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Professional Identity Of Female Engineering Graduates: An Exploration Of Identity Status Through Life History Research

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PROFESSIONAL IDENTITY OF FEMALE ENGINEERING GRADUATES: AN EXPLORATION OF IDENTITY STATUS THROUGH LIFE HISTORY RESEARCH

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ABSTRACT

The number of students entering engineering programmes is too low to meet the need for engineering graduates. Still, many leave for jobs outside the technical sector right after graduation. Professional identity is a concept that helps to explain why they stay in or leave the technical sector (Cech 2014). It is the result of the process of professional socialisation. This study uses life history research to understand the professional socialisation of engineering graduates from kindergarten age until a few years after graduation. An analysis of the life experiences of male and female engineering graduates shows differences in how they describe moments of choice, reflecting different professional identity statuses of male and female graduates.

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1 INTRODUCTION

1.1 Background

The shortage of engineering graduates in the Netherlands and other countries is an urgent issue (Monitor Techniekpact 2020, UNESCO 2021). For many societal problems, engineers are needed to contribute to the solution. To ensure that this shortage is reduced, attracting more students for engineering programmes and ensuring that engineering students who have graduated from an engineering programme do not leave the technical sector right after their graduation. A more developed professional identity can contribute to staying in the technical sector (Meijers, Kuijpers and Gundy 2013). It is the result of professional socialisation, a process in which an individual goes through experiences that develop the knowledge, skills, attitudes, habits, and modes of the professional group that one belongs to (Bragg 1976). Higher education is supposed to play an important role in providing experiences for professional socialisation, like guest lectures, internships, excursions and exposure to teachers who have experience in the field (Weidman, Twale and Stein 2001). Professional socialisation starts however long before students enter higher education. Experiences in the early childhood and at primary and secondary school also contribute to professional socialisation and as such, shape professional identity (Goodson 2008).

In this study, we analysed the socialising experiences of six female engineering graduates who stayed in engineering after their graduation and their professional identity status and compared these to the identity status of male engineering graduates. The graduates' life experiences are obtained through life history research, a form of narrative research that includes a large part of the life span of the graduates (Jessee 2019). This study focuses especially on the moments of choice in their lives: for a secondary school, for a profile at secondary school, for a degree programme and for a first job. These moments and how the graduates handle choice processes give insight into their identity statuses.

1.2 Literature review

Professional identity has been described from both a personal as well as a social perspective, the former referring to the individual development process and the stages that a person goes through (Ibarra 1999, Crocetti, et al. 2014), the latter based on the social interactions that shape professional identity (Crocetti, et al. 2014, Bartels, et al. 2010, Tajfel and Turner 1986). These two perspectives are integrated into the work of professional identity formation of Weidman, Twale and Stein (2001). The strength and the content of professional identity can be described by two behavioural indicators, as described by Marcia (1966), based on Erikson (1956). The first is called exploration and refers to the extent to which an individual explores and weighs the different identity possibilities before making decisions about goals to strive for. The second is commitment, which refers to personal investment that aligns with the choices made (Marcia 1966). These two dimensions lead to four different identity statuses: achievement, characterised by high exploration and high

commitment; foreclosure, characterised by low exploration and high commitment; moratorium, characterised by high exploration and low commitment and diffusion, characterised by low exploration and low commitment. Two identity statuses were found in a previous study on the professional identity of male engineering graduates who stayed in the technical sector (van Hattum-Janssen and Endedijk 2020, Paalman 2020), The life stories that never spoke about considering options outside the technical sector at the moments of choice and a solid commitment to the technical sector, already visible from an early age, can reflect a foreclosure identity status. Those characterised by elaborate considerations at moments of choice, a tendency of indecisiveness and to keep options open as much as possible can be categorised as a moratorium identity status, with a lower commitment to the technical sector and high explication inside and outside the technical sector. At each moment of choice, a careful consideration of pros and cons is made, but coincidental life experiences may also influence the final decision. Female engineering graduates show lower levels of identification with being an engineer (Möwes, van Veelen and Endedijk 2017) and are more likely to leave the technical sector. The question is how the life experiences that result in identity statuses of male and female engineering graduates compare, as research indicates that the professional identity of female engineering graduates is related to whether they stay in or leave the technical sector (Endedijk, van Veelen and Möwes 2017).

2 METHODOLOGY

In this study, life history research was carried out by interviewing six female engineering graduates from a University of applied sciences and a research university, all found and contacted through their former course directors. They had two to six years of working experience, were between 26 and 30 years old and worked in in technical company or function.

Life history is a form of rather unstructured interviewing (Brinkman 2014). Jessee (2019) states that “(…) the life history interview should be directed by the interviewee, with the interviewee speaking in as little or as much detail as they feel is necessary to narrate those events and experiences they feel are most relevant” (p. 431). Structured or semi-structured interview schedules are therefore not appropriate for life history interviews, as they are not aimed at obtaining factual information, perceptions or opinions of the interviewees, but to engage with the subjective and intersubjective nature of the life history interview to explore the meaning of experiences from the past for the individual (Jessee 2019). The interview guide therefore consisted of an introductory question, “Tell me what you still remember about your kindergarten time at school” and only adds four further similar questions on the transition phases in their lives and the related moments of choice: the choice for a secondary school, the profile chosen at secondary school, the choice for a degree programme and the choice for a first job. The interviewees were asked to tell what they remembered about these periods and decision moments and, if possible, describe specific experiences they would recall. The interviews took place at a place

the interviewees chose to ensure they would feel at ease at the chosen location and took 60 to 120 minutes.

3 RESULTS

All interviews were transcribed and analysed using Schütze's method of conducting and analysing narrative research, cited in Jovchelovitch and Bauer (2000). Pseudonyms are used for each interviewee. The indexical material is used to reconstruct the life stories. The life histories of the female engineering graduates show a number of patterns. They were good at math and physics at primary and secondary school and generally, they had high grades.

> (…) and I remember that, well, my brother was two years ahead of me and I tried over and over to do all his schoolwork although he was two years older. (Mila, Industrial Engineering and Management, Research University)
>
> I always wanted to be the best in class you know. (…) At the playground at school I always wanted to win, win, win. (…) And looking back I realised I was a lot smarter and more structured than the other kids in my class. (Isabella, Technical Physics, University of Applied Sciences)
>
> Well, I was just very conscientious. If you look at my grades, I was good at everything, eights, nines and tens on my list. (Emma, Technical Physics, Research University).

They also had rather broad interests, going beyond technical interests. They tell about a range of different hobbies and sports at primary and at secondary school and also during their time at university. Emma for instance tells about here time at secondary school.

> I did gymnastics, played the flute, and sang in a choir. I guess I found it exciting to do Greek and Latin, kind of a secret language and philosophers and to me that was exciting. (Emma, Technical Physics, Research University)

Technical interests at a young age are mentioned in all the stories.

> Yes, at the farm we had trees and ditches behind the land and corn, and we would, you know, feed the chickens and make rafts for the water and go fishing. (Isabella, Technical Physics, University of Applied Sciences)
>
> I always liked crafting and working on my computer, although it was still through a phone connection so less easy but I had a computer in my room. (…). And I remember once I was ill, not really ill, but with some flu and my teacher gave me and two other boys an assignment to take apart and assemble a computer as a project, make it work again. That was a lot of fun to work on. I still remember that. (Lina, Electrical Engineering, Research University).
>
> My dad is a real handyman and has a garage with lots of tools so we would always help him. (…) Especially when we were young, we would sometimes hold things but we were not allowed to. (…) I apparently helped to build a rabbit hutch or perhaps for a chicken, but it meant a lot of watching and holding stuff because of sharp tools, but yes I really enjoyed it. (Nicole, Technical Physics, Research University).

The first choice process, for secondary school, is described as straightforward.

> I was the third on in a row in my family, so I just went where my brothers went. (Kira, Mechanical Engineering, Research University)
>
> That was actually quite easy. I lived in a small village, and I had a secondary school very nearby. Just one. There I could do the first two years of senior general secondary education or

> pre-university education, so actually no choice. (Lina, Electrical Engineering, Research University)
>
> So not a lot of choice. You could go for one school or the other, so not a lot of choice, or further away. (…) And based on the reputation of both schools, I decided, together with my parents to go to [name town]. Well not a very difficult choice at that moment. (Isabelle, Technical Physics, University of Applied Sciences)

Later on in the interviews, the interviewees do not get back to the choices they made, except for Nicole, who made a choice that she regretted afterwards,

> That [choice for secondary school] was kind of special, as I did not want to learn. I was good at it but I thought it was too scary to do senior general secondary education. That would be too difficult, and I just did not feel like it, so I went to pre-vocational education. My twin sibling and I did not want to learn but do something with our hands and with animals, not sitting behind a desk, but from day one we felt we were so different from all other children at that school. (Nicole, Technical Physics, Research University).

She ended up at pre-university education at the end of the second year.

The choice processes for the profile at secondary school show two distinct patterns. Some of the interviewees are told that choosing for a nature and technology (N&T) profile fits them well and helps them to keep their options open.

> *And did you speak with your parents or classmates about your profile choice?*
>
> Yes, and also with my best friend at secondary school and what I found difficult is that all my girlfriends were going to do something else like the economic or cultural profile and I was the only one going into N&T and I feared I would end up among the nerds. But I also spoke to my math teacher and my parents. And my parents said that I needed to do what I liked most, and I will find my way. (Mila, Industrial Engineering & Management, Research University)
>
> It took me quite some time to land as I still remember that I went to the fourth year and had to make a profile choice. And I said to my math teacher that I wanted to do the economics and society (E&M) profile with history, economics and geography, a bit of mathematics and he looked at me and said: “No, you are not serious about this! You have to do a technical profile.” And I did not want to do anything like a technical profile, I don’t want to study anything technical later on. And he said: “If not you, then who will do a technical degree programme.” So I thought, okay, he may be right. If you are able to do it, it makes sense. You cannot go back to technical profile if you decide for the economic profile, but the other way around you can, so that is what I did. (Nicole, Technical Physics, Research University).
>
> My mother actually played a large role in the choices. She said with a technical profile you have more options in the future than with a non-technical profile and it became clearer to me what these profiles actually were. So, she said if you are good at math, physics and chemistry, then go for it. And she said with other profiles you have far less options afterwards. (…) So, she had those arguments and I thought, well that is also the kind of job I would like to do anyway, so we chose the N&T profile. (Isabella, Technical Physics, University of Applied Sciences)

In another life story, the N&T profile is regarded as the obvious:

> Well, I just like the technical courses the most. it was the most logical choice for me and if i would do anything else, i would have to go to senior general secondary education as they thought my grades were not good enough. I just liked this profile most. (Lina, Electrical Engineering, Research University)

The interviewees describe the choice process for a degree programme as a careful process that involves considering a number of mostly technical options at different institutions. Parents are mentioned as a discussion partner in this process. Peers are

mentioned as being present during visits to open days, but not so much as the ones with whom the choice process is discussed.

> Eh, yeah, I talked a lot about it with them [parents] and they helped me too, well what do you really like, and we sat together and crossed out a number of options and then decided which open days to visit. (Lina, Electrical Engineering, Research University)
>
> So to Delft, Eindhoven and Enschede, but I also went to look at Business Studies or Econometrics and in Utrecht. (…) I went together with a group of girlfriends and sometimes we had to split up, because they would go to things like law and anthropology, and I wanted to go to the technical programmes and get a more all-round overview of what is possible. (Mila, Industrial Engineering & Management, Research University)
>
> In Delft, Eindhoven, so mostly technical universities as I had all kinds of flyers and brochures and had looked around a lot, also with my mother, who also wanted to come with me to help me. (Nicole, Technical Physics, Research University)

The last moment of choice that was explored is for the first job. Some respondents refer to being a woman as relevant in the selection process.

> It surprised me that so many employers actually wanted to talk to me, so what is so special, and then they said: “Well you are a woman in the technical sector and that is a big pre. But wouldn’t men just want to have men? No, diversity. Those were new things that I learned that are were not obvious to me. But is was what I got used to. That I had been an active student, had been in the US for a while and so on… I had three clear advantages. I did not expect that and it did not fit with my initial self-image. (Isabella, Technical Physics, University of Applied Sciences)
>
> Before I graduated, I already knew where I was going to work. I was at the company days of the University and met someone who was very enthusiastic about women in a company, so diversity and said that I should come and work for them. And that person brought me in contact with someone who had a traineeship in mind for me. So, I went there and they said right away that I could start. (Electrical Engineering, Lina, Research University)

Others talk about staying at their graduation company. Another theme that appears is the broad orientation before deciding which offer to take.

Figure 1 shows the identity statuses found among male and female graduates that stayed in the technical sector.

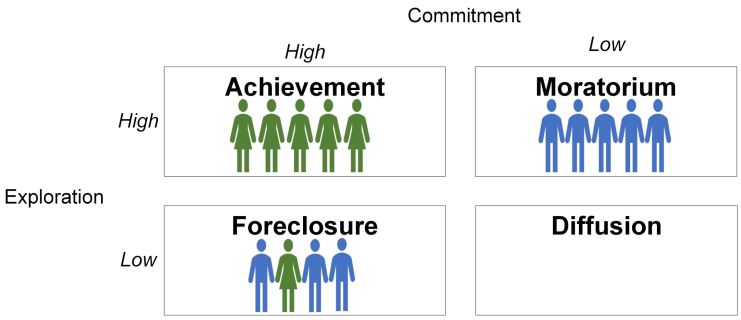

Fig. 1. Identity statuses of the male and female interviewees (based on Marcia (1966)*)*

Looking at the four moments of choice and the experiences told by the female interviewees, the identity statuses of the Isabella, Mila, Emma, Nicole and Kira, can be characterised as having an achievement identity status, showing commitment to and remaining in the technical sector. They reflect the exploration that characterises this identity status. Their life experiences show a tendency to keep different options

open, having a variety of hobbies and sports, having broad interests and having doubts at moments of choice. Lina's stories point to a foreclosure identity status, as committed to being in the technical sector, but not exploring a lot within or outside the technical sector. She knows that she wants to go for a technical profile, a technical degree programme and a technical job and the exploration activities seemed more a way of confirming a choice that was already made than really finding out what she wanted. The tinkering and technical crafting in her childhood that she tells about are comparable with the stories of the male graduates. The extensive talks she has with her parents to make sure that she makes the right choice differ from the stories of the male graduates who share stories about very obvious choice processes that were hardly or not at all discussed with others.

The male graduates that stayed in the technical sector showed a moratorium or foreclosure identity status. The absence of exploration characterises the foreclosure identity status. The moratorium identity status has a high exploration, but the commitment to the technical sector is rather low. The exploration in this case can lead to a technical as well as a non-technical outcome of one or more of the choice processes.

4 CONCLUSION

The identity statuses of female graduates are different from male graduates. The foreclosure status appears to be less outspoken in the sense that although the female graduate with this status is committed to the technical sector, and not exploring extensively, some of the activities described that can be regarded as exploring, appear to be a final confirmation of the decision made. The female graduates with an achievement identity status remain connected to the technical sector. In contrast, the male graduates that stayed in the technical sector did not depict any life experiences that would fit in this identity status.

The life histories of the female graduates that stayed in the technical sector show, in general, more deliberate and conscious choice processes than the male graduates. They do not mention the lack of examples of role models in their stories, or even the experienced difficulties to make the choices they have made. They know they want to remain in the technical sector and want to keep options open, but within the technical sector. They seem to have chosen paths that were not obvious or common, but did not describe experiences that can be regarded as suffering from being different or having a complicated time. Their experiences of not being mainstream was a constant factor in their lives. However, they do describe many life experiences that include the importance they attribute to the feedback of others on their, sometimes unusual, choices. These others may not be single role models, but could consist of a mosaic of elements from different people (Spaans, et al. 2023).

For those working on attracting more women to technical programmes, this means that the environments that these female students are in at the main moments of choice need to be more supportive. Teachers, parents, study counsellors at

secondary school, friends and prospective universities seem to play a stronger role in the choice processes of female than of male graduates.

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