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FONTYS PROUD HONOURS PROGRAM

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ABSTRACT

In September 2009 the department of Engineering of Fontys University of Applied Sciences in the Netherlands has started a pilot honours program for excellent engineering students called Program Outstanding Development (PROUD). Aim of this program is to give those engineering students, who have the ambition, the opportunity to work on extra profession related challenges in their study. By means of this PROUD program Fontys University of Applied Sciences is responding to the wishes of students for extra curricular activities and increasing need from the industry for excellent professionals with an extra level of theoretical knowledge and practical experience.

In this paper the courses offered at the Engineering department of the Fontys University of Applied Sciences are discussed. Different study possibilities/routings for students were developed depending on earlier acquainted competences, adaptation abilities to our system (special possibilities for slow starters) and tracking and tracing by intensive study coaching. This resulted in an improvement of the yield of students to 74% of students started in 2008.

After working successfully on reducing the drop out rate of our engineering students the department focused on possibilities for excellent students. The department started the PROUD pilot together with engaged engineering students. In 2008 engineering students have carried out a research among their fellow students, lecturers, other institutes [1] and industry. This resulted in a quite different approach of an honours program for the department of Electronic and Electrical Engineering.

In the PROUD program the student is stimulated to personally shape his educational career and to explicitly work on developing his own competences. The PROUD excellent program starts after the first year and extends to at least 3 semesters in the following years.

The student, guided by a supervisor and outside the regular study time, is working on building an excellent portfolio at the university as well as in industry. During this period the PROUD student will work in industry one day a week in average. This is on top of his bachelor educational program. The students will receive an excellent honours certificate together with their bachelor's degree at the end of the study to express their honourable work.

Each year about 20 students apply for a place in PROUD but thus far only about 3-4 passed the first interview round. It turns out that student, university and industry are eager to participate in this PROUD program.

1 INTRODUCTION

The Electrical and Electronic (E&E) department of Fontys Engineering wants to educate the best product developers who are ready for the future. They are needed in the region of Eindhoven where many companies work in E&E product development. This requires a challenge for us to bring the latest technologies into our education, like embedded controllers, FPGA's, EMC proven design, high tech analogue and digital design, high speed design, wireless technologies and medical oriented design. Therefore a "body of knowledge" is important for our students. Mathematics, component knowledge, circuitry, programming, controllers, telecommunication and electromagnetic waves are the basics for future development. And although students want to be an engineer in future and are highly

motivated, for some is the body of knowledge a hurdle hard to get over. But other students have time left and have an easy time at the university. Most of these students even have a part time job simultaneously in order to earn for some extra money.

For all these students we made different study routes. The “One system fits all” approach [2] does not fit in our system as well! The main stream of our students (55%) will be graded with their bachelor certificate within the standard 4 years. About 30% of our first year students do have problems keeping up with the other (main stream) students. They used to stay in the same classes but due to the bad results (too) many of them left our department. Nowadays they will switch to what we call a ‘slow lane’. Each student has a counsellor and together they can choose for a personal study route which in this particular case is slower than the route of the average student. Instead of following new courses these students will be pushed by their coach to use their study time to repeat the same course. But now the course is in a slower pace and with more attention to practical assignments. Due to this the student does not have the pressure of doing exams in new courses as well as in the one they failed. The only deadline students have is the rule that they have to finish all their first year courses within a period of 2 years.

It turned out that our yield improved enormously due to this change in approach. The drop out rate, in particular in the first year, was very high in our opinion and so more student concentric solutions had to be found and implemented. As a result different study possibilities/routings for students were developed depending on earlier acquainted competences, adaptation abilities to our system (special possibilities for slow starters) and tracking and tracing by intensive study coaching. This resulted in an improvement of the yield of students as it moved up from 53% yield of students started in 2006 up to 74% of students started in 2008. With this new route the number of enrolled students that obtain their certificate has increased and we do have one of the highest ‘yields’ of our university. Around 75% of all subscribed first year students will finalize their study in the end with the engineering degree!

In the first two years students have several courses and practical assignments. One third of their time students work in projects. In the second year they have four industrial projects to get in touch with the way of working in industry and to see which techniques are used. In the third and fourth year the students have their specialisation. They choose a more broad education by entering a minor of another discipline or specialization in the Engineering’s discipline. The students also work as a trainee in industry for six months in the third year and in the last semester again for six months but then working on their graduation. The student is of course free in choosing specialisation courses, graduation topics and companies where they want to do their thesis work.

About 15% of the students opt for a study route we call ‘fast lane’. These students are able to get their bachelor certificate in three years time instead of four years. This is achieved by finalizing their first year of study in a half year period instead of a full year. Above that most of these students are already experienced by doing several traineeships in their education. So these students are allowed to also skip their trainee work at our university which is another half year gain.

Another option to choose in the last two years is a preparation for the master study. In that case students study the pre-master minor and in their specialisation they can choose to start already with their Master courses instead of the Bachelor courses. This brings down the total study time of the master with 1 year approximately and is a great option for those students who want to continue their study into the E&E master program.

2 PROUD

But not all engineering students want to excel in a further academic education (shown by Wetzels [4]). The PROUD Engineering Program will enhance the capability for engineering education to adapt to the changing needs of a technological and diverse society. Our institute Fontys University of Applied Sciences is located in the Brainport of the Netherlands. In this area there are many companies specialized in product development and design. We do want to contribute as much as possible and that is why our department of Electrical and Electronic Engineering has a goal: to educate the “Best E&E product designers of the Netherlands”

Therefore the engineering department will prepare students to help this increasingly diverse society in which human progress and our nations' economic future depends on the development and application of technology. Working on innovations, embrace and fulfil the aspirations of a diverse student body, and meet the needs of the engineering enterprise and society will contribute to our goals.

This will be done by:

1. The maximum development of human potential.
2. Innovation in curricular structure and content.
3. Leadership in the innovation and use of educational technologies.
4. Continuous improvement in the engineering education process.

The type of community we are creating involves much more than just being good at science and mathematics. Although that is clearly part of it, we are also looking for

1. Students who want more from their engineering education than fulfilling minimum requirements.
2. Students looking out for an educational experience that challenges their abilities and honours the uniqueness of their ambitions.
3. Students whose vision of engineering embraces both the opportunities and needs of a rapidly changing world.
4. Students who are eager to belong to a community of talented individuals coming together to encourage, support and enjoy each other's pursuit of excellence. An engineer who is top of the bill regarding product development and all engineering aspects involved with that.

These excellent students may choose for our excellent program PROUD to reach their goals. PROUD is an honours program of the Department of E&E engineering. This specific program has been created in collaboration with the engineering students. We formed a development group and this group held many inquiries and interviews amongst fellow students, lecturers and of course in industry [5]. The outcomes were quite unexpected results and therefore an unexpected PROUD program has been created.

3 PROUD DEVELOPMENT PROCESS

Usually the honour programs at universities are broad and they are the same for all students. Universities choose mostly for honour minors and in these minors students collaborate interdisciplinary at a subject related to society problems as e.g. sustainable energy, C2C, pollution, traffic control, etc [4]. Also at our universities this kind of honour programs are available. But before introducing an honours program in our department, we decided to start a work group to investigate the wants and needs of our engineering students regarding honour programs.

Five students and two lecturers started a research on this topic of excellence and ended up with a recommendation for the management of our department. The first inquiry was started to find out the ‘specification’ of the honour program as engineering students would like to have it. It turned out that 45% of Fontys first year engineering students (N=75) wants to participate in an honours program (shown by Wetzels [4]). If these first years students could choose then 60% wants to become an outstanding engineer. This in contradiction to 28% of the first year students who would choose for a more academic education: more courses and more theoretical background. The PROUD development team was astonished about the specification list of the engineering students. All respondents agreed that an honours program is only serious as it is an extracurricular effort for the student: it should be additional study/work on top of the whole engineering program. The students in general disapproved the thought that one could be excellent just by having a specific honour minor instead of regular minor as is the idea of our university management (see Fig. 1). “If one is excellent then the student should have (spare) time to do extra work/study” was phrased often. This is in a remarkable contradiction with the ideas of our central management who offers a honours minor.

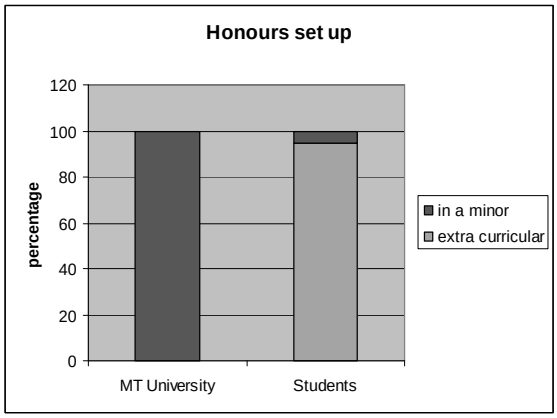

Figure 1: Honours curricula seen by Fontys Management and engineering students

So now the question arises: "what should the honours student do in this extracurricular time?" The inquiries showed that 80% of our students have a part time job next to their study. So it is obvious what students do in their spare time: work and earning money. If students would join our engineering honours program, and this program requires spare time from the participating students, it will conflict with their part time jobs they have right now. And indeed, it turned out that students will apply only for our honour opportunity if they get paid for this extracurricular work. Combining this with the students' indication of getting more engineering experience it was obvious that the department had to look for ways of collaborating close with industry where become experienced and get paid go well together.

Practical training in companies has been recognized for many years as a main component of the education of engineering students all over the world. This is especially important for engineering graduates wishing to compete in a global labour market. At present, employers highly value new engineers with practical training, as a way to guarantee that they have competences in engineering skills, team working, communication abilities, leadership and some others. It is in this context that some people have asked for including compulsory work placements in engineering study programmes [3]. Our honours program translates this into a voluntary extra work experience for honour students besides traineeship and thesis work. These students broaden their engineering horizons in selected companies. In this interaction with industry they work to solve real-world engineering problems on an increasing level of complexity.

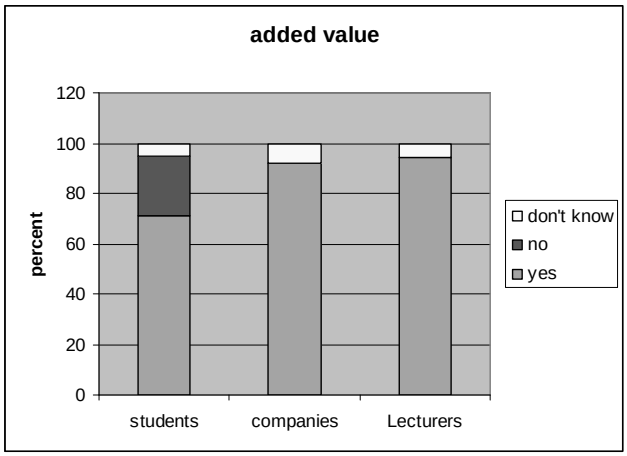

Figure 2: A honours program has added value

Before continuing this process the group had several meetings with industry which showed the huge interest of industry in meeting our honour students as shown in Figure 2. Industry was eager to collaborate with these excellent engineering students. They offered to create very flexible learning jobs in which the students will be paid reasonably well. So this is a real win-win situation: students

work in a professional environment, industry meets and educates successful students and the university stays in close contact with industry and therefore it creates a great honours program opportunity!

4. PROUD REALIZATION

Selecting students for an honours program is difficult and criteria are not clear. Comparison with different universities and departments it turns out that there is not a single set of criteria as entry conditions for honours programs. The PROUD development group also investigated the wishes and views of lecturers and students on this subject. As Figure 3 shows, it turned out that also here the visions on selection criteria differed enormously. Students are much more selective and firm: PROUD students should have a high average in marks and only a few should enter the program. This in strong contradiction to the lecturers who would like to focus on the students' eagerness and willingness to participate and above that lecturers prevail an extra selection made by industry.

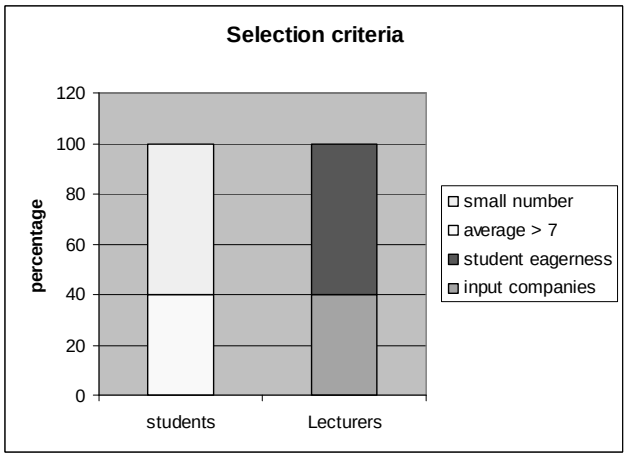

Figure 3: Selection criteria

In conclusion the PROUD program committee came to the following selection criteria as guide lines. The student has to have:

1. Completed the first year (preparatory year) in one year.
2. An average of seven on all exams.
3. An application intake at the university and an intake/interview at the company where the student applies for fulfilling his PROUD industrial work. In this application the student motivates why he/she should be accepted in the PROUD excellent program of engineering.

With these selection criteria we fulfil all wishes as from the students as well as from the lecturers.

In the PROUD program the student is stimulated to shape his educational career and to explicitly work on developing his own competences. The PROUD excellent program starts after the first year and extends to at least 3 semesters in the following years. The student, guided by a supervisor, is working on building his excellent portfolio in school and industry. During this period the PROUD student will work in industry at least 1 day a week in average on top of his bachelor education program. Six profile points are defined and in industry the student will work on the Profile points one to five:

1. Passion
2. Ambition
3. Professional skills
4. Innovative skills
5. International orientation
6. Leadership.

Becoming aware of this skills and the ability to express this to others is essential for participant PROUD students. Fontys Engineering offers the PROUD student different ways to work on point 3 (Professional skills) and point 6 (Leadership) at the university. Therefore students have to fulfil the following assignments:

1. In the first semester: PROUD students give workshops and/or lectures for other engineering students. Some students will also develop course material (both in Dutch and English).
2. In the second semester: students give technical support within our second years' projects or practical assignments.
3. In the third semester the student brings in a project from the company he is fulfilling his PROUD program into the university. He or she coaches the project and judges and grades the participating students in the role of (technical) group leader.
4. During the whole program the student will be a member of the Engineering Promotions team (PR, think tank, advisory commission regarding the engineering curriculum). The students will be stimulated by interacting with equally motivated and successful engineering students.
5. During their PROUD honour time the students are guided by a coach of the university and a coach from industry. Together they approve each semester the students proposed learning goals and agree on improving competence goals. Of course PROUD members get access to our dedicated PROUD program advising committee to discuss these goals.

The students will receive an honours certificate together with their bachelor's degree. But only after the PROUD program committee has screened the students' portfolio on his work. In the end the committee has an overall interview and will explore the students' results on professional attitude and skills (the earlier mentioned six points). The student should have shown these in a complex professional engineering context. Development and innovation in the professional engineering environment is a part of a good engineering curriculum. That is why a critical view on the engineering curriculum and teaching methods is an important item in this interview. Together with their excellent portfolio these participating students are able to show-off "PROUD" designations on their permanent transcripts when applying for jobs.

Due to this research outcome and the huge interest in this PROUD honours program Fontys Engineering management decided to start a pilot PROUD program in 2009.

5. FIRST PROUD RESULTS

Each year about 45 E&E engineering students start the second year of their study. This is the target group for the PROUD program. The first step is an introduction of the PROUD honours program nowadays given by participating students. Besides that posters are used to inform the first year students. In the first year about 20 students were interested but only 11 students applied for a place in PROUD by sending their application letter and CV. Two members of the PROUD committee interviewed these 11 students. In this first round only three students passed. All theother students were rejected based on:

1. poor motivation
2. study results too low
3. not enough time available for extracurricular activities

In table 1 an overview is shown of the accepted students in the PROUD route so far:

In the meantime eight companies were selected on participation in this honours program. They were selected on the ability of educating the students. One of the selection criteria was having enough engineers employed in their design department and in their production facility. Also the possibility for students having flexible working hours is a strict condition for participating companies. All companies are SME's. Large companies could not handle flexibilities needed in operating in this set up were students timetables of course change every 10 weeks.

During the first two years only one student has left PROUD. There were some conflicts in the company he was placed and the students' communication and negotiation skills could not help him

enough to solve the problem. Regarding the professional communication skills required (most engineers will have to give leadership) we decided to remove this student from the PROUD program.

Table 1: Number of students accepted in PROUD

Year	Interested students	Applied	Accepted	stopped	Graduated with certificate
2009/2010	20	11	**5**		**5**
2010/2011	24	6	5		5
2011/2012	32	13	12	2	2
2012/2013	40	20	9	1	
2013/2014	38	15	11		
2014/2015	31				
Total	**185**	**65**	**42**	**3**	**12**

All the other students participating in PROUD are highly motivated and show eagerness in their situation in the company. They really show progress in their practical engineering skills. Above that all students learn new technologies used in their companies. And because of this the university is able to rapidly introduce these new technologies in their curriculum. PROUD students bring in these new technologies in project work for the other students they manage at the university in cooperation with their companies.

6. CONCLUSIONS AND RECOMMENDATIONS

It turns out that Engineering students, industry and university are eager to participate in this Electric and Electronic PROUD program.

For students the main advantages are:

- A university and educational experience that is challenging and honours their ambitions. They are able to contribute substantially to the development of the curriculum and the introduction of innovative technologies.
- A reasonably well paid job besides the study which contributes to their professional education. In particular they work on professional and innovative skills, international orientation and leadership.
- An excellent portfolio and PROUD designations on their transcripts to show off when applying for jobs.
- An excellent honours certificate additional to the bachelor's degree.

Practice proves that many students apply but only few students pass the intake. Motivation, study results and not enough time available for extracurricular activities prove to be a serious threshold.

From the first experience with the PROUD program we can conclude that the selection criteria are not yet specific enough and measurable enough and for sure also not unbiased enough. Sometimes students are refused to participate but this is unfortunately not based on hard criteria. Improving the selection criteria and the intake process is recommended.

For the participating companies the advantage is:

- An excellent opportunity for pre-selecting future employees.
- A highly motivated junior employee doing a job.
- The ability to contribute to the practical training of students and introduce the student in the company's way of working in product development and design methods.
- Maintaining contacts with educational institutes.

The first experiences with PROUD shows that participating companies in general are very enthusiastic about the excellence program. A drawback is that students often demand high flexibility in working

hours (for instance working in the evening hours or on Saturday). Not all companies can fulfil this claim and therefore students choose another company. This sometimes leads to disappointment in the company management.

Another practical problem of the PROUD construction proves to be the fact that in the company a workplace (desk, computer etc.) has to be allocated, which is only used one day a week maximum! A further point of attention is the in-company learning path for the student. When PROUD students enter a company they just finished their first year at the university. On the end of the program they are third/fourth year students. Though the first participating students have been doing a variety of in company activities the learning path is not explicitly specified and more or less ad hoc.

We recommend that the learning path in the company is explicitly planned and documented from the beginning and updated every semester.

For the university the advantages are:

- Challenging educational activities for excellent students.
- Keep in touch with innovations in industry and an easy route of implementation by means of the contribution of PROUD students in curriculum development and in coaching other students.
- Maintaining contacts with industry in the region with the goal of staying up to date and stimulating participation of industry in the curriculum.
- Highly motivated students contributing to all kind of PR-activities.
- The PROUD honours program is used in PR presentations of the university. It proves in practice that parents consider the excellence program as an important extra possibility for the education of their child.

Until now the PROUD students were asked to contribute on curriculum development and PR activities more or less ad hoc. We recommend the E&E Department to integrate the PROUD student contribution in a more structural way. But overall it is a great pilot program with great results for all participating members ending up in a very special honours program of education of the Fontys Department of Electrical and Electronic Engineering.

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