Engineering educations are currently being transformed, both to attract new groups of students (e.g. women) and to provide the students with broader skill-sets than those traditionally included in engineering educations (e.g. team working skills). In this study we explore how students understand the educational opportunities provided by a particular engineering education, namely bachelor Engineering Mechanics Programme (EMP), with a particular focus on how the perceived opportunities are related to class and gender. The empirical data consists of engineering education websites, interviews with EMP students, and video-diaries recorded by the interviewed students. In the analysis of the websites four different, potential engineering identity positions were discerned: The engineer as a traditional technologist, the engineer as a contemporary technologist, the responsible engineer, and the self-made engineer. The initial analysis of the interviews and video-diaries bring tensions between practical and theoretical/analytical aspects of engineering to the fore, and we use two case studies of interviewed students to illustrate how these students navigate the theory/practice dichotomy and the various identity positions available within the EMP.

Keywords: engineering education, higher education, gender

INTRODUCTION

This paper is set out to explore the changing landscape of engineering education, with a particular focus on how educational and professional opportunities are presented and understood in the context of a traditional engineering education, that of Engineering Mechanics. It is widely argued that engineering education needs to change in order to attract new groups of students and provide students with knowledge appropriate for the future society. Firstly, a key concern is a focus on widening participation, in particular an increased recruitment of women, as women remain strongly under-represented (Powell, Dainty, & Bagilhole, 2012). Secondly, it is argued that the contemporary engineer need to possess other skills in addition to those traditionally included in engineering educations (Adams et al. 2011), for example, team-working skills (Sahin 2010). The new perceived demands on engineers are also manifested in pedagogical innovations within engineering education, for example, implementation of project-organised courses (De Graaff and Kolmos 2007). Still, Faulkner (2007) has shown how there are tensions between the technical and the social in engineers’ stories about what counts as ‘real engineering’ and individual engineers have to engage in identity work in order to, not always successfully, reconcile the technicist engineering identity with the heterogeneous reality of their actual work. The valuing of practical skills and technological know-how, that is a key aspect of the technicist engineering identity, has by Wajcman (1991) been interpreted as one aspect of the masculine culture of technology and culture that is simultaneously associated with the calculative rationality and analytical power of the technical specialist, making the masculine ideology of technology a very flexible one.

The purpose of this study is to explore how students understand the educational opportunities provided by a particular engineering education, namely bachelor Engineering Mechanics Programme (EMP), through the research questions:

1) How are the educational and professional opportunities provided by EMP presented by universities and conceptualised by beginning students?
2) How can students’ conceptualisations of their chosen education be understood as classed and gendered?

METHODS

The empirical data comes from the project ‘Remoulding Engineering: Knowledge and Identity Perspectives on Project Work in Engineering Education’. This paper reports on the pilot phase of the project and makes
use of data consisting of engineering education websites, interviews with students in the EMP, and video-diaries recorded by the interviewed students. EMP is the branch of engineering that involves the design, production, and operation of machinery and, as such, represent one of the more traditional engineering programmes. Further, it is one of the largest programmes in Sweden in terms of student numbers (both on bachelor and masters level) (UKÄ 2016). In this paper we focus on the bachelor version of the programme, a three year degree which combines theoretical elements of engineering with more vocationally focused elements. In order to create a diverse data set data was collected from different types of universities: technical universities, traditional research universities, and more recently established universities. The website information we have analysed consist of information texts presenting the programme, pictures/photos, and student presentations (downloaded January 16, 2016). The interviews were conducted with five EMP students (all men, three from working class backgrounds, two from middle-class backgrounds). The semi-structured interviews (30-60 minutes) focused on the students’ background, their reasons for choosing this education, their plans for the future, and their experiences of project work during the education. In addition to the interviews, the students also recorded video-diaries on three occasions during a module on Machine Elements. For this paper we have made use the video-diary that included the task to present their education for prospective students. Our analysis takes departure in a social constructionist interpretations of discourse analysis, where discourses are not seen neutral and objective reflections of ‘what is out there’, but rather play an active role in creating and changing identities and social relations (Phillips and Jørgensen [2002] 2006). Identity, from this perspective, is not concerned with an everyday understanding of identity as a somewhat static ‘core’ of a person, instead, we employ and sociocultural understanding of identity. Hence, identity is understood as a negotiated experience that is continuously constituted in relation to and the intersection of different discourses (Gee, 2005). Next we present our preliminary results.

RESULTS
In our analysis of the engineering education websites, four different, potential engineering identity positions were discerned: The engineer as a traditional technologist, the engineer as a contemporary technologist, the responsible engineer, and the self-made engineer. The traditional technologist is an identity position that takes stock in traditional interpretations of engineering practice, focused on technical problem-solving and design. An interest in technology and practical skills, such as tinkering with engines, is foregrounded in website texts about the bachelor degree, especially in the presentations of male students. At master level, scientific and analytic aspects of engineering are stressed more. The identity position of the contemporary technologist opens up for more heterogeneous conceptualisations of engineering, which foreground social aspects as well as the importance of generic skills such as writing. What is characteristic for this identity position is that the ‘softer’ skills of engineering always are mentioned in direct connection to technological skills, using the technological skills as a stepping stone for arguing the importance of other skills. The responsible engineer represents an identity position that conceptualises the engineer as the key to coming to terms with contemporary environmental problems, while sometimes also acknowledging that technological progression in itself can be problematic from a sustainability point of view. The self-made engineer is an identity position that foreground engineering as an individualised career project, where success awaits anyone that has the strength and desire to make use of the unlimited opportunities provided by engineering educations. The initial analysis of the interviews and video-diaries with bachelor students brings the tensions between practical and theoretical/analytical aspects of engineering to the fore. All interviewees stress how their education is characterised by the practical aspects of engineering and that they also are given ample opportunities to try, for example, lathing and CNC systems. Some students also explicitly relate these practical aspects to interests in and previous experiences of engines and machinery. However, other interview data show that such a conceptualisation of EMP as confined to practical skills and applications is far from unproblematic. This renegotiation of EMP as something other than a highly practically applied
engineering education occurs in two ways: (1) By stressing the mathematical aspects of the education as well as theoretical knowledge about production and manufacturing (‘Because it was tougher in the beginning with maths and a lot of modules focused on calculations’). (2) By foregrounding that the education, in contrast to Master of Engineering programmes, is not limited to theoretical aspects, but combines theory and practice, thereby giving opportunities for students to become well-rounded engineers. The perceived well-roundedness of the mechanical engineer is also manifested in how students repeatedly construe the education as wide and not confining the student to a particular profession (‘It wasn’t like “this profession is what I want”, it’s a very wide education’). How the students’ conceptualisations of the educational opportunities can be understood as classed and gendered will in the presentation be further explored through case studies of two students: ‘Niklas’ who stress the academic side of the EMP-education and distances himself from the perceived laddishness of his fellow students and ‘Anders’ who values the practical side of the EMP-education and the practical skills he has developed during previous work in the industry, but also was attracted to the education as a means of establishing a trajectory away from strenuous industrial jobs in unhealthy working environments.

DISCUSSION

The engineering education websites as well as the student interviews and video-diaries are characterised by tensions between traditional conceptualisations of engineering and contemporary demands. A striking feature of the entire data set is further the continuous conceptualisation of EMP as a ‘wide’ education, providing the students with a wide variety of professional opportunities. This is a conceptualisation we argue need to be understood in relation to both the expected life trajectories of working class men, but also the neoliberalisation of the educational and professional landscape. For the men we have interviewed the EMP creates opportunities to return to their industrial childhood community, while giving access to other jobs than manual industrial labour, hence, in comparison, the education is perceived as wide/widening. The conceptualisation of the EMP as a wide education is also well in line with the identity position of the self-made engineer, fore-grounding the neo-liberal students’ potential to make use of opportunities provided by their education for their own individualised career project.

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