Mind the Gap

Why do technical alumni stay in the technical sector

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ABSTRACT

This study seeks to explore why around 40% of the alumni of technical degree programmes in higher education in the Netherlands leave the technical sector in spite of the high number of technical vacancies available. The study is part of a larger project called Mind the Gap that explores professional identity as a constellation that provides a key to understanding the career choices of technical alumni, assuming that a stronger and deeper professional identity as an engineer leads to stronger commitment to the engineering profession. Through life history interviews with eight male engineering alumni from a university and a university of applied sciences who stayed in the technical sector, a contextualisation for their choices in study and career is provided. Results indicate that there are two trajectories the alumni went through, one being a more applied and focused engineering trajectory, the other being a more theoretical trajectory where engineering was one of the options amidst a number of other technical and less technical options. Further research into life histories of women and those who left the technical sector, male and female is foreseen.

Conference Key Areas: Attractiveness of Engineering Education, Engineering Education Research

Keywords: professional identity, engineering alumni, life history research

INTRODUCTION

The technical sector is continuously looking for engineering graduates. Initiatives

have been taken to educate more students in Science, Technology, Engineering and Mathematics (STEM), but the number of students in these fields in the Netherlands that are in the end available for the industry is still insufficient, as around 40% of the graduates choose to work in other than the technical industry [1]. In trying to understand why all these people leave the technical sector, professional identity proves to be a useful concept. A more developed and stronger professional identity as an engineer or technician increases the chance of a choice for a career in the technical sector than a weaker, less developed professional identity. In the project Mind the Gap a digital tool was developed to understand the professional identity of STEM students and professionals and how it is related to their career choices. The tool is based on a large quantitative study. This article describes a qualitative study that is complementary to the quantitative study and helps to interpret its findings.

1 THEORETICAL FRAMEWORK

1.1 Professional identity

Professional identity (PI) is seen as a personal as well as a social constellation or a combination of both, referring to the identity of a person related to their career or job. Ashforth, Harrison and Corley [2] distinguish both content and strength of professional identity, where content is about characteristics, behaviours and norms that form the professional identity and strength refers to the commitments to these components. Research shows that PI influences career choices positively in the sense that a clear and stable PI contributes to persistence in engineering [3]. Social interaction shaping the content of PI takes place during higher education, but also before entering a course in primary and secondary school and in the family context [4]. Research on the formation of professional identity does not usually focus on early childhood and teenage years, but is most often aimed at the period in which a student selects a course, the university years and the first years of the professional career [5, 6] assuming that formation of professional identity starts in this period. Cohen-Scali [7] though studies two dimensions of PI formation: socialization for work and socialization by work, the former taking place in a family and (early) school context, the latter in the professional context. How PI is shaped throughout life experiences that start taking place long before educational and career choices were made is explored especially in educational and medical contexts, but not yet for engineers.

1.2 Life history research

Narrative inquiry provides a framework to study the development of professional identity in an in-depth and interconnected way, not trying to predict and control reality, but to make sense of the complexity of human lives. In narrative inquiry, the focus is on stories told in order to reconstruct these stories and create meaning about how people interpret the events in their lives.

Life history research is a form of narrative inquiry that focuses on entire lives of respondents in order to "(…) be generative of alternative ways of seeing, knowing, understanding and interpreting life experiences" [8]. According to Cole et al. [9] "(…) life history inquiry is about gaining insights into the broader human conditions by coming to know and understand the experiences of other humans. It is about understanding a situation, profession, condition, or institution through coming to know how individuals walk, talk, live, and work within that particular context. (…) To understand some of the complexities, complications, and confusions within the life of

just one member of a community is to gain insight into the collective" (p.11). Goodson [10], in his studies on the lives of teachers, argues that in order to unravel socialization processes contributing to formation of professional identity, it is necessary to cover the socialization process during its full span of life and work, as opposed to the training period only. As the goal of this type of qualitative research contextualisation is a contextualised understanding instead of generalisation, the number of respondents is small.

1.3 Research question

This research aims to provide a contextualisation of the study and career choices of alumni who recently finished technical degree programmes in higher education. As PI is shaped by experiences – socialisation for work – , it is relevant to find out what experiences are regarded as meaningful by the alumni. The research question is therefore:

What experiences in life stages preceding the first jobs of engineering alumni shaped their study and career choices?

2 METHOD

2.1 Design

This study is based on life history interviews. A total of eight were held with alumni of engineering degree programmes. With this type of interviewing, the number of questions is limited and respondents are asked for their stories on certain themes. In the case of this study, the alumni were asked to share stories on the following stages of their lives: early childhood-primary school, 12-18 years of age, their engineering studies, the transition from their engineering studies to their first jobs and the actual working life from the start to the moment of the interview. Although the interview schedule is very open and loosely structured, the criteria defined by Dollard, cited in Polkinghorne [11], are used to fully explore the stories of the alumni. The interviews took about 60 to 90 minutes each.

2.2 Respondents

The respondents of the study are eight male engineering alumni, four from a university and four from a university of applied sciences, both in the Netherlands. The engineering degrees they graduated from are Electrical Engineering, Industrial Engineering and Management, Mechanical Engineering and Technical Physics. They graduated between 1,5 to 3 years before the date of the interview and are between 24 and 27 years of age. All respondents are male.

2.3 Analysis

All interviews were recorded, transcribed and analysed according to the method described by Fraser [12], who describes seven steps of the analysis of narratives that are suitable for the purpose of the interviews.

3 RESULTS

The results of the interviews are described according to the four stages in the lives of the alumni between early childhood and current job. Quotations from the interviews illustrate the findings.

3.1 Childhood: 4 to 12 years

> I can hardly remember things. I was definitely not in the reading corner or anything. (…) I have not played with dolls or building blocks and definitely no Lego or Technic Lego. *(Robin[1], Mechanical Engineering, University)*

Robin makes clear that Lego and building were not his favourite activities in his early childhood. Most respondents do not have very clear memories of the kindergarten age, but they do mention playing soccer and doing other sports. Some of the respondents have vivid memories of doing little technical projects like taking apart appliances.

> [My dad] would bring typewriters home. Very funny, with all the tiny balls inside that you could play with. And computers. And once an old monitor, He likes old stereos and replacing amplifiers, speakers or an old DVD player and got me to look what is inside. It was fun to explore that. (Simon, Technical Physics, University)

Others have no experience at all in this kind of projects. All alumni describe a primary school period that was rather easy in terms of subjects, especially, but not exclusively, mathematics. They mention persons like teachers, siblings and parents. that are part of their experiences, but do not attribute a large role to them at this stage of their lives in influencing study related choices.

3.2 12 years till start of studies

At this stage, the trajectories of the alumni start to diverge. In the Netherlands, there are three different levels of secondary school (lower, intermediate, higher), lasting 4, 5 or 6 years and giving access to vocational education, university of applied sciences or university directly. Only one of the respondents started with the 4 years lower level education, three followed the intermediate level and the remaining five followed the 6 year secondary school that gives direct access to university. All of them choose for a math and science profile without considering other options, except for one.

> At that time everything was easy and I thought what am I going to choose? And yes, it needs to be as difficult as possible, because that will give me the best possibilities.
> *So what did you think was the most difficult option?*
> I my eyes that was the math and physics profile.
> *But if that is easy for you, it is the hardest option? It may be difficult, but…*
> Yes, but everyone said that the physics option is the most difficult one. This is also what school told us, look if you are a really good student, you can do this, but for others, the arts and humanities may be a more sensible option. So perhaps that was my biggest motivation, because it is the most difficult option. (Matthew, Industrial Engineering and Management, University)

At this age, a dichotomy in the group of alumni is becoming clearer. On the one hand, there is a group that describes hobbies like welding and soldering, taking engines apart and repairing mopeds and tractors. On the other hand, the other alumni do not describe this kind of experiences and refer to more general hobbies like sports, music and reading. They tell stories about more analytical experiences like detailed route planning for holidays. None of the alumni have a clear idea about future professions. Two have memories of ideas they had about their future. One of them wanted to be an inventor and the other a managing director of a company.

The dichotomy between the two groups is also visible in the process of choosing a university degree programme. The alumni who describe technical hobby projects and

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[1] Names of respondents are replaced by pseudonyms

specific technical interest during their secondary school chose an engineering course, went to open days and confirmed their choice, without considering alternative options, inside or outside engineering. Their choice is seen as a logical consequence of interests and experiences. The other alumni did not have such strong feelings about the choice for a specific engineering course. They considered a range of options, both inside and outside engineering, like economics and econometrics. They went to open days of different programmes and looked for more information, or spoke with teachers, the student counsellor or older brothers to get some advice.

3.3 University period

About their time at university, the alumni depict study related activities as well as other activities like student associations, hobby activities and sports. When asked for important experiences in their first year, many stories are not directly study related. One of the alumni had some doubts about the choice he made:

> But at a certain moment I really started doubting my choice, is this the course for me? I like it, but it is not fantastic.
> *What made you doubt?*
> I think one of the programing courses, that was given so badly that I thought, this is really bad. Fortunately, I have not had any programming courses after that. (…). But I have always considered other courses that may have been interesting.
> *Like what?*
> Mechanical Engineering of Physics. And I spoke with teachers there (…), but in the end I stayed at Electrical Engineering. *(Luke, Electrical Engineering, University)*

The students who have doubts during their course are also the ones who have considered more options before they enter university.

The division between more practical and more theoretical students remains visible at university.

> […] as at Mechanical Engineering there were around 50% of the students who were really into Calculus, Statics, all the math, physics and chemistry that you get at Mechanical Engineering and the other 50% was really into technical hobby projects with bikes, cars and so on.
> *And you are the first category?*
> Absolutely! (Robin, Mechanical Engineering, University)

Robin explains this with an example:

> The design. I could not care less about the design. Things about pulleys and wheels. At the moment I had to calculate the size of the beam in order to touch the wheel, it started to become interesting again. Making calculations. (Robin, Mechanical Engineering, University)

At the other end of the spectrum there is Thomas, who wants to do very practical engineering projects.

> In the second year we had to design a device that would move cupboards. I did not like it. And exactly in that weekend my dad asked me (…) if I could make a wood splitter. I said I can do that. So I thought, perhaps I can connect that to my assignment. And I talked to me teacher and he said, that is fine with me as long as you pay the materials. So that was great fun and the machine is still being used (Thomas, Mechanical Engineering, University of Applied Sciences)

He also explains that

> (…) if you never felt the urge to tinker with something in your free time, then a technical course does not seem a good idea to me. (Thomas, Mechanical Engineering, University of Applied Sciences).

3.4 Transition to first job

For all alumni, the transition to their first job was a smooth one and the jobs related well to their engineering degrees. Half of the alumni were found by a recruitment company through e.g. LinkedIn. Two stayed at the company they graduated, one started his own company and only one actively applied to a job post he found. They are happy with their first jobs, but looking back on the recruitment process, they are critical:

> *So how do you find out if that job is actually suitable for you? If it fits you and the ideas you have in mind?*
> I don't know if you have that clear for yourself. I did not, and if I would apply again, I would have better ideas now.
> *What questions would you ask now if you'd do it again or what would you have done differently in the process?*
> Now I applied starting from the idea that I have to sell myself, but I think that is not the idea, I actually have to make sure they sell themselves to me. Why would you want to work here and what tasks do we have that fit you? Not only my sales pitch, but why I would be good for that company.
> *Did you have enough insight in the tasks that you would do at the company or would you say now….*
> No, I did not really know what I was going to do, which does not mean I am at the wrong place here. (…) Because in the end… I still do the things I like to do and that suit me (Robin, Mechanical Engineering, University)

At the moment, all alumni have a technical job in a technical company and most of them see themselves in a similar job in five to ten years. Most have not considered a non-technical job. Only Robin and Matthew thought about jobs in the financial world, but concluded that was not what he really wanted. Looking for the challenges of doing difficult things, he saw that he could also do that in an engineering job.

> Actually I was never interested in technical things.
> *OK, that could be a conclusion.*
> But in the end I ended up in the technical sector.
> *Do you think you stay there?*
> I have been quite indecisive. Also before I went to *[company X]*. I have applied at *[company Y]* and *[company Y]* is a trading company, a kind of Robeco, but a lot worse. So in the end I did not want to do that. I kind of see it as evil.
> OK.
> Making the orange a euro more expensive in China, get it here and grab part of the chain. But it is… You cannot get it more analytical… (Robin, Mechanical Engineering, University)

Most of the alumni expect to be still working in a technical company or technical job in five to ten years.

4   DISCUSSION

The analysis of eight life-history interviews, revealed the personal trajectories for study and career choices. Looking at possible people who have either influenced the interviewees directly by providing information or guiding them towards a certain study or career option or serving as a role model, parents, siblings, teachers and study counsellors are mentioned, but in none of these interviews there are identified as a decisive factor. Experiences they have gone through have shaped their study and career choices in a clearer way. One group of alumni tells stories about practical projects they were involved in at a young age; tinkering with cars, bikes, agricultural vehicles, welding, soldering and taking appliances apart were part of their daily lives and are serious hobbies. Also at university they enjoy being involved in this kind of activities. This type of alumni can be characterised as 'engineers', regardless of the course they did.

On the other hand, there are the so-called 'scientist', although coming from engineering courses, those who were not particularly interested in technical hobby projects and were looking for (mathematical) problem solving challenges that were difficult. They explain they just "want to do difficult things." For the engineers, the choice for a specific engineering course is obvious and they did not consider any other options, especially not outside engineering. When choosing a course, they visit open days of only one type of engineering course and enrol at that course. The scientists however, consider more than one course, inside or outside engineering sometimes doubt their choice during their studies. The specialisation they choose towards the end of their studies is not a straightforward choice and they tend to seek input from people around them to confirm their final choice.

The narratives of the alumni reveal that especially for the so-called scientists the experiences during their studies in a technical company are especially relevant for the final choice for a technical company or technical job. Being in a company context in a technical company shows that these companies offer the kind of complex problems that these students are looking for. Experiences have a more prominent role during primary and secondary school and during university than people in their environment. People like parents, siblings, friends, teachers and student counsellors are present in the narratives, but do not really appear as decisive.

The transition from studies to work is characterised by quick decisions. The alumni do not refer to elaborate processes to select their first job. The offer of the future employer seems to be more important than the professional and personal interests of the graduates. They refer to the choices they made as a logical continuation of the preceding phase as opposed to an explicit decision moment.

5   FURTHER RESEARCH

This study has been carried out with eight male alumni from technical degree programmes who are still active in a technical company and technical job. The question rises whether similar findings can be obtained with alumni who have left the technical sector and if they have similar narratives on their different stages of life. Another issue for further research raised by the findings of this study is the question whether similar patterns are verifiable for women who finished engineering degree programmes. To what extent do they recount comparable experiences in their early childhood, school career and university education? Future research in this project will focus on women in the technical sector and those who have left as well as male engineers who no longer work in the technical sector.

The deliberations of the alumni in the period of transition from studies to work, the contexts in which these are taken and the factors that possibly influence these decisions are currently, although of major influence on a career choice, rather indiscernible, both for the alumni, as well as for the universities they come from. More qualitative research on this transition period can help to understand the choice of the alumni for their first job and provide opportunities for interventions aimed at keeping technical graduates in the technical field.

ACKOWLEDGEMENT

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