

DOUBLE DEGREES: HITS AND PITS FOR THE CAREERS

(Preprint version, to be published in proceedings from INTED2017)

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Abstract

Most of the programmes at KTH Royal Institute of Technology are engineering programmes with traditional contents, but some are norm-breaking innovations, created to respond to changes or demands perceived in society or in working life. One example is the double degree programme *Master of Science in Engineering and in Education*, given in cooperation with Stockholm University. In this programme students get two degrees, one in engineering and one in education as teachers for the upper secondary school. This is a rather unusual concept in Sweden and Europe, but similar programmes exist in Gothenburg, Sweden, and in Tampere, Finland.

Graduates from *Master of Science in Engineering and in Education* have several career options. Their engineering degrees are characterised by much Mathematics and Pedagogics, but also contain a specialisation in Physics, Chemistry or Technology/Computer Science. Besides working as engineers, graduates can work as teachers in the upper secondary school. It is a challenge for students in these double degree programmes to develop two professional identities [1]. Similar identity problems also exist for scientists who later add a second career as teacher, but they focus on one career at a time, which could make it easier [2].

In this study we focus on how alumni from *Master of Science in Engineering and in Education* describe their working tasks and careers, and how they perceive their success on the job market.

Data were gathered by means of questionnaires and interviews. The development of the careers was addressed in a web questionnaire, sent out in the spring 2016 to alumni who graduated 2-9 years ago (49 respondents). To get more details, we invited 17 of the respondents to follow up interviews. The programme exit survey, given to all graduates within 12 months from their graduation, provides a picture of the introduction to working life (106 respondents).

Preliminary results indicate that a little more than half of the graduates work in business, about 30% work as teachers, and about 10% are employed at universities. 2-9 years later, only a slightly higher percentage seems to have been working as teachers. About 10% of the alumni seem to have been working as engineers as well as teachers, and about 20% with education in another context than school.

More than 50% of the respondents think that they have been favoured on the job market by having studied this particular double degree programme. About 40% express that they have been neither or both disadvantaged and favoured, and about 10% think that they have been disadvantaged. Some express that they were more favoured on the job market for teachers than on the job market for engineers.

The interviews provide details about the introduction to working life. Those who work as teachers seem to have a busy first year. They perceive that their subject knowledge is appreciated and many have additional responsibilities as e.g. scheduler, head of department, or for the learning management system. When applying for jobs in engineering, many find it challenging to explain their qualifications to an employer. Especially outside of Stockholm, few employers seem to have knowledge of the programme and of double degrees in engineering and in education. Many respondents seem to find the first year as an engineer to be a soft start, but some data indicate that they may advance rapidly towards more difficult challenges and responsibilities.

Keywords: Double degree, Engineering, Education, Teacher, Career.

1 INTRODUCTION

KTH Royal Institute of Technology is the largest technical university in Sweden. The university is hosting over 110 programmes in engineering, architecture and education. Most of the programmes are engineering programmes with traditional contents, but some are norm-breaking innovations, created to respond to changes or demands perceived in society or in working life. A well-established and very successful example of such innovations, first developed by Linköping University in 1969, is the engineering programme *Industrial Management*. A more recent example, established in 2002, is the double degree programme *Master of Science in Engineering and in Education* [3]. The programme is given in cooperation with Stockholm University. In this programme students get two degrees, one in engineering and one in education as teachers for the upper secondary school. This is a rather unusual concept in Sweden and Europe, but similar programmes exist in Gothenburg, Sweden, and in Tampere, Finland.

Graduates from *Master of Science in Engineering and in Education* have several career options. As they receive two degrees in different professions, they can choose to present themselves as teachers or as engineers, or both. Their engineering degrees are characterised by much Mathematics and Pedagogics, but also contain a specialisation in Physics, Chemistry or Technology/Computer Science. Recently a specialisation in Technology/Energy and Sustainable Development has been added. It is a challenge for students in these double degree programmes to develop their professional identity [1]. Similar identity problems also exist for scientists who later add a second career as a teacher [2], but they focus on one career at a time, which could make it easier.

In this study we focus on how graduated alumni from *Master of Science in Engineering and in Education* describe their working tasks and careers, and how they perceive their success on the job market. The research issues are: (1) How do the alumni classify and describe their employments and careers? (2) How do the alumni evaluate their opportunities on the job market?

2 METHODOLOGY

Data were gathered by means of two questionnaires and interviews.

A programme *exit* survey has been sent every year to those who have graduated during the last twelve months. In total, on December 31, 2015, the survey had been sent to 136 graduates. The answers from the 106 respondents provide a picture of the introduction to working life.

The development of the ongoing careers was addressed in a *career* questionnaire, sent out in the spring of 2016. Our results are mainly based on answers from alumni who graduated 2-9 years ago (49 respondents), and sometimes compared with data from the exit questionnaires.

In order to get more details, we invited 14 of the respondents to follow-up interviews. The interviewees were selected according to Theoretical Sampling [4].

Our results are presented in form of diagrams, case reports, and quotes from respondents, and we make efforts to compare the results with statistical data from other sources. However, dropouts, different professions, and different cohorts make comparisons difficult. Though the number of respondents is often less than one hundred, we have chosen to present data in percentage form in order to facilitate comparisons between different slices of data.

3 RESULTS

3.1 Employers and tasks

The exit surveys give a picture of the employment directly after graduation. Our data indicate that about 60% of our double degrees alumni work as engineers in business or as self-employed, about 30% as teachers, and about 10% are employed at universities (Fig. 1).

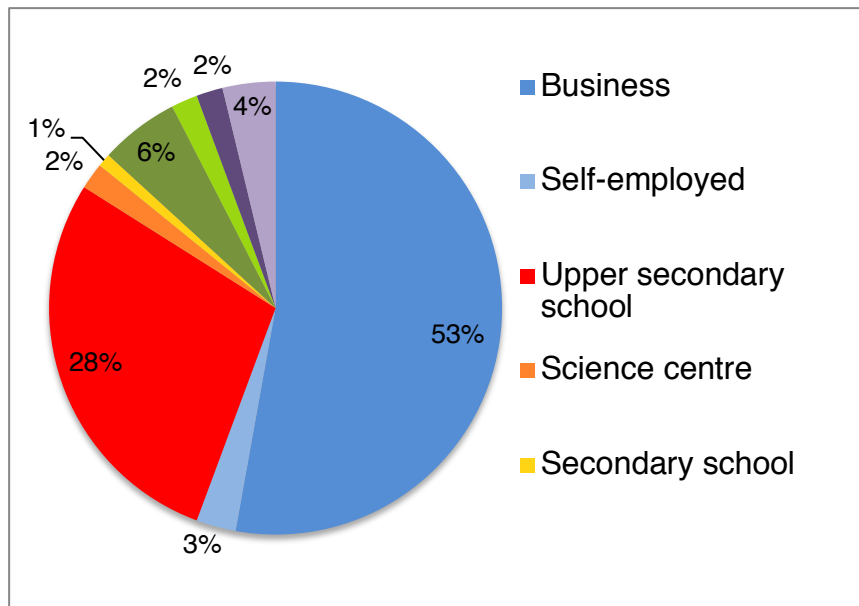


Fig. 1. Employment according to the exit survey.

In order to map the trend in the long run, the career questionnaire in the spring of 2016 requested the respondents to mark all employments they had had during their careers. The following alternatives were offered: teacher, educator, business with pedagogical tasks, business without pedagogical tasks, other. These data are presented in Fig. 2. Note that in the career questionnaire it was possible to choose several alternatives, as alumni might have had several different employments.

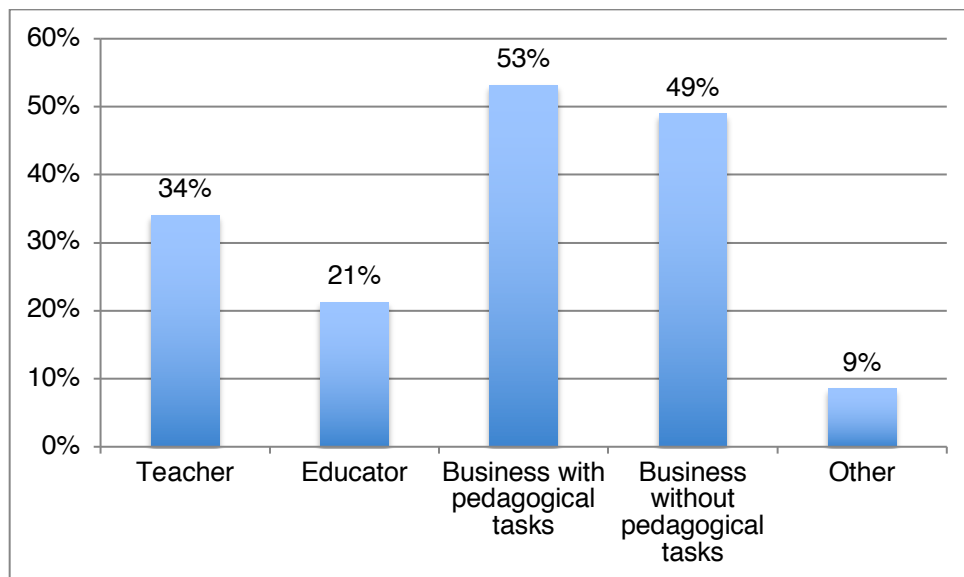


Fig. 2. Employment according to the career questionnaire.

As many alternatives could be chosen in the career questionnaire, the percentages are not exclusive. In the career questionnaire (Fig. 2) only a slightly higher percentage (34%) has worked as a teacher than in the exit survey (Fig. 1, 29%). This corresponds to an increase by a factor 1.17. As the increase is rather small, it may indicate that few alumni who began working in business later work as teachers, but it is rather difficult to draw any firm conclusion as the respondents are not the same.

In the career questionnaire, totally 74% indicate that they have been working in business at some occasion (with or without pedagogical tasks). This is an increase by a factor 1.32 compared with the 56% involved in business or self-employed in the exit survey. This may indicate that it is more common that those who began working as teachers switch to working as engineers, than the opposite.

11% report that they have been working as teachers as well as in business, which is one third of those working as teachers and one seventh of those working in business. 19% indicate that they have worked as educators as well as in business. Obviously, it is more common for business persons to work with education outside the school than in school. 53% have worked as teachers or educators, which means that more than half of the graduates work with education in one way or another.

In total, only 15% have *not* worked with pedagogical tasks in any form.

The narratives from the interviews provide more detailed accounts of some sequences and motives of career changes. Two alumni were employed in schools during the first year after graduation but they shifted to business companies after that. Some years later, downsizing made one of them return to teaching. Due to difficult work conditions in schools, she now tries to come back to a business context again. Others report that work conditions as well as lower salaries for teachers make them prefer working in business.

The exit surveys indicate that some schools and companies seem to attract or recruit graduates from this programme *Master of Science in Engineering and in Education* more than other employers. To explore this phenomenon a bit further, the career questionnaire asked if they had colleagues from the programme, and, if so, why this was the case. The answer alternatives were: Yes, where I am working now; Yes, where I was working earlier; No; I don't know. As can be seen in Fig. 3, more than half of the graduates are or have been working at the same company or school as other graduates. The comments from interviewees indicate at least two types of reasons for why they had colleagues from the same programme: Some expressed that they had recruited or been recruited by a programme colleague, e.g. "I coaxed them to start working with us". Others expressed that someone at the company had positive experience of them, e.g. "The previous personnel manager detected our qualifications".

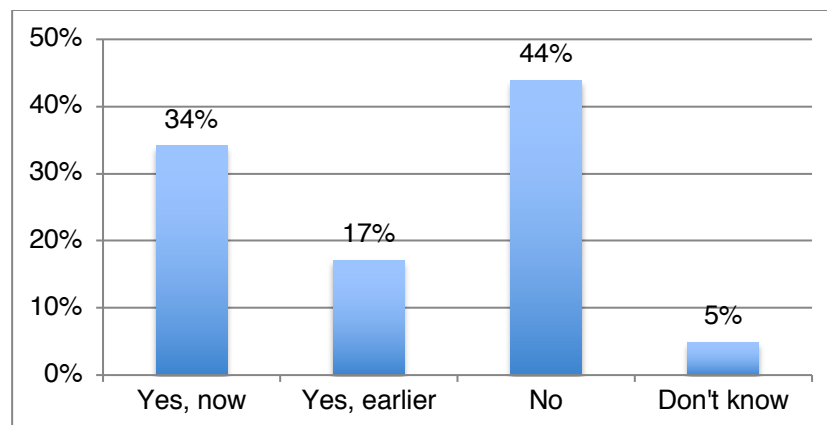


Fig. 3. The proportion of graduates having colleagues from the same programme according to the career questionnaire.

3.2 Opportunities and careers

3.2.1 Finding a job

In the exit survey, 4% of the respondents indicated that they were unemployed (Fig. 1). This is similar to the average for engineers from KTH. According to data from another survey based on data from more than 3000 alumni, 6% of the students were unemployed after graduating from KTH during 2010-2012 [5]

The career questionnaire included a question about whether they had felt favoured or disadvantaged on the job market after having graduated from this particular double degree programme (Fig. 4). 54% of the respondents expressed that they have been favoured (definitely or probably), 37% expressed that they have been neither or both disadvantaged and favoured, and 9% that they have been

disadvantaged (probably or definitely). In the questionnaire, it was possible to add a comment. The comments express that some have felt more favoured on the job market for teachers than on the job market in business. .

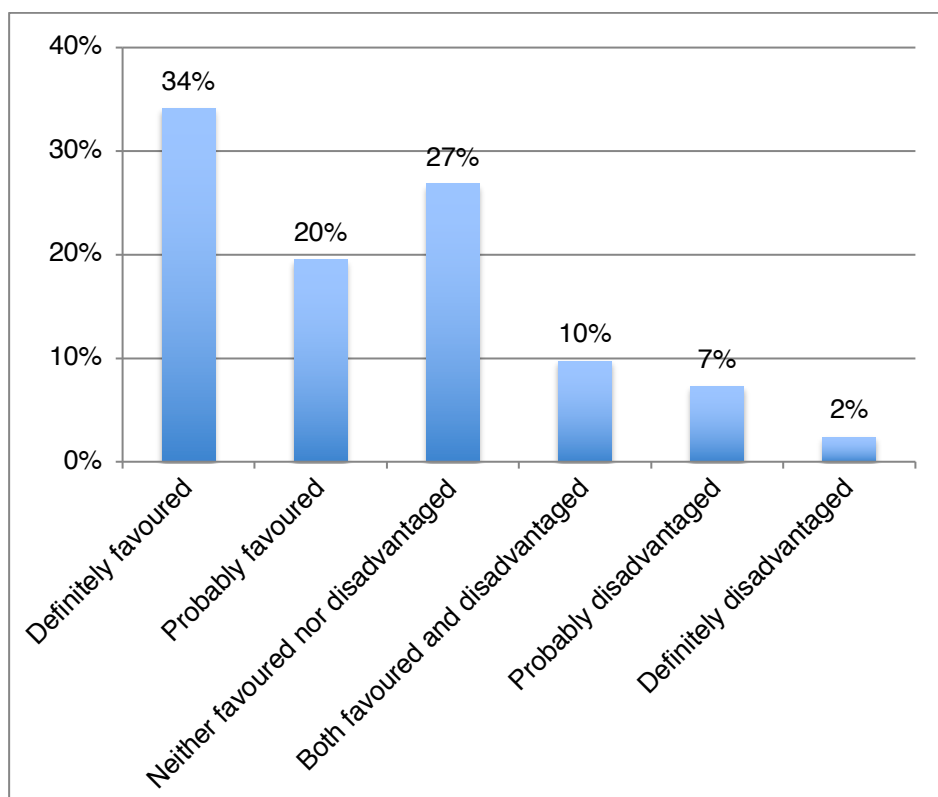


Fig. 4. The proportion of graduates having felt favoured and/or disadvantaged, according to the career questionnaire.

Some alumni who have settled down far from Stockholm claim that most employers are very ignorant about this double degrees programme. This is often the case for employers in urban business companies, too. Several respondents admitted that they adapted to business employers prejudice by marketing themselves as engineers with additional competences in leadership, communication, and learning, instead of presenting themselves as teachers. This strategy is perceived to be successful, as the word "teacher" makes many employers sceptical.

Some have prejudice related to 'teaching', but I changed that formulation to leadership in my CV; and that was a very winning concept (Comment in questionnaire, male alumnus, consultant)

This programme is very well-known in schools; but not in business companies [--- but] the word 'teacher' has a negative connotation here (Comment in questionnaire, female alumna, industrial enterprise)

Contrary to this scepticism there are advantages related to this double degrees programme as well. In business companies a number of employers are impressed by the fact that a young person could obtain a double degree already.

I think several employers are impressed by persons having two degrees. And they see the advantages for the company, too, as they employ an engineer and an educator at the same time. Probably, both are very useful for the company

School principals have positive expectations in relation to the double degrees alumni, who are wanted and very welcomed in schools. According to the principal of an alumna employed as a teacher, teachers who have studied at KTH behave differently from other teachers in Maths and Science, by demonstrating more self-confidence and active manners (Source: Recorded interview with a principal).

3.2.2 The first years of the career

Beginning teachers have a tough period in several ways during the first years, not least in relation to preparing lessons, as every course and lesson has to be prepared for the first time. By tradition, teaching is mainly an individual endeavour. One teacher compared the first year of teaching to deep diving into shallow water. When asked to develop this metaphor, he gave two examples:

- 1) *[As a beginning teacher] you should be very brave, but it's necessary to be careful too, because you never know what will happen. Sometimes I have to ward off an incident in the last moment.*
- 2) *Due to profound subject knowledge, I wish to go deep in my teaching, but the task and its conditions require that priority must be given to basic skills.*

In contrast, several alumni employed in business companies were bored and under-stimulated during the first and second years of their careers. Consequently, an alumnus chose another employer, an alumna asked her manager to get a more challenging position – where she succeeded, and another alumnus moved to another department of the same company, which made him satisfied.

Several teachers as well as engineers seem to be successful in working life. They are gratified by different kinds of professional acknowledgements and rewards. In schools, several alumni have become informally promoted by getting responsibilities outside the classroom context. Thus, Hoyle makes a distinction between restricted and extended professionalism in the school context, and to our alumni the latter represents coordinating tasks delegated from principals [6]. In the career questionnaire, our respondents indicated that they had the following tasks:

Except for teaching, I am the ICT coordinator [at my school] and the head of the Math department.

I am very eager to solve problems. That's why scheduling is delegated to me.

I am responsible for sustainable development [at my school] thanks to my Master thesis, which was oriented towards that domain.

3.2.3 Personal careers – selected anecdotes

General career data about Masters of Science in Engineering from KTH indicate many early informal or formal promotions [5]. Thus, our specific group of alumni does not necessarily differ from their previous fellow students who attended other programmes at KTH.

Positive experiences are reported by many alumni. An alumnus presents the following comment in the questionnaire:

As a person with double degrees, I benefit from advantages compared with many colleagues. Educational training implies competence to explain in a clear way. "To speak the same language" is often very appreciated. I also believe that pedagogics makes it easier to help [coach] people. I can ask the right questions, so that they by themselves can change perspectives and approaches.

The following anecdotal reports are based on four interviews and illuminate the extra merits of studying education. We attribute the following fictitious names to the interviewees: Peter, Henry, Chrissie, and Pamela.

Peter considers himself to be a silent and shy person and so do his colleagues and executives. Nevertheless, he can perform verbal presentations in a very professional way thanks to his educational training.

Today, *Henry* is very relaxed during oral presentations in professional situations. His colleagues as well as clients praise him for his pedagogical talents. Nevertheless, he feared oral presentations at school. In fact, he sometimes hoped that a traffic accident would save him from this painful situation.

Chrissie was promoted to a more qualified position two years after she became employed, which is much faster than usual. Her colleagues objected, and argued that the corresponding advancement normally takes a decade, and demands much wider professional experiences. However, according to her executive, she had the qualifications needed for that position.

Pamela describes how she has made a career leap from being an instructor to the position as responsible for internal training, in the same company:

Most of my work mates were experienced workers, while I could see the situation from a logic and abstract perspective. Still, I could carry through the courses. I introduced new learning methods in the company. This reform received a lot of attention, because it was quite new. That led to a promotion; I became responsible of internal training in the company, which had 150 employees.

The cases mentioned above don't prove that our alumni are more successful than others graduated from KTH, but they indicate that educational training makes difference.

In contrast, some alumni report negative implications of this programme. An alumnus states that the programme's advantage is its wide scope, but that it lacks a cutting edge. An alumna says that it is difficult to market oneself e.g. at career fairs, as the programme is relatively unknown to companies. Others complain that the subject knowledge in Physics, Chemistry or Computer Science is not transparent enough, as it is not included in the name of the program, and the chosen specialization is not specified in the degree certificate.

The companies do not know that the programme exists. Thus, it is difficult to get a job in programming, as computer science is not included in the name of the programme. [...] Generally, our programme is difficult to describe. We are neither specialists in Engineering Physics, Computer Science, Mechanical Engineering, or Vehicle Engineering, nor are we well-known generalists, like those graduated from Industrial Management. We cannot compete with these brands.

4 CONCLUSIONS

The general picture is that this programme contributes significantly to society and working life. However, both hits and pits emerge in our data. Some of these are summarized in Table 1 below.

Table 1. Hits and pits.

	Teachers	Engineers
Employers' preconceptions	(1) Positive	(2) Sceptical
Employees' start	(3) Demanding	(4) Soft
Marks of progress	(5) Extension	(6) Promotion

School employers' positive preconceptions (square 1) towards graduates from this programme is easily explained. The number of teachers in Science, Technology, Engineering and Mathematics must increase. The status of teaching must also be improved. Graduates from this programme contribute to both.

Company employers' sceptical preconceptions (square 2) could be related to ignorance and conservatism. Not least companies outside the Stockholm region have rarely heard of the programme at all. Concerning conservatism, Trevelyan noticed that employers are keen on additional competences, outside the technical domain. But they are normally sceptical to innovations that might reduce the technical core competence [7].

The demanding start in schools (square 3) versus the soft start in companies (square 4) is related to the structural features of these institutions. Teaching is mainly an individual and demanding task, not least for beginning teachers. But engineers employed in business companies seem to be given a softer and longer introductory phase within a diversified organisation.

The word extension (square 5) denotes that some teachers are offered specific tasks to serve the rest of the school. This is often the case for graduates from this programme, according to our data.

Traditionally, teachers are rarely promoted within the school context, except for those who become principals. Since a few years, however, the Swedish state offers merit pay called "First teacher" (förstelärare) to a minority of teachers, who are considered to be more skilful or useful than other

teachers, according to the principal's assessment. In contrast, several alumni employed in companies report that the soft (and boring) start of their careers often led to expanded responsibilities, including leadership, within a few years. The anecdotic configurations of Chrissie and Pamela illustrate that manifest promotions (Square 6) are possible, too.

However, "career" is a multi-dimensional concept. According to one classification of career profiles, the following four motives and strategies are manifested: expert, linear, spiral and transitory careers. [8]. Referring to our anecdotes Chrissie's promotion is related to the expert category, as she shifted from applying standards to developing new standards in her domain. However, Pamela's promotion represents the linear category, as she became the head of 150 employees.

People who prefer exciting experiences or personal development may give priority to transitory or spiral careers. The former is not noticed in our data, but we recognise that pattern from other contexts. One of us knows a fellow who studied humanities at the university, made a successful career in a company, then he turned into forestry work, and now he is a fireman. The logic behind this career is that he gives priority to variation in life rather than economic benefit or prestigious positions.

According to our data, spiral careers seem to be well represented among graduates from this programme. Statistical data indicate that about one third of the graduates from this programme work as teachers, but most graduates (85%) have or have had tasks that involve pedagogics in one way or another. It is difficult to estimate the future mobility between employments in schools and in business companies, but according to several respondents learning rather than earning seems to be the most important professional reward. The double degrees and double competences could facilitate spiral careers and personal development during the life span.

ACKNOWLEDGEMENTS

We wish to thank Johan Blaus, Coordinator, KTH Business Liaison, for contributing to funding of this project, Emma Jones, Head of Alumni relations, for support with sending out the survey through the KTH alumni network, and Elisabeth Öijermark for language support.

Conflict of interests: Cronhjort is the present Programme Director of 'Master of Science in Engineering and in Education'. However, he was not involved in the programme when our respondents were students. Naeslund and Nyberg belong to Departments involved in the programme, but they have not been involved in the programme before this study.

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