

# PROFESSIONAL IDENTITY DEVELOPMENT AND CAREER CHOICES IN ENGINEERING EDUCATION: THE ADDED VALUE OF LIFE HISTORY RESEARCH

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**Conference Key Areas:** *Diversity and inclusiveness*

**Keywords:** *professional identity, alumni, life history research, narrative research*

## ABSTRACT

In the Netherlands, there has been a shortage of qualified technical workforce for many years. This is not only due to the number of students entering engineering degree programmes, but also due to the number of graduates that leave engineering right after their graduation. Around 42% of the engineering graduates does not start working in an engineering job after graduating. Professional identity is a key concept in understanding the study and career choices that students and alumni make.

The project Bridge the Gap is aimed at understanding how professional identity (PI) of engineering students develops over time during and after their studies. Part of this project is a study on PI development from an early age on. In order to understand what experiences in life have shaped their study and career choices, life history interviews were carried out with both alumni that stayed as well as alumni that left engineering after their graduation, 13 in total.

Life history research is a form of narrative research that is about comprehending the complexities in decision making in the daily life of an individual in order to get insight in a collective experience of a group. The nature of the collected data enables us to have a critical look at assumptions about study and career choices of engineering student and alumni, rather than allowing for generalizable conclusions. This paper describes the value of LHR for understanding professional identity development and career choices in engineering education.

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## **1 INTRODUCTION**

In the Netherlands, there has been a shortage of qualified technical workforce for many years. This is not only due to the number of students entering engineering degree programmes, but also due to the number of graduates that leave engineering right after their graduation. Around 42% of the engineering graduates in the Netherlands does not start working in an engineering job after graduating [1] and at the same time the number of job openings for technical positions in the Netherlands has risen from 41.200 at the beginning of 2016 to 71.600 at the end of 2019 [1]. In the search for understanding the large number of engineering graduates that leave engineering, many hypotheses on the motives for staying in or leaving the technical sector have been stated by industry, by universities, by experts on attractiveness of the tech sector for young people and by regional and national administrations. These hypotheses range from the importance of early contact with technology in e.g. toys and games at school or in extracurricular settings, the importance of role models in STEM, especially for girls, the role of parents or study advisors and also the actions that technical companies can take to convince alumni to stay, especially in terms of salary. Based on these hypotheses, many initiatives have been taken to raise interest of young people in STEM, attract more students to engineering degree programmes and increase the number of women in engineering. At the same time, researchers have been trying to understand the study and career choices of those who do or do not choose for an engineering degree programme after their secondary school education, as 42% of students decide – sometimes even before graduating - not to start working in engineering. In order to effectively decrease the shortage of engineers, this phenomenon needs to be understood better. Professional identity has proven to be a key concept for understanding study and career choices [2]. In order to explore the formation of professional identity, life history research can be used to get a more holistic view of the development of professional identity. This article describes the role of life history research in understanding study and career choices of engineering students and professionals through analysis of their professional identity.

## **2 PROFESSIONAL IDENTITY AND STUDY AND CAREER CHOICES**

Professional identity gives an answer to the question “who am I as a professional?”. It describes one’s professional self-concept based on one’s own values and beliefs [3] and it is shaped by the social environment and social situations [4]. It is a concept that plays a key role in understanding study and career choices. Professional identity can be seen as a personal as well as a social construct. When focusing on the personal perspective, professional identity is defined as one’s perception of occupational interests, abilities, goals and values [5], considering as such professional identity as something that is different for every individual. The social perspective on the other hand looks at a group level and describes professional identity as “the degree to which employees identify themselves with the profession that they practice and its typical characteristics” [6]. Previous research shows that

different professional identity profiles of engineering students and professionals are related to their study and career choices: a more prototypical engineer tends to stay in engineering [2]. The profiles also provide insight in the fact that women are more likely to leave the technical sector as they are overrepresented in profiles that have a higher tendency to leave engineering [7].

### **3 PROFESSIONAL IDENTITY DEVELOPMENT**

As professional identity appears to play a key role in study and career decisions of engineering students and professionals, it is important to understand how professional identity is formed. This is studied predominantly in contexts of high school, higher education and early career, assuming that professional identity is shaped during adolescence and early adulthood. Students do not enter degree programmes as blank slates and begin their education with preconceptions [8]. Professional identity formation of doctors has been extensively studied by e.g. Stubbing, Helmich and Cleland [9] through focus groups on experiences and emotions in the process of identity formation during medical school. The trajectory that precedes formal education is acknowledged as relevant, but usually not taken into account systematically. Authors refer to identity development as a continuous process that starts at a young age [10, 11, 12], but do not take this into account when studying professional identity development. Forsythe [13] simply ignores early stages of identity development when studying professional identity development: “Kegan posits a total of six stages of development (0 –5) of which three are relevant to our discussion of emerging professional identity (stages 2, 3, and 4).” By separating primary and secondary socialisation processes [14], research on professional identity development has a tendency not to take earlier life stages into account, as if the development process of professional identity starts from scratch when entering formal education or just before. The experiences that professionals go through before professional socialisation processes and the meanings they construct from these processes may however provide useful insights in their study and career choices and therefore in the early foundations for professional identity formation. Many experiences that take place before, during and after formal engineering education contribute to the professional socialisation of engineers [15]. As argued by Goodson [16] “... in order to unravel socialisation processes contributing to formation of professional identity, it is necessary to cover the socialisation process during its full span of life and work, as opposed to the training period only.”

### **4 LIFE HISTORY RESEARCH**

When looking for ways to understand the experiences in life of technical alumni, narrative research provides a useful qualitative research framework. Life history research is a specific form of narrative research that is focusing on one's whole life. Respondents are asked to narrate life episodes of one's entire life [18]. The specific focus lies on individual stories. According to Cole and Knowles [19] life history research is about: “(...) gaining insights into the broader human condition by coming to know and understand the experiences of other humans. (...) It is about

comprehending the complexities of a person's day-to-day decision making and the ultimate consequences that play out in that life so that insights into the broader, collective experience may be achieved (...) To understand some of the complexities, complications, and confusions within the life of just one member of a community is to gain insights into the collective." The in-depth exploration of these individual stories helps understanding the complexities in the broader context where the respondent is in [19]. It is therefore not only about what is narrated, but also about how the story is narrated. During life history interviews the teller is in charge and tells life experiences without being interrupted or pushed into a certain direction. The role of the interviewer is to ask questions to deepen and further develops the story [18].

## **5 LIFE HISTORY RESEARCH IN ENGINEERING EDUCATION**

In engineering education most research is conducted in a quantitative or mixed-methods manner [20, 21]. Life history interviews have proven to contribute to the research of identity development. To our knowledge, except for the studies of van Hattum-Janssen and Endedijk [22], Tegeler [23] and Paalman [24] within the context of the project Bridge the Gap, no further research has been conducted that explores professional identity based on life history research in engineering education. Within Bridge the Gap, 19 life history interviews have been carried out so far with technical alumni that graduated 1,5 till 4 years before the interview. Both men and women (N = 18) that remained in the technical sector as well as those who left, participated in life history interviews. They were asked to share their life experiences of their early childhood, primary and secondary school, university period and early work life after graduation. The choices they made, what they remember with regard to these choices and how they felt about it were important focus points. Life history interviews have a rather open interview protocol. There is no specific set of information that the researcher is looking for and a structured interview protocol is not appropriate for life history research. An open protocol that allows especially for relation building between the researcher and the respondent and at creating a setting in which the respondent feels at ease to share stories of his life is necessary. In this setting, the respondent will disclose stories of his life of which the researcher and the respondent make meaning. Results of the interviews show that certain patterns for study and career choices made by those who stay and those who leave are, to some extent, already visible before they start their engineering degree programme. Those who stayed in engineering and never really considered leaving engineering show an interest in technical hobbies, tinkering and have engineering related besides school and university. At a young age they already engage in activities that fit well with their future engineering courses,. They hardly ever think about choosing a degree programme outside engineering. The interviewees that are not engaged in engineering related activities have in common that they are characterised by a clear search for cognitive challenge and engineering is a possibility to find this challenge, but it may as well be found elsewhere. As opposed to the first group that will always choose for technical options when study and career choices are to be made, the

second group considers a wide range of options both in and outside the technical field. At secondary school, they tend to choose for a technical profile, because they consider it the most difficult one. During their studies, they go for the most challenging, most demanding specialisations and consider many, sometimes rather divergent options. The life history interviews as carried out with the engineering alumni show an added value of this type of research, but are problematic from time to time, as the individual alumni are often hesitant at the beginning of the interview, have clear hypotheses about why engineers leave engineering and find it hard to imagine what their life story can contribute towards getting more insight, especially coming from a positivist research paradigm themselves. In general, narrative research can make voices heard that remain otherwise unheard, but, as argued by Brown [25] in his research on narrative research on organisational identity “(...) unlimited plurivocity is, in some respects, admirable, it is also potentially confusing.” Plurivocity refers to the potentially limitless number of interpretations of individual narratives.

## **6 FINAL REMARKS**

The life history interviews as carried out within Bridge the Gap seek to enrich the already existing findings of professional identity development in STEM through the inclusion of individual experiences. Rather than presenting conclusions at a general level, life history research helps to understand the individual experiences of professional identity development in STEM. By looking at technical alumni in a different way and taking their life histories into account, the phenomenon of staying or leaving in the technical sector is not reduced to the acceptance or rejection of a specific hypothesis on one or more aspects that may be relevant for study and career choices. It enables us to look at the possible patterns that are coherent with their entire life history and may help us to learn more about how future choices will be made by these alumni. From the interviews in this study, we learnt that the alumni that stayed in engineering and have never considered other options, relate similar life experiences and choice processes. Their study and career choices do not seem to be strongly influenced by external factors like parents, teachers, study advisors or specific programmes to gain their interest for engineering. From an early age, sometimes as early as primary school, these alumni show an interest in the technical field. This interest is not clearly visible in the group of alumni that have considered both staying in the technical sector as well as leaving. Their interest is not in things like tinkering and soldering. They make study and career choices based on their search for cognitive challenges and/or diversity in their work context and professional activities. For them, the technical field is one of the possible options to fulfil their ambitions. The visibility of these different patterns before the period that is usually included in research on professional identity formation makes a case for the inclusion of earlier stages of socialisation into the period of analysis.

## ACKNOWLEDGEMENT

We thank Iris Paalman, student at the Master's programme Educational Science and Technology of the University of Twente, for her contributions to this paper.

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