUTORING

To organize effective guidance and assistance, the Faculty of Computing and Electrical Engineering (FCEE) in Tampere University of Technology started to develop first-year studies for bachelor degree students in Information Technology (IT) and Electrical Engineering (EE). These study areas have a common bachelor's degree program, and the yearly intake for both study areas each is 90 students. The FCEE decided to completely renew the studies in 2013.

Instead of organizing a typical freshman's week before the studies begin, the FCEE decided to try something new. Two new introductory courses were designed, which aimed to familiarize students with studying at the university; motivate students to their basic studies; provide students with hands-on experience through a simple electrical construction project; provide students with the tools needed for scheduling their own studies; and provide students with possibilities for group work and peer support. Altogether, a strong integration of the science and technology skills and the other needed skills was started in the very beginning of the studies.

These new introductory courses were planned to be implemented in the first study period of first study year, and they lasted for seven weeks. They are compulsory for all students in the faculty. The courses and their contents are described in *Fig.1*. In *Fig.1* it can be seen, that the learning outcomes include both basic technical knowledge and generic skills like scheduling and learning strategies.

New introduction studies (10 ECTS)			
Introduction to Studies in Technology		**Introduction to Information Technology**	
• An overview of study and research subjects • Getting familiar with university • Starting to create student's personal study plan • Developing skills in scheduling and learning • Introduction to entrepreneurship • Contacts to Finnish companies related to faculty subjects	Teacher tutoring	• Basics of digital logic • Basics of computer technology • Introduction to operating systems • Introduction to basic concepts of programming and algorithms	Project: • Constructiong a simple device using LEDs and microcontrollers • Learning project skills • Learning group work • Learning presentation skills (written and oral)

Fig.1. The contents of new introduction courses.

Teacher tutoring is integrated into both introductory courses, but the students' work load was counted to course Introduction to Studies in Technology. Each teacher tutor was assigned a group of 14-18 students. The group had a meeting every week during the first 7 weeks. Each week had a previously planned theme and material to discuss with the students. The objectives for the teacher tutoring were to improve the contact between students and teachers and to make the transition from high school to university life easier. In addition, this tutoring allowed students to learn how to work in

a group, how to study in an organized manner, and how to self-evaluate their own learning.

Teacher tutor groups worked together without their tutor in exercises in course Introduction to Information Technology, and other learning events during the first period. The aim was to familiarize the group to each other and create a safe environment for students to try new things.

To create a common bachelor's degree program, the basic studies had to be planned to suit both study areas. Therefore, few other changes were made to the curriculum: three new compulsory courses were implemented and three old courses were removed. To make room for the new introduction courses, two courses were moved to the second study year and students cannot choose that much elective studies.

2 METHODOLOGY

Since lot of effort and time had been put to make the changes, the results and impact of the changes needed to be evaluated. The research questions are:

1. Does the curriculum changes and new introductory courses have an impact on ECTS credits the students complete on their first study year?
2. Does the curriculum changes and new introductory courses have an impact on compulsory course passing rates on the student's first study year?
3. How do the students experience the new introduction courses?

Comparison data of ECTS credits and compulsory course passing rates from two previous years was collected from university database. Then the same data was collected from students starting their studies in 2013 and 2014 after their first study year. The data was collected only from present students, not from absent students.

Student experience was collected as course feedback questionnaire after the course. Since there were no corresponding courses before 2013, comparable data is not available.

3 RESULTS

3.1 Study progress

The results are promising: The average amount of ECTS credits completed by Information Technology students was improved as can be seen in *Fig.2*. The change in averages when comparing years 2012 (before new introductory courses) and 2013 (first implementation of the new introductory courses) is 6,3 ECTS, which is more than 1 passed course during the year per student. Also in *Fig.2* it is seen that the standard deviation has decreased, which indicates less variety between students. Electrical Engineering students had already quite a good amount of cumulative ECTS credits already before the study renewal process, but it still improved as shown in *Fig.2*. The improvement in the averages of ECTS between years 2012 and 2013 is 4,7, which is notable improvement. Although there has been improvement in amount of ECTS credits also from 2011 to 2012 in both programmes, the progress is still continuing to 2014.

The passing rates of compulsory courses have increased from 2011-2012 to 2013-2014 in most of the courses, as shown in *Figs.3* and *4*. Especially big and important improvements in Information Technology have been in the first mathematics course, *Mathematics 1* (*Fig.3*). When students get positive experience with the very first mathematics course, it is likely to improve the study success also in later courses. Also the number of Electrical Engineering students who passed the first mathematics course increased a lot, even though the increase in IT was much bigger. The smaller increase in the passing rate numbers of EE students may be due to the better starting situation when compared to IT students. This is seen in *Figs. 3* and *4*. The decrease in passing rates of Introduction to Computing in 2013 is because of changes in exam scheduling. Students could delay their exam to fall semester of second study year.
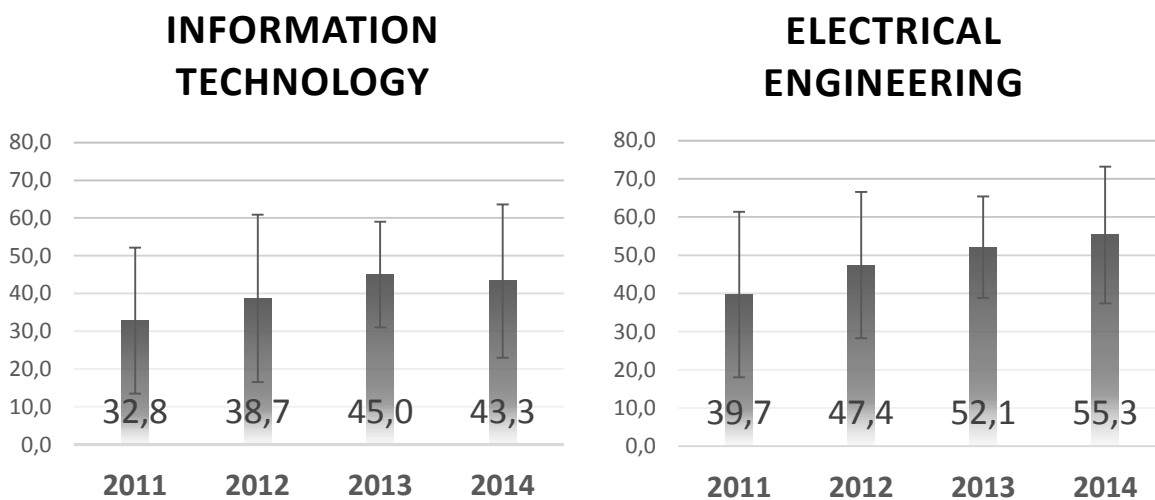
INFORMATION TECHNOLOGY

	2011	2012	2013	2014
	32,8	38,7	45,0	43,3

ELECTRICAL ENGINEERING

	2011	2012	2013	2014
	39,7	47,4	52,1	55,3

Fig. 2. Average of ECTS completed during first year by information technology and electrical engineering students.

INFORMATION TECHNOLOGY

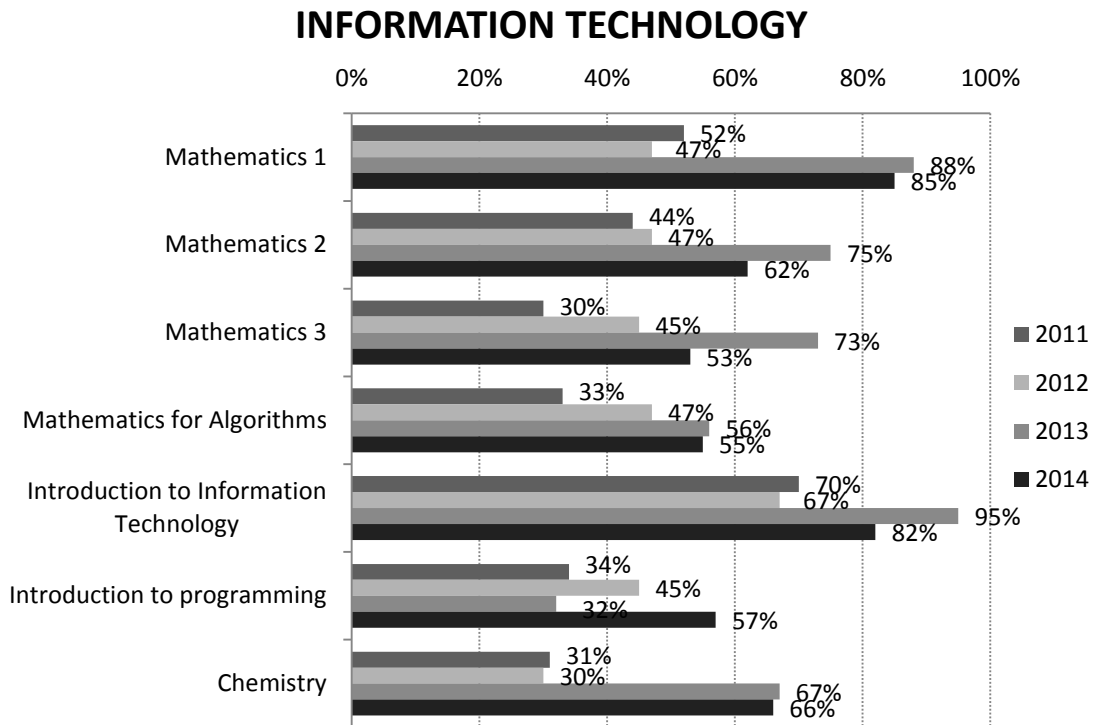*Fig. 3.* The passing rates of compulsory basic courses lectured in first year, information technology students.
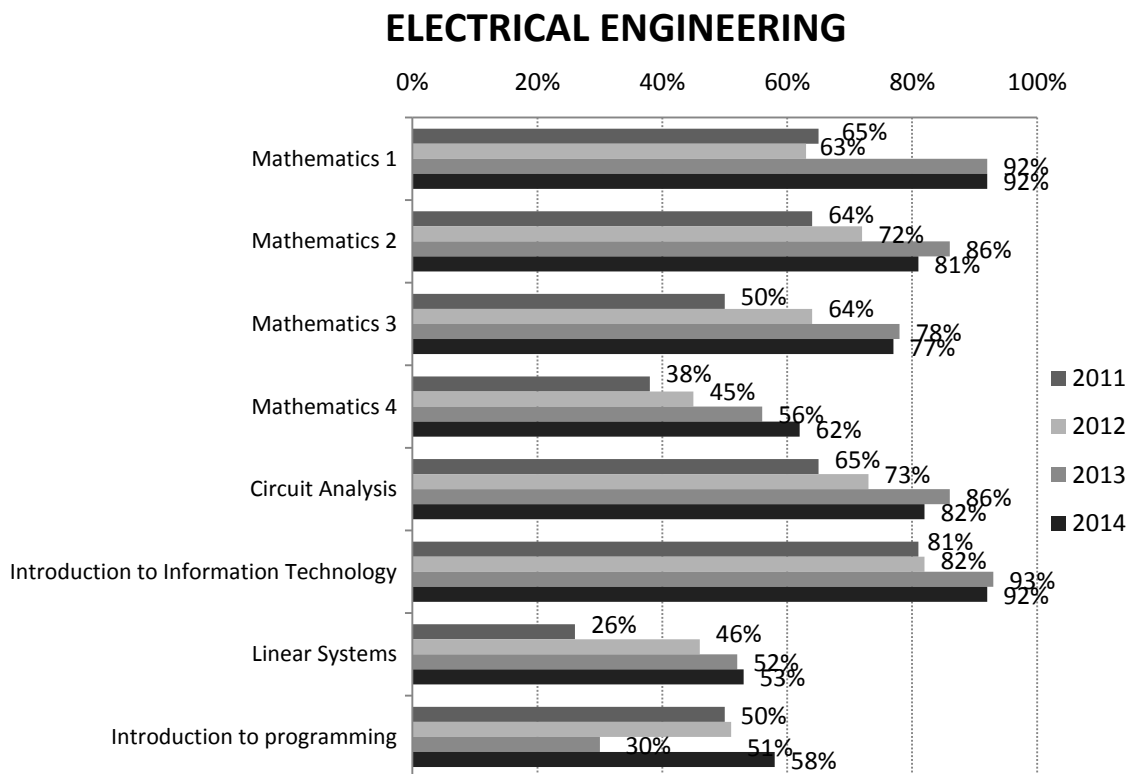
ELECTRICAL ENGINEERING

Fig. 4. The passing rates of compulsory basic courses lectured in first year, electrical engineering students.

2.2. Student feedback

We collected feedback form students right after the course period. The students' feedback has been mainly positive. The average overall grade students gave to the course Introduction to Studies in Technology was 2,81 out of five (year 2013) and 3,54 out of five (year 2014). Students evaluated also how the course answers to the pre-set learning outcomes. The average of their evaluation in scale 0-5 was 3,26 (year 2013) and 3,74 (year 2014). Since there were no similar courses before fall 2013, we do not have comparable data from years 2011 and 2012.

Verbal feedback has also been very good, as can be seen in these quotes:

"It was great to get to know the people in your tutor group as well as to meet the teachers and professors. The course put my studies going! "
"the lectures were interesting and it was good to involve students in the discussions "
"the course was very informative and included all important things"
"teacher tutoring got students working together"
"better view to the course whole and schedule is needed, since the course is quite complex and fragmental"

According to the feedback, we were able to organize and schedule the course better every year, but the main contents has remained the same.

4   DISCUSSION

The success of students varies from year to year, but there has been improvement for two years (2013 and 2014) compared to the previous two years (2011 and 2012). It seems that more systematic tutoring in the beginning of studies helps students to focus on the compulsory courses instead of other courses, and accordingly may help to complete the studies more efficiently. In addition, the intense teacher tutoring in small student groups helps students to integrate to university life. This leads to a smooth start to university studies, leading also to improved study results.

The improvement in study efficiency may also be due some other variables: different student groups, changes in other courses etc. Anyway, the increasing development of passing rates of all compulsory courses during both semesters indicates that this renewal process has contributed to the success of students.

We will continue to monitor the study success of our students also during their second and third study year to see how the changes effect on the further studies. It would also be interesting to investigate the drop-out rates of students before and after the changes.

The introductory courses will be held for the fourth time on fall 2016. Since the results have been good, the basic principles will remain the same. Improvements have been made mostly to scheduling. Also the topics have been focused better to suit the student's needs according to their feedback.

5   SUMMARY

First year university students need to adapt lot of new knowledge and learn to learn in university as well as assimilate generic skills. To meet these challenges, orientation and beginning of studies in Tampere University of Technology were renewed in 2013.

In Faculty of Computing and Electrical Engineering, we tried to achieve better study experience for our students, better study success during first year studies and throughout the rest of their bachelor's degree. Our methods were to adopt systematic teacher tutoring and to focus on co-working in smaller student groups. The courses were planned to give as much support in generic skills development as possible.

During the follow-up time 2011-2014, the amount of ECTS credits as well as passing rates of compulsory courses during the first year have improved notably. Also the student feedback of the new introduction course has been very good.

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