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# 'I started this, and I will end this': a phenomenological investigation of blue collar men undertaking engineering education as mature students

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**ABSTRACT**

Many blue-collar jobs, most of which are performed by men, are likely to be displaced by automation. These workers will, therefore, need to be retrained and reskilled, many of them choosing for engineering education as mature students. This paper uses Interpretive Phenomenological Analysis to draw a complex portrait of the experience of blue-collar men studying engineering as mature students in Denmark. We found that the participants faced considerable challenges in their engineering studies: they brought baggage from a challenging youth, from family traumas and educational failures; they felt alienation and cynicism about the world and saw their own possibilities for progress thereby limited; and they experienced difficulties with the contents and the process of the engineering curriculum. However, they persisted with faith in engineering education as a gateway to a better life and a sense of social responsibility as future engineers. The study concludes that more pro-active university support systems would alleviate the difficulties faced by such students.

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Psychology; interpretive phenomenological analysis; adult learners; mature students; engineering education

## Introduction

The twenty-first century is proving increasingly challenging for blue-collar workers, referred to in the European Socio-economic Classification as lower technical occupations and lower supervisory and technician occupations (Rose and Harris 2010). According Hawksworth, Berriman, and Goel (2018), 44% of low-education jobs are at risk of automation by the mid-2030s. While some scholars propose a universal basic income to support these workers through the changes (Bregman 2017; Raworth 2017), the more commonly advocated practice is re-training and re-skilling through education as mature students (also known as adult learners) (Illanes et al. 2018). The definition of what constitutes mature students varies: some count all adults over the age of 21 at first matriculation (Tones et al. 2009; McCune et al. 2010), while others use 25 years of age as the cutoff point (Phillips 1986; Reay 2002). However, focusing on age as the defining factor may not be so interesting in the context of blue-collar workers, who often begin their working careers young. For the purposes of our research, we define 'mature students' as those with experience of working in lower technical and supervisory occupations as their primary occupation prior to their enrolment at university, excluding

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'gap-year' work. We will eschew the use of the term 'low-skilled' to describe them, since what they lack are not skills *per se*, but merely academic skills.

In 2008, the European Union, recognising the vulnerability of lower technical and supervisory workers to automation and other threats to their employment, announced an objective of increasing adult learner numbers to 15% of the population by 2020 (Commission of the European Communities 2008). Achievement of that objective has been patchy across the union and depends on what is being counted as education. Data from the third Adult Education Survey (AES) of the EU shows that the average enrolment of adult learners in formal education across the EU was 5.8%, continuously dropping since the first survey in 2007 (Eurostat 2016). The Scandinavian countries were the exception to this trend, with continually rising mature student participation in formal education over the period, coming close to the 15% mark in Finland, Sweden and Denmark. This makes Scandinavia an interesting case to study, especially given its higher education financing model, which guarantees free education for all EU citizens. In addition, Denmark offers all Danish students (and EU students under certain conditions) a maintenance grant of around 6000 Danish Crowns per student per month for students not living with their parents, and a bit less for those living at home, effectively 'paying' students to study.

This is significant given the prominence of financial issues in the literature on nontraditional mature students. Tones et al. (2009) noted that students of lower socio-economic status were far more likely to report difficulties in adjusting to university life and coping financially than other mature students. Bowl (2001) focused more specifically on working class women, painting a bleak picture of non-traditional female student experiences. She describes exclusion, prior educational trauma, lack of support and financial and time poverty as contributing to making university something 'to be endured, rather than enjoyed' (155). Reay (2002) corroborated these findings in a study of working class women that reported a desire for self-improvement hampered by material and educational constraints. These women juggle family responsibilities, financial hardship and the psychological scars of prior failed educational pathways. The prominence of financial hardship in the experience of mature students may be detracting them from important psychological challenges that come with returning to education. Reay (2002) studied how the question of selfhood and identity percolate the experience of working class mature students. She found that while some mature students were keen to preserve their working-class heritage, others saw university education as a means to break free and reject their blue-collar background. These identity questions are fundamental to understanding how nontraditional students experience their return to formal education and essential to explore in the light of the predicted increased need for re-training and re-skilling, particularly in Western countries. Using Denmark as a case study allows us to explore identity and other psychological processes in a context-free of the weight of financial anxiety. It provides an opportunity to focus on other challenges that lie in the mature students' experiences.

Engineering education sits at a particular crossroads when it comes to mature students. Within the EU, engineering is the third most popular choice for adults who return to formal education, behind health sciences and business administration (Eurostat 2016). Just as the demand for low-education workers is likely to fall, global environmental challenges, particularly climate change, will likely increase the demand for highly skilled engineers to drive the necessary technological responses. This trend is reflected in current industry demands for technical sustainability competences (Bonini and Görner 2011) and the adoption of a sustainability discourse by the engineering education community (Boyle 2004). As a consequence of these increased demands, the number of mature students who choose to re-train in engineering is likely to rise. Yet in a meta-analysis of mature student achievement, Richardson (1994) indicated that while mature students tended to do well in arts and social sciences subjects, they struggled within scientific and mathematical disciplines. He conjectured that mature students' broader life experience helped with humanities and social subjects, but hampered mathematical and scientific skills that required constant practice. But this study is over twenty years old, and almost nothing has been written on mature students in engineering education since.

A final feature of note in the framing of this study is the gendered nature of the re-skilling of low-education workers in engineering education. While there are no statistics available for the gender

ratio of mature students in engineering education in Europe, Engineering education as a whole is the most male-dominated university study in Europe, where men account for nearly 75% of students (Eurostat 2016), and in Denmark, men outnumber women for mature student enrolments (OECD 2017), and men are more likely to have experienced blue-collar work (Eurostat 2019). Yet while there has understandably been a rising emphasis on understanding the experience of female and ethnic minority students in engineering education research (e.g. (Beraud 2003; Brainard and Carlin 1998; Huang, Taddese, and Walter 2000; Stonyer 2002)), not enough attention has been paid to socio-economic status in the male population. Future projections for a massive increase in the re-skilling and re-training of (predominantly male) blue-collar workers and the increasing popularity of STEM subjects make the case for investigating the phenomenon of mature engineering students. In this study, our research question is, therefore: how do Danish blue-collar male mature students experience starting a bachelor programme in engineering?

## Methodology

Interpretive Phenomenological Analysis (IPA) is a well-established qualitative research approach for investigating a particular phenomenon within a specific group of people. It is characterised by small sample sizes, rich, in depth descriptions of participants' experiences and an interpretive layer that acknowledges the subjective nature of the hermeneutic process inherent in the method (Smith and Osborn 2008). The purpose of IPA is not to test hypotheses or make generalisable statements but to explore the meaning given to a particular experience by participants of a homogenous group. But it is not merely descriptive of those experiences, providing an interpretation 'which positions the initial 'description' [of the experiences] in relation to wider social, cultural and perhaps even theoretical context' (Larkin, Watts, and Clifton 2018). Given its idiographic commitment, IPA works with samples ranging from a single case study, to up to ten participants (Smith 2008). In seeking to weave a narrative of meaning anchored in similarities of experience, IPA takes a different point of departure to other popular qualitative approaches in engineering education research, such as phenomenography and discourse analysis (Baillie and Douglas 2014).

Sampling is always purposive in IPA. In order to identify appropriate participants for this study, we contacted students starting their first week of a bachelor in engineering across three departments of a Danish engineering faculty, with an email explaining the research project. We received 19 responses, and from that set, we excluded participants who did not fit the gender and socio-economic profile that we were looking for. We narrowed the sample down to four participants who best fitted our research question, listed in Table 1 using pseudonyms.

**Table 1.** List of participants and their backgrounds.

| Name | Age | Profession | Study | Background |
|---|---|---|---|---|
| Carl | 23 | Electrician | Electronic Engineering | Comes from a low-education, economically deprived family in the rural areas. Was ostracised from his family at the age of 18 and went to a technical college to become an electrician. Carl was diagnosed with autism and has a prior history of depression. |
| Hans | 29 | Electrician | Mechanical Engineering | Comes from a low-education family in the urban areas. Tried various low-education jobs after high school. Enrolled in a technical college after a period of unemployment and trained as an electrician. Worked as an electrician until a work accident prevented him from continuing his profession. |
| Mads | 32 | Transportation / Military | Mechanical Engineering | Comes from a family of entrepreneurs in the urban areas. Worked in various low-education jobs since age 13. Joined the military for two years and served in Afghanistan. Then went to work in warehouse management and transportation. Became a father at age 30. |
| Niels | 31 | Shipfitter | Electronic Engineering | Comes from a low-education family. Went to technical college after high school to train as a shipfitter for the marine. Spent a decade working in various shipyards and travelling for his work. Niels was recently diagnosed with autism and ADHD. |

It should be noted that two of the participants have mental health diagnoses. This was not part of the sampling procedure – in fact one of them only received his diagnosis half-way through the research project. In this research, we do not draw conclusions on mental health and working class background, though this has been done elsewhere (Pietikäinen and Kragh 2019). This may be one of the limitations of this paper.

The participants were invited for a first semi-structured interview, following the list of themes listed in Table 2. After that, they were invited for a second interview three months after the first, and a final interview a full year after the first. These two extra rounds were less structured, focused on developing the points brought up by each participant in his previous interview and seeing the developments and changes over time. All of the interviews were conducted by the first author, in English. The interviews were audio-recorded using a voice recording phone application. The participants were asked for oral consent to record the interview and to use the recording for research purposes before each interview. The giving of consent was recorded at the start of each interview.

The consecutive rounds format is not generally used in IPA, but in this instance allowed the interviewer to build a trusting rapport with the participants, and gave the participants time for self-reflection in between the interviews, which increased the quality of the responses. We found this approach useful for a situation where the interviewer was not from the same background as the participants (different nationality, gender and socio-economic background). It helped the interviewer to break down communication barriers with the participants and gave the participants the chance to discuss the researchers' interpretation of the data after the first two rounds.

The interviews were transcribed verbatim after each round by the second author, excluding only stutterings that were clearly a result of hesitations in pronouncing English words. Overall, the level of English of the participants did not pose any difficulties for the interviews. Each transcript was initially individually parsed through and freely annotated for impressions, ideas and interpretations by each of the authors, working separately. The authors then shared their impressions and discussed points of divergence, to come to a common interpretation of the data. Based on these discussions, the first author coded the transcripts one by one. After further discussions involving all authors, the emergent categories were grouped into four superordinate themes (Smith and Osborn 2008), which form the structure of this paper. We followed Osborn and Smith's (1998) lead in separating the analysis section which focuses exclusively on the data, from the discussion section that embeds the results in the literature.

With some exceptions (Ecklund 2013; Servant and Dewar 2015), the use of IPA is uncommon in engineering education, despite calls from prominent journals in the field for developing approaches that focus on depth and understanding (Case and Light 2011). As such, this paper serves the added purpose of strengthening the case for IPA as a tool for understanding engineering student experiences and to promote research that espouses an idiographic epistemological commitment in engineering education. In the early days of qualitative approaches in engineering education, the epistemological peculiarities and small sample sizes of certain methodologies caused friction within a quantitatively-oriented peer-review system (Borrego, Douglas, and Amelink 2009). However, a decade later, such methodologies seem more in demand than ever before and offer great possibilities for new ways of looking at engineering education issues.

**Table 2.** Semi-structured interview themes for the first round of interviews.

| Interviews round 1 semi-structured interview themes |
|---|
| 1. Personal history, including previous work and educational experiences |
| 2. Reasons for enrolling as a mature student in engineering |
| 3. Expectations, challenges and fears for educational journey, particularly with regards to project work, group work, study load and engineering contents |
| 4. Future expectations for engineering career and personal journey |
| 5. Perceptions of impact of social responsibility concerns for engineering career and personal journey |

## Analysis

### *Bringing in baggage from a difficult past*

None of the four participants we interviewed had an easy life prior to their university enrolment. Starting from childhood, they experienced fraught relationships with authority figures. For Carl, his father's harsh treatment left a lasting mark that manifested in self-destructive behaviour: 'my dad has always been incredibly hard on me so I guess I'm just kind of picking up on that and just […] I just … well, doing what I've learnt, in some way', while Mads' parents weren't around for him: 'both my parents have had their own companies and stuff like that and they also worked 12–14-hour shifts. And, *er*, I remember *errr*, I've always just wanted my parents to be home with me but they were never home'. Even though Niels and Hans' respective parents were supportive, having not gone to university, they could not provide educational support. As teenagers, Niels, Carl and Hans were led to believe they were not suited for academic work, and neither high school (in Northern Europe, this is known as *gymnasium,* and is specifically gears towards university preparation) nor university were within their reach. The lack of belief expressed by Niels' teachers ground down his self-esteem as a teenager, and birthed a rebel streak in him as a reaction:

> in the school I was in it was like: 'well you don't really have the skills, the skill set for gymnasium and for university'. So, I was like: 'OK, if they don't think so, then I won't', and then I took a technical education instead. And then later on I sort of … yeah, 'they're not gonna decide that for me, if I'm at that level or not'

This feeling of being a misfit and treated unfairly in the conventional education system echoes both Hans and Carl's experience:

> I've been told I have dyslexia from first class so then in the ninth, in Denmark … and then I went to *um* some special place for kids who don't fit in anywhere, where they can they get a pay grade for showing up to school and being put into workshops (Hans), I think a lot of the, the teachers I had were kinda: 'ok, so this is what he can do and we don't really have to read … necessarily fairly read the things he does because it's, they're all obvious mistakes he always makes, so this is just, this is this grade'. (Carl)

These men dealt with financial struggles and early working experiences in their lives. Carl recalled his family struggling financially: 'My family aren't really well off, a lot of them are alcoholics and so I don't really get any support from home'. Mads was given his first job at age 13:

> my birthday gift for my 13th birthday was some guy who came and told me how to deliver newspapers and I started delivering newspapers after that so, it was a nice gift. But I started working for a furniture company when I was 17 I think and I was there for eight years total.

As a result of academic struggles and financial imperatives, all four men sought out low-education jobs that could bring them financial independence right away.

However, upon choosing to return to formal education as mature students, these childhood issues (arguably in some cases the word trauma is not too strong) still weighed on them, and a part of their motivation for studying was a quasi-therapeutic quest to prove their parents and teachers wrong.

Mads and Niels carried this psychological baggage with some degree of pride. They valued their professional and life experience and took on roles in managing the social dynamics of their project groups, while maintaining a distance from the younger students. Carl and Hans struggled more with the weight of the past. Hans blamed himself for his failures and disparagingly referred to himself as mentally immature and lazy: 'I'm not mentally old. I'm still like … I just told my group when we start talking and I was saying just because I'm 29, I don't have all the answers. I'm just as childish as all of you'. Despite undergoing psychotherapy and being hospitalised several times prior to his university enrolment, Carl still experienced bouts of depression that plagued his social and academic life.

### *Seeing limited possibilities for improvement in a bleak world*

It will not come as a surprise that these young men, given their personal history, had a dark view of the world they live in. Even when asked ostensibly about social responsibility within an engineering

career framework, their deeply personal reactions betrayed alienation from a world in which they did not feel much agency or hope.

Both Hans and Niels felt such despair at the state of the world that they vowed not to have any children. Hans expressed it as a personal choice: 'it might be a bit personal but I choose not to have kids because I think the society as we're building it today it's *er*, a b*tt-load of cr*p at the moment'. Niels framed it as a more political choice:

> Well when you look at the graphs, and how the population is just increasing all the time and you see the crossing of how the earth is doing and how many people we are getting, that's obvious, not to get any children.

Carl's alienation from society grew substantially between the first interview, in which he merely expressed concern at the state of public discourse, and the final interview, in which he spent a lot of time following nihilistic discussions on internet forums: 'They [the people writing on internet forums] have embraced nihilism completely, and I feel like I kinda feel that too. I feel like I can relate to them in such a massive way'. Mads' initial stance during the first interview was not to worry too much about the state of the world, focus on the present, and hope that things would turn out all right. By the time of the final interview, he had developed a broader awareness of the environmental crisis, an interest ostensibly triggered by a course on plastics within his study programme, and concluded that

> I've learned a lot through lectures and through things we've researched and stuff like that, and then … it's a big problem. And I just saw that 11,000 scientists just released a report that says that the world is pretty much … *f***ed*.

Given their challenging histories, and within this bleak worldview, the four men saw their own possibilities as quite limited, and adjusted their ambitions accordingly. They saw the world as a rigid, almost natural pecking order in which they just happened to fall near the bottom, and their only possibility, through studying engineering, was to climb a bit higher up, if those above them would allow it. Carl offered the most striking example of this belief:

> I've always been, like, at the bottom, I mean, to me when it's been the worst, I've always felt, like, subhuman. So for me to kinda like be somewhere at little higher up, *er*, than just, you know, outcast or what, say, an electrician, which you know, in the whole society isn't really that high.

Mads shared this belief, but expressed it less as a personal failing and more as just-the-way-things-are: 'You just have to accept and that's your place in life and, and some point someone above you will see the potential you have and then yeah, you get a better job hopefully'. Neither Hans nor Niels could see themselves taking managerial or leadership positions even within the engineering profession because they perceived themselves as cogs in a machine without the essential attributes to move to the top: 'I'm just going to be a pawn, a small pawn in the big game' (Hans); 'Someone with natural leadership skills, that has the mental resources for it, has to take that role because I know I don't have it' (Niels). Hans actually wanted to be a graphic designer, but he forbade himself from chasing his dream and studied engineering in order to secure a job after his studies: 'I guess we all miss our dream, we all want the dreams, instead of the practical or the pragmatic choice but I'd rather make a living than living on welfare'. As a result, he suffered from demotivation during his mechanical engineering studies: 'this semester has almost no interest for me. It's about metallurgy and process optimisation and I really don't care how metals are built under the microscope. It's a really hard semester, motivationally'.

### *Experiencing engineering education as an uphill struggle*

All four men started their engineering studies with apprehensions about returning to education after such a bumpy ride in their formative years, particularly with regards to mathematics. Mads explained: 'I have a hard time understanding how something works in theory if I can't imagine how it works. Some of the equations we use, of course, I can use them but, I don't know *why* we use them'.

Niels repeatedly talked about the difficulty of theoretical calculations, and how failing calculus sabotaged his first attempt to undertake engineering education in robotics, leaving him 'scared' about his engineering prospects. Carl, quoting a friend, stated: 'there's three reasons to kill yourself Cal-Cul-Us'. Hans described his fear of failing mathematics and his difficulties in understanding thermodynamics. They almost talked about mathematics as a kind of mythical monster to be slain. Unfortunately for Niels and Hans, their fears proved founded, as they failed calculus and thermodynamics respectively in their second semester. For Niels, this triggered disillusionment with the whole system of engineering education. He knew that he was capable and passionate about understanding the subject, but he was just slower than the younger students whom he saw as grade-chasers

> For your exam, you have four hours, in these four hours, if you perform well within the four hours and you solve like, 50%, 60%, then, *yay* [claps sarcastically]. But if you could solve the whole thing but it would take you ten hours and after four hours you only solved like … one third of the problem but you *are* capable of solving all of the problems but it takes you ten hours, then you're f***ed.

For Hans, his failure triggered an 'existential crisis', which, compounded with grief at his father's passing at the end of his first semester, led him to doubt his capabilities and his future:

> it started almost … a few weeks after I flunked my first exam, and of course my father wasn't there to talk with and such, so, yeah. I think it started the whole 'what am I gonna do if this doesn't work out' thing.

Instead of taking the time to grieve his father, he kicked himself for his inability to get work done:

> I'm trying to fight that procrastination gene in me because I can … I can have my book out and be in my bed and look over at the book and think I should be studying right now, but instead I pick up my phone and look on Facebook […] There's a lot of, internal struggles. Battles with myself and my lazy mind (Hans).

In seeing his inability to concentrate as a battle of will *versus* genetics, Hans placed this struggle squarely on his own shoulders and did not seek help until he was forced to acquire a medical dispensation allowing him to retake his exams. By the time of the final interview, he was getting psychological support through the medical care system, but not receiving any support from the university.

Carl and Mads passed all of their courses, but Carl maintained a fear that his 'luck' could run out at any point and constantly believed that he was on the verge of failure. He put his good project performance down to one of his teammates: 'I don't really feel like it was *my* success. I feel more like it was [name redacted], a really genius guy. I feel more like it was his success and I was just pretty much along for the ride'. Mads was the only one who gained in confidence with mathematics over the course of the three interviews, saying that while he struggled in the beginning, he appreciated the need for a theoretical understanding of problems as his studies progressed and felt more comfortable with that approach.

The men also experienced difficulties with the social processes inherent in group-based project studies. The educational format left Niels feeling 'exhausted' by the required social interactions. However, between the first and second interview, he was diagnosed with autism-spectrum disorder and Attention Deficit Hyperactivity Disorder, which helped him to make sense of these difficulties. As a result, Niels sought out psychological counselling, and joined an autism support group at the university that helped him to manage his studies. He also had the support of friends who were either going through the same adult learning process as him, or who complemented his own skillsets in some way. But even with this support, he still fell into a depression and experienced an existential crisis: 'you know Søren Kierkegaard? He is sort of moody, and I was sort of below that, a little bit more moody than Søren Kierkegaard. […] I couldn't [study]'. Mads dealt with the group work essentially as with a job, focusing on what was under his immediate control. As such, he made a point of not stressing about exams, spending only the time he needed to study at the university, did not engage more than he needed to with the younger peers in his project group, and then went home to his partner and daughter and put work aside. By contrast, the others took their work and their study-related worries home with them.

The social aspect of the education was excruciating for Carl. His mental health deteriorated between the first and final interview as he experienced social setbacks that he attributed to his long-standing autism diagnosis, culminating in being cast out of his project group after a suicide attempt during the second semester: 'they told me that they didn't want to be in a group with me anymore. So, I was kind of kicked out of the group'. For the third semester, he was put into a new group of students by default: 'I came in, well, kind of a lazy group, my group now, they never really study or anything, and that causes me a lot of stress'. At the time of the third interview, he was shutting himself out from the social world, and deliberately not seeking help from the university as he feared that this would reinforce his feeling of otherness.

### *Hanging on through resilience and hope*

Despite their backgrounds and struggles, none of the men showed signs of giving up on their engineering studies. In the final part of this analysis, we will look at the resilience mechanisms that allowed them to carry on, and what drove them to push forward.

It is remarkable that despite their situation, the participants displayed such resilience in pursuing their studies. Mads showed the greatest coping capacity and seemed quite positive about his own progress. In the beginning, he had difficulties adjusting to the slow pace of the study process and was still in the problem-solving mindset of his previous job. By the end, though he still struggled with the theoretical aspects of engineering, he felt adjusted to his studies. He felt that once he was able to choose the members of his project group in semester 3, he could join forces with like-minded people that could provide a support network for his studies. Hans also treasured this social support network:

> when I'm in the group, with the project and also taking courses together, […] they're almost all from the same background as me […] and we have an agreement that we're gonna help each other to get through this education.

He was clear that were it not for the support from his project group, he would likely have dropped out. Niels found himself needing more than his project group and his friends, and spent great effort on locating the right support within and outside the university. But he was also buoyed by dogged determination: 'I don't do well at losing. It's a competitive streak. I started this, and I will end this'. This chimes with the persona he adopted in his previous life as a shipfitter, where his crew mates referred to him as 'The Captain', owing to his seafaring experience and proclivity for rum. Even as he hit the low point of his engineering education experience, he still nurtured this rebellious identity.

Carl struggled the most, even though he actually did well in terms of study achievement. He stated that: 'I keep going because I have to', pushed forward by a fear of failure. It was also clear that he was motivated by an interest in working with his hands, and a love of all things technological. Technology was like a mental escape, as he entertained thoughts of building rocket ships to Mars, building Sterling engines, and finding technological fixes for the climate crisis. The pleasure he got from working with electronic components was apparent:

> I like the hands-on approach like, that's one of the things I also like about electronics is that when you turn it off and on you kinda get some results but if you have something that you're supposed to control with the controller, I press forward and it doesn't move forward, you know it's … you can see that, oh there's a problem here that needs to be solved.

Ultimately, though, it is not so much resilience mechanisms, but the drive for self and societal improvement that pushed the participants forward. Whilst the baggage that they brought in from their past was a challenge during their studies, it was also a fuel for their drive to engage with engineering education. In particular, each of the men, in their own way, saw engineering education as a way of dealing with feelings of unfulfilled potential within their prior professional lives. Niels recalled feeling like the odd-one-out at his work place, and aspiring to be like his colleagues: 'I liked being in the office and the guys in the office was way higher educated than me so I was like: I like the job but I

felt I was undereducated, compared to all the other guys'. For Mads, this was seen as a last chance to fulfil his potential, to escape his self-described status as the 'black sheep of my family' due to his educational failures: 'I think this is my last chance to, to try something new. Er I, I … it's a big decision when you're 32, to start an education that lasts three and a half years' (Mads). The kick-starter for his decision was the birth of his daughter, an event that challenged him to want better working conditions and a higher salary. For Hans, engineering education was a chance to set his life straight after years of indecision and meandering from job to job, and fulfil a promise to his dying father: 'it's *er*, a personal, really personal … I don't know … quest? Quest, now because my father died on the first of January this year, and he wouldn't … He said that, that even though he wasn't here anymore I shouldn't quit'. For Carl, engineering education was the escape route from the bleak social and economic conditions of his family: 'when I was young, we always worried about money it was like, where can we, you know, where can we *not* spend money, so I would like to be in a position where I don't have to worry about, 'ok, so can I eat today?'. It was also framed as a pathway to thinking better of himself, to go from feeling like an 'outcast' to going 'a little higher up'.

The men were also driven by a passion for engineering's potential to improve their own and other people's lives. Niels clearly loved the subject-matter, which made his failures all the more painful to him. Nonetheless, he persisted: 'I want this knowledge and if took me ten years, I would also take this, I would be on it!'. Hans was inspired by his heroes Musk, Einstein, Pascal, Bohr, and Topsøe because he saw in them ordinary men who changed the world through their 'crazy mind'. To him, they symbolised hope for his future: 'they came from nothing, and I also came from nothing'. He took the social responsibility that comes with being an engineer most seriously of the group: 'I just think if you're going to be an engineer, you have some social responsibility because engineers, in the most part, have changed the world, for better or worse'. Mads developed a strong sense of social responsibility as an engineer over the course of his studies that was not there at the start: 'I think that engineers are going to be the ones who solve the problems that we have, and scientists, of course, and stuff like that. We have to make solutions to save the world, I think'. By the time of the third interview, Carl, who was previously indifferent, developed a strong belief that climate activists and progressive politicians were taking the wrong approach on the environmental crisis, and was driven instead by the hope 'that there is a solution, a technological solution to this problem, and that we can find it. […] I do think we can still undo the damage'. It is these hopes and aspirations that pushed these men to carry on despite the difficulties.

## Discussion

### *Working class men's identity in engineering education*

Women and ethnic minority groups are significantly under-represented in engineering education, which has driven scholars to focus on the experience of these groups within engineering studies (e.g. (Beraud 2003; Brainard and Carlin 1998; Huang, Taddese, and Walter 2000; Stonyer 2002)). While this focus has led to increased awareness of the situation of these underrepresented groups, little to no attention has been paid to differences within the predominantly white male population of engineering students. For instance, a study of success in engineering education by Ohland et al. (2011) gave a fine-grained analysis of variations among Black, Native American, Hispanic and Asian ethnic groups, declined by gender but did not mention socio-economic background. Our findings show that this is quite an oversight. In being lumped in the 'white male' majority, blue collar men who matriculate as mature students slip under the radar of the institution, teachers and peers, and are not considered at risk. We would argue that our four participants were 'at risk' both academically and personally, yet only Niels received help from the university because he actively sought it. This propensity to lump male students in the same group tends to promote the notion that failure on their part is the result of personal defects rather than structural disadvantages. This belief was visible in Hans' descriptions of his 'battles with his lazy mind', or Carl's refusal to seek help because he did not wish to feel different.

Going further, we could interpret a tacit identity conflict within these men. Their socialisation within low-education contexts conflicts with the new expectations of them in studies that are dominated by middle-class white males, but where the socio-economic component remains hidden. In his work on working-class male identities, Willis (Arnot 2003) showed how 'lads' build up a rebellious identity in relation to educational institutions as a result of educational exclusion in their youth. We see expressions of this rebellion most prominently in Niels's discourse, but it is also present in the others. Yet as they integrated the university system, their bitterness towards formal education was at odds with their perception of an engineering degree as a pathway to a better life. We can see the strife in Niels' final interview, where he lambasted the 'system' for rewarding clever studying tactics that younger students learnt in the quintessentially middle-class *gymnasium* high school. But at the same time, Niels credited those students for making it in the system, whereas he was struggling. Mads resolved the conflict by adapting to the system and succeeding therein, Hans and Carl by placing the blame for their perceived failures on themselves rather than the system, and Niels was still battling with the conflict, resulting in an unresolved existential crisis. Such identity conflicts and resolution tactics were identified by Reay (2002) and Means and Pyne (2017), as a core feature of the experience of working-class mature students, and yet remain largely unaddressed in engineering education. In response to such identity challenges, Thomas et al. (2017) suggested that in the domain of health sciences and nursing, it would be more helpful for students to focus on developing a professional identity linked to the specific study programme that to try to create a general identity as a 'higher education learner'. This lesson could be applied to engineering programmes as well, though as Berge, Silfver, and Danielsson (2019) pointed out, the engineering education discourse tends to re-enforce the neoliberal ideal of the 'self-made engineer', in which class differentials are erased and personal responsibility for success emphasised.

### *Resilience and hope as key drivers to education success*

One of the key findings of this analysis is the resilience with which these men persist in their engineering education despite the setbacks. There is a lot we can learn as educators from the key drivers of that resilience, and also its weak points.

It is clear that social support was a key element in preventing breakdown and drop-out for three of the four participants. This support mostly came from fellow project group members, especially when the students could choose their own groups, but also from partners at home, and in the case of Niels, the university support system. One reason that Carl was struggling the most was in large part because of his worsening social isolation. The importance of social support in helping students to build resilience was highlighted by McGivney (2007) for mature students and Ecklund (2013) for male engineering students. They found that seeking help and building a community of peers, for both learning and social activities, were key success factors. This can be in part attributed to the sense of belonging created by such networks of peers, as argued by Strayhorn (2012). He posited that successfully fulfilling the need to belong creates positive outcomes for students from marginalised groups (engagement, achievement, wellbeing, happiness), whereas the reverse creates negative outcomes – which were apparent in Carl's case. The problem-based project pedagogy that the participants were learning with was particularly helpful in that regard, in that it embedded collective learning and social relationships within the fabric of the learning experience. This point was made by Chance and Bowe (2015) about female students but is clearly also valid for male mature students.

We identified motivation and hope for professional improvement as another key driver for persistence within our participants. This goes against the findings of French, Immekus, and Oakes (2005) that motivation had no significant effect on retention in engineering education, but theirs was a quantitative study done on engineering students generally, not accounting for mature students, and not making the distinction between intrinsic and extrinsic motivation. Intrinsic motivation has been promoted in education psychology as a stronger driver for academic achievement (Taylor et al. 2014) but extrinsic motivation appeared to be powerful for our participants who experienced poverty, lack of

opportunities, or job dissatisfaction. In fact, Swain and Hammond (2011) noted the predominance of extrinsic motivational factors for studying in mature students, such as better job opportunities, opportunities to live abroad and gaining a recognised qualification. Although we did see intrinsic motivation for study in Niels and Carl, the dominant discourse was the possibility for a better life and more interesting, better recognised, higher paid jobs offered by an engineering degree.

In terms of risk factors for resilience, we see in our data that the men started out with a generally positive attitude, though they expressed some fears about their mathematical abilities. But for all but Mads, that confidence was dented by failed exams, setbacks and study difficulties throughout the first three semesters. The risk that difficulties with mathematics poses to retention in engineering education was noted by Gardner and Broadus (1990), but it took on a special relevance for these mature students who suffered negative experiences and poor results within formal education in the past, thus denting their confidence *a priori*. Our findings will unfortunately add fodder to the argument that poor prior educational achievements, including in mathematics, are the key determinants of drop-out risks in engineering education (French, Immekus, and Oakes 2005). However, we submit that it is not the prior educational failures, but rather the socio-economic conditions underlying those failures that are the key driver here – a point somewhat missed in the literature. This makes a difference because prior educational achievements cannot be changed, whereas the socio-economic conditions that lead to poor achievement can be in part mitigated through proper support channels. For instance, Markle (2015) noted that self-confidence in study abilities was a key factor in determining persistence rates in male mature students, while McGivney (2007) found that male adult learners are more likely to drop-out for course-related issues rather than family or personal issues. Both of these issues are relevant to our participants, and could to some extent have been addressed through extra support from the university. Such support was identified as a success factor for struggling male engineering students by Ecklund (2013).

### *Implications for practice*

The purpose of phenomenological studies is not to make generalisations or build theoretical models but to produce a rich hermeneutical interpretation of a particular experience. That said, we can still draw some conclusions for practice from small-sample phenomenological studies, as explained by Feilberg, Norlyk, and Keller (2018, 239):

> phenomenology cannot be satisfied with any ontology of isolated entities that are unique and singular or all similar and common. There is no contradiction at all in the basic experience of a figure as unique and at the same time one of a kind.

So while we cannot say that blue-collar men generally experience engineering education in the way that our four participants have, we endeavoured to place the experiences of these men within the context of a broader 'background' (Feilberg, Norlyk, and Keller 2018) within which these experiences could be understood. From this juxtaposition of the unique and the common, we are able to tease out some implications for practice.

In particular, we learned that university support systems were largely absent from these men's experiences, except in the case of Niels who worked proactively to find help. There was no mechanism in place for identifying them as 'at risk' students, and no check-in to monitor their progress. Thus, Carl and Hans' descent into depression and self-doubt went completely under the radar of the teachers and programme managers. Niels' issues were only handled by the university once he took the step of getting a psychiatric diagnosis in the medical system and then sought help. Carl and Hans could not bring themselves to take those extra steps, and tried to deal with their issues by themselves. We surmise that if the university was not able to detect or manage these problems, then there may be a whole host of other students in difficulty undetected by the system, giving a misleading impression that all is well when students are in fact struggling. As Carl's case demonstrated, students can be struggling mentally even when their grades show the appearance of success.

This fits with the findings of Tones et al. (2009), who studied university support systems for mature students from low socio-economic (LSES) backgrounds, and found that these students had poor awareness of university support systems, and generally did not know where to go to look for help. It was also reported that counselling services were often unavailable to mature students, even though, they noted, 'mature-aged students from LSES backgrounds (…) emerged as [a] group in probable need of further support to promote retention'.

The key implication for practice here is that more pro-active university support systems could mitigate the risks for mature students in engineering education, improve the student experience and maybe even increase student retention. There are some suggestions in the literature that could prove useful for engineering education, though Young (2000) cautioned that there is no silver bullet solution in dealing with the very different needs of individual mature students. He concluded that it is 'crucially important that lecturers identify their students' needs in this respect, and do so at very early point in the course', though we would argue that this should not be left solely in the hands of the lecturer or project supervisor, who may not be equipped to deal with psychological distress.

A report from the University of Surrey (Newson, McDowall, and Saunders 2011) suggested avenues for improvement, such as creating dedicated spaces on campus and meeting times for mature student to get together and create a social support network, and raising the awareness of faculty members towards the situation of mature students. Even where support systems are available, the report recognised the need to raise awareness of those services among at-risk student groups, for instance during the student introduction week. Bolam and Dodgson (2003) suggested more pro-active measures such as having teacher reach out to mature students who fail to hand in work on time to check how they are doing, developing mentor schemes for mature students, and having academic tutors as a contact point for students that could serve as a bridge to counselling and other support systems. In the context of engineering education, thought should also be given to providing extra support for mathematics and other difficult technical subjects that cause anxiety in blue-collar students, such as calculus and thermodynamics.

We recognise that these interventions could be costly in terms of faculty time investment and financial investment into university support systems, but these investments should be seen as a part of the university's diversity and inclusion policy, which must go beyond just focusing on gender and ethnic background and also take socio-economic background into consideration.

## Conclusion

As we head into a future where large numbers of blue collar workers, particularly men, will head into engineering education as mature workers, it is critical that we understand the implications of this transition for the people it affects. This phenomenological study has endeavoured to provide a rich, in-depth exploration of the experience of enrolling in an engineering programme as a male from a low-education background. We have described and interpreted that experience as one marred by past and present struggles, in which tacit questions of identity come into play, and persistence depends on fragile resilience mechanisms. As a phenomenological study, the purpose of this paper was to bring attention to a relatively unexplored phenomenon, rather than propose a sweeping analysis, and our implications for practice are therefore also suggestions for further exploration. Indeed, it could be valuable to follow up this work with either broader qualitative methods (thematic analysis or grounded theory, for instance) or quantitative studies. We hope that this paper will contribute to the engineering education literature by both bringing socio-economic background into play, and demonstrating the strength of a phenomenological approach in exploring complex phenomena.

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