

Using personas as a mediating tool in the development of engineering programs

Anna Yström, Lena Peterson, Björn von Sydow, Johan Malmqvist

Abstract— The undergraduate programmes within electrical engineering, computer science and engineering and information technology at Chalmers are currently under revision. Some notable problems for these programmes are the long-term trends of diminishing number of applications and a low share of female students. This is not only a problem for Chalmers, since there is a strong need in society for engineers within these areas. Swedish universities can presently not meet this need, as witnessed recently in particular in the electric power and IT industries.

This paper describes the stakeholder's needs identification and analysis phase of the project, where current professional roles for these types of engineers were mapped out in order to find out what knowledge skills and attributes that are necessary to work as an engineer in this field. As the number of occupational roles is large, a persona methodology was used to gather all the necessary information into a graspable format.

The personas were based on information gathered through workshops with Chalmers staff and representatives from the local business sector, alumni surveys and observational journals from working engineers as well as documentation from different organizations on the future demands on engineers. About 100 different roles were identified and clustered into six groups; research, education, development, marketing and communication, economics and administration, and, finally, management and leadership. From these groups, in total nine personas were created.

The personas are used as a mediating tool in the next stage of the project, which is program design. This paper describes the process of how the personas were created as well as the result of the project phase.

Index Terms— Engineering, personas, occupational roles, workshops.

I. INTRODUCTION

The undergraduate programmes within electrical engineering, computer science and engineering and information technology at Chalmers are currently under revision. Some notable

problems for these programmes are the long-term trends of diminishing number of applications and a low share of female students. This is not only a problem for Chalmers, since there is a strong need in society for engineers within these areas. Swedish universities can presently not meet this need, as witnessed recently in particular in the electric power and IT industries.

The process of changing these engineering programs has been inspired by the CDIO initiative [5]. Instead of making only minor changes, it was decided to take a holistic approach and not to choose the easy solutions instead of the best. The revision project started in the autumn of 2008 with a general analysis, collecting and analysing data from many sources regarding labour market trends, demography and university application trends, as well as an analysis of our existing programmes. The next step, which is the focus of this paper, was an analysis of professional roles for engineers. We foresaw that an overwhelming number of disparate and similar roles would be proposed and decided to approach the problem using the method of personas as a means to condense information. Personas have for a long time been an accepted mediating tool in e.g. software development [2][3], in particular for describing users/customers. In this project, we collected information from Chalmers faculty and alumni, industry representatives, work journals and various task classifications and distilled these into nine personas. These are now being used as part of the background material in the current phase of the project, a feasibility study of an education structure where the master degree (civilingenjör) builds on the bachelor degree (högskoleingenjör).

The rest of this paper is organized as follows. Section II discusses personas as a method and the particular process we used. Section III discusses the resulting personas, section IV their use in the subsequent phase and section V offers some conclusions.

II. PERSONAS AS A METHOD

A. Educational development process

The main phases of educational development processes include identifying stakeholder's needs, developing the programme idea and structure, designing courses and learning environments, as well as faculty competence development. In a successful development process, these tasks are tightly interwoven, and there is an evident trace from stakeholder needs to learning experiences [5].

The outcome of the first phase – identifying stakeholder's needs – is the statement of a set of programme learning outcomes (PLO). The PLO:s typically include 20-40 high-

Anna Yström is with the Dept. of Technology Management and Economics, Chalmers University of Technology, Gothenburg, Sweden, e-mail: anna.ystrom@chalmers.se.

Lena Peterson is with the Dept. of Computer Science and Engineering, Chalmers University of Technology, Gothenburg, Sweden, e-mail: lenap@chalmers.se.

Björn von Sydow is with the Dept. of Computer Science and Engineering, Chalmers University of Technology, Gothenburg, Sweden, e-mail: sydow@chalmers.se.

Johan Malmqvist is with the Dept. of Product and Production Development, Chalmers University of Technology, Gothenburg, Sweden, e-mail: johan.malmqvist@chalmers.se.

level statements of the knowledge, skills and attributes that the graduate should possess upon graduation. The PLO:s are used to guide the development of the programme idea, structure and courses.

A “good” set of PLO:s is firmly grounded in the professional activities of the graduate, covers all knowledge, skills and attributes that the graduate should possess, is specific enough to be a helpful tool in the course design phase, is solution-independent, and is well anchored with external stakeholder such as industrial and government, with faculty and with the students [5].

However, engineering programmes educate students towards many different professional roles including researcher, project manager, operations manager and business developer. It may be difficult to merge and trace the specific competencies of these professions in a summary kind of document like a PLO statement. Due to their comprehensive and general character PLO statements may also be difficult to interpret for faculty who are unfamiliar with the particular kind of language used. This might create a barrier for faculty to contribute with their insights to the PLOs. The risks also include lack of understanding and commitment towards the PLO statement.

The premise of this paper is that a stronger sense of commitment towards and understanding of the PLOs can be obtained if faculty are actively involved from the very beginning of the stakeholder needs analysis, and that “personas” are a suitable tool for facilitating this involvement.

B. Why personas in educational development?

When we need a way to organize and communicate information, personas become a tool to “package” a great deal of information in a relatively brief and graspable format. This was the case with the occupational roles, where there surely are several hundred for engineers in this field, and that information would not be possible to handle and consider without a method or a strategy. Personas are also useful because they give us something concrete to refer to and discuss. Through a persona, it is possible to explore new thoughts and possibilities, a way to free your mind from what has previously been obvious [9].

The probability of a good result is greater if you choose to design the product to the needs of one single user, rather than consider all potential users [4]. The difficulty lies within the prioritization – which users should be chosen to be represented by the persona? In this project, that was not an easy question, as there were many opinions about “what the typical engineering role should be, or is today”. We needed to select a few roles that could represent the entire group, without being inconsiderate to the needs and requirements from the rest of the group, as they still probably need to be able to get a qualifying education at Chalmers.

It should be noted that the primary reason for not reaching the desired result with the personas, is that they are only partially implemented, not communicated well enough, or there is a lack of understanding of how the personas could be used in a beneficial way [6].

It may be tempting to use stereotypes about certain professions or persons, especially, if you know that a clear, common perception about a certain role or category of students etc already exists. As this project strives to break this

type of behaviour (as described in [8]), the creation of the personas must to a large extent be based on real, current information rather than preconceived opinions.

However, it is a goal that the revised programmes should be more appealing to female students, and since the personas should lead the way to this change, it is important to include women among the personas. This makes it even more important that the persona is not based on assumptions about what career goals women have or how they make their choices. However, this will not be easy, as the available sample of female students in this area is quite small.

C. The work process

The process used to create personas in this project was based on an established model [1][7][9], which suggests the use of extensive qualitative and quantitative data, e.g. from interviews or questionnaires. In this project, it was necessary to have a somewhat different approach, as there was no possibility to retrieve that amount of material in the short time available. Instead, the main data was collected through workshops with Chalmers staff and industry representatives.

To complement this, we also had access to current documentation on the topic, an alumni survey from a few years back and journals from a number of working engineers. It is always important to validate the personas after they have been created, and that also applied to this project, where a validation workshop was held at the end of the project phase. The process of how the occupational roles were generated and then gradually refined and reduced is described in Fig. 1.

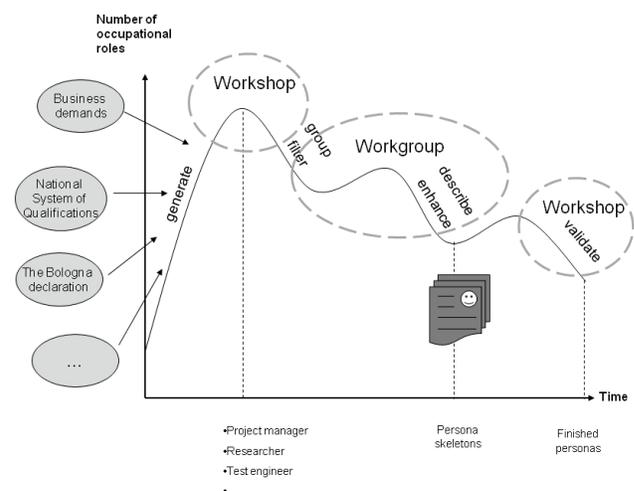


Fig. 1 The work process of creating personas

D. Current marketing materials from universities and companies

The project started with an overview of what possible occupational roles the Master's programs and the engineering programs at Chalmers mentioned in their marketing towards prospective students. The result was very clear; the number one occupational role mentioned was PhD student/researcher. It was followed by project manager and scientific or technical expert. Few mentioned more "common" roles e.g. development engineer, support engineer, or verification engineer.

Engineering education at other universities in Sweden, Europe and the U.S. were also briefly reviewed. It appeared as though Sweden in particular focused on more academic, expert oriented roles, as opposed to more general competences or engineering skills. It was also noted that many of the prestige universities in Europe and the U.S provided little information regarding the labour market opportunities; perhaps a degree from those universities in many cases is enough to get a job, no other specific qualifications are needed?

The internet was also scanned for information from large engineer employers regarding what jobs they offered and what tasks these jobs included. This information was valuable when giving accurate descriptions of the personas' jobs.

The alumni survey contained information regarding current type of work and industry, main tasks and opinions about relevance of the education for their work. As the questions were not written with this project in mind, only some of the information proved to be useful.

E. Workshops

In total, four workshops were held. Three during the project and one as a follow up at the end of this project phase. Of the first, two were directed at Chalmers staff and student representatives, and one was designated for representatives from the local business sector, especially, those who are major

employers of Chalmers alumni. The largest workshops had about 60 participants, the smallest around 15. The aim of the workshops was to generate as many occupational roles as possible for engineers, and, preferably, in electric, computer and information technology engineering. After a short introduction, the workshops were divided into three main groups. In the first, the participants were given five minutes alone to brainstorm on the subject of what kind of work an engineer does, just to get the mind going in the right direction. Thereafter, the participants were divided into groups of five to eight persons, and given about half an hour to discuss what they each had come up with. They were provided with big pieces of paper, pens and post-it notes, and they were to write down their results on the notes e.g. teacher, test engineer, researcher. The third and last phase aimed at adding more descriptive information to these occupational roles, competences, skills or knowledge that were important for each role. New post-it notes were distributed, and the participants were also asked to physically group roles that they found to be similar.

After the workshops, each sheet of paper with post-it notes was transferred to an electronic mind-map structure. When all mind-maps had been transferred, they were merged into one large mind map. However, much information from the groups was the same, which indicated that the perception of what an engineer does is quite clear. If that perception reflects reality is another issue. It could also be noted that the business representatives were better at providing detailed and descriptive information than the Chalmers staff and students were.

The roles were categorized into six main groups; research, education, development, marketing and communication, economics and administration and, finally, management and leadership, as illustrated in Fig. 2. The information from the workshops was mainly used to select which occupational roles that would be suitable for the personas. This decision was

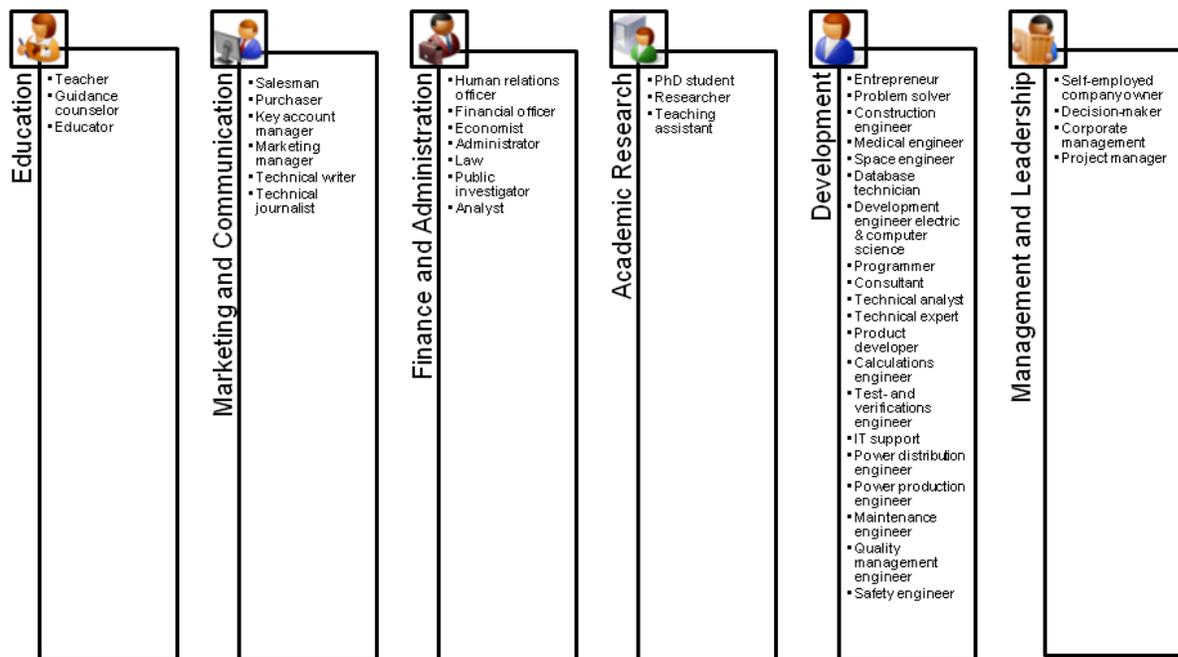


Fig. 2 The identified roles from the workshops, in categories

based on what roles that appeared to be common in e.g. the alumni surveys, and which roles that appeared to be common in many workshop groups. Of course, the overall group of personas had to represent a large field of engineers, and they should, therefore, be able to represent parts of this field in some way.

F. Journals from working engineers

As a large part of the creation of personas is about creating believable reflections of reality, it was decided that the information about engineers provided “in second hand” through the workshops would not be sufficient to create the type of personas that was desired. To give the personas more life, more current and qualitative information was needed on career goals, job descriptions and tasks. About 100 working Chalmers alumni in the requested fields, residing in the Gothenburg area were contacted via e-mail and asked to participate in the study and offered a symbolic compensation. Their task would be to fill out a pre-formatted journal over three days, where they described what they did and how much time they spent doing it. They also had to answer some more general questions about their working experience, career goals etc. In total, about 20 journals were submitted. The low number of respondents could be explained by the short time frame which limited the possibilities to send reminders. Despite this, the information provided in the journals proved to be very important to be able to create realistic personas.

III. RESULTS – THE PERSONAS

A. Assembling the information – from skeletons to personas

When the necessary information had been gathered, the workgroup assembled and chose a number of roles that were developed into skeletons, i.e. not complete personas, but still with main characteristics determined. When the skeletons had been created and reviewed in the work group, eight of them were selected to become full personas.

A persona can contain different kinds of information depending on the purpose. It was decided that our focus would be to describe the occupational role, what the most common tasks are, career goals, something about education or skills and a short personal note. The personas would be described in plain text on no more than a standard A4 page, and have a picture. Both the picture and the personal note help to make the character more realistic. This was the only part of the persona that had no connection to the qualitative and quantitative data collected.

B. Validation

All previous participants of the workshops were invited to the validation workshop, which also discussed the future phases of the project. During the validation workshop, the participants were divided into groups of about five persons, and they were given five minutes to mingle around and meet each persona, which was printed on big posters and put up on the walls. Beside each persona were red and green post-it notes, which were used to write positive comments or tips for

improvements. After this session, the groups sat down and discussed the overall picture of the field, which the personas hopefully reflected. Comments were made on post-its on big pieces of paper. All in all, about two hours was spent on this validation exercise.

After the validation workshop, the comments were reviewed in the work group and some were cause enough to change certain details, other were disregarded because they were too detailed, brought on by misunderstandings, or contradictory to other comments or information. Some comments were about the female personas having unrealistic workloads and that working under such pressure will lead to sickness (cf the example in Fig. 4). The male personas with similar “leading” positions received no such comments. However, some comments regarding one specific area led to the creation of a ninth persona, to better represent the competences needed in that particular area.

C. The personas

The personas were in total nine characters, two women and seven men. Their occupational roles ranged from PhD student, network administrator, project manager, entrepreneur, IT solution architect, microwave specialist, test engineer, component engineer to technical writer. They portrayed engineers, who had been working for some time after graduation, and a few of them had reached leading positions in the companies. Their educational level ranged from three years to five years technical education, except for the PhD student, who was still in the educational system. Their workplaces ranged from very large companies to very small, with only a few employees. An overview of the characteristic features of the personas can be found in Fig. 3, i.e. the depth and breadth of knowledge they possess in relation to their years of education. The placement on the timeline also implies that for many positions, it has taken some time for the personas after graduation and to get there.

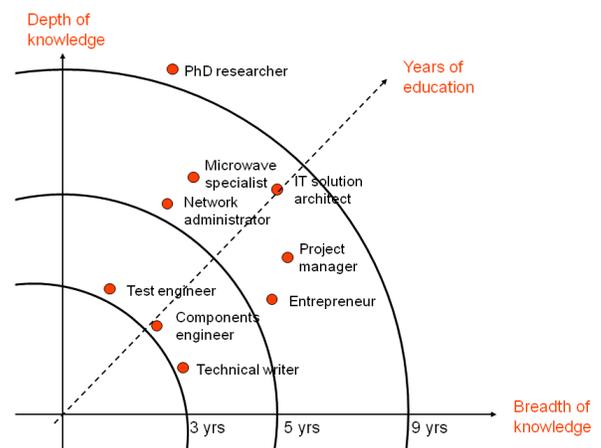


Fig. 3 Characteristic features of the personas created

IV. DISCUSSION

The revision of the programmes has proceeded after the study reported in this paper was concluded. In the succeeding phase working groups have developed concept proposals for two new programmes (to possibly replace the existing five programmes).

The personas have served as reminders that the roles for engineers at work are broad and contain many tasks and aspects that are traditionally not covered in engineering education. The personas have especially been helpful in the work of designing new and more diverse profiles at the bachelor level. In addition, the personas work, which was performed rather broadly across the departments involved in these five programmes, has served as a basis for making the premises for the succeeding revision well known across the organization.

However, in this phase, the working groups have found it hard to design these programmes explicitly for the personas.

Moreover, one of the main reasons for revising these programmes was to increase the number of applications and to broaden the appeal to a wider group of students. The working groups have found it extremely hard to beforehand judge how a certain programme concept would fair in this respect. As a help in this process, it would have been beneficial to also develop personas for the prospective applicants to the programmes.

V. CONCLUSION

This far, the project could be said to have been a success, because it has involved a large group of Chalmers staff, and even though many were sceptical in the beginning, at least some have been pleasantly surprised by the results.

It has also been indicated that personas might be useful in other types of development work, for example student recruitment, by explaining future professional roles to potential applicants. Personas for prospective students could also be helpful for the university to understand attitudes of potential applicants.

The next stage of the process is to use these personas as "reflections of reality", as the project continues with what educational programmes Chalmers should offer in this area, program design, and course design.

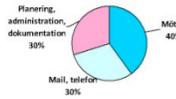


**CAMILLA JOHANSSON,
PROJEKTLEDARE**

Roll

Camillas jobb som projektledare för en grupp om 25 personer inom fordonsbranschen innebär en hel del multi-tasking. Företaget har över 5000 anställda. Hon deltar i flera möten varje dag, ibland där hon själv leder mötena och ibland där hon rapporterar till sin ledningsgrupp. Hon får sällan tid att sitta för sig själv och arbeta, utan är ofta ute bland teammedlemmarna och diskuterar och bollar idéer. På så sätt blir hon ofta motorn i projektet som engagerar och inspirerar medarbetarna. Mycket tid går till dessa spontanmöten. Varje dag behöver också Camilla sköta en del löpande administration och dokumentation. Hon ses använda sin mobiltelefon flitigt för e-post och samtal.

Camilla om en typisk dag



| Activity | Percentage |
|--|------------|
| Möten | 40% |
| Planering, administration, dokumentation | 30% |
| Mail, telefon | 30% |

Mål

Camilla trivs i ledande befattningar, och att hålla många bollar i luften. Hon siktar på att bli kvalitetschef inom 5 år, helst inom samma företag.

Kunskaper och färdigheter

Camilla har en lång teknisk utbildning, och har således en gedigen teknisk kompetens. Hon känner att hon haft stor nytta av sin utbildning för det jobb hon gör, även om hon själv inte längre arbetar med teknisk konstruktion. På arbetsplatsen har hon gått utbildningskurser i den projektledningsmetodik som företaget använder, och läst in lite extra ekonomikunskaper. Hon är en van användare av de olika planeringsverktyg som används på arbetsplatsen.

Personligt

Camilla är gift med Carl sedan två år tillbaka, även han ingenjör. De har inga barn men vill gärna ha det någon gång i framtiden. Camilla är en ordningsam person på jobbet, men hemma blir det lätt att markservicen får göras på helgerna, när de båda har tid att hjälpas åt.

"Det är sällan man vet vad som ska hända en dag innan man går till jobbet. Det dyker alltid upp saker som jag måste hantera, men det är det som gör det här jobbet så spännande. Jag lär mig nya saker varje dag!"

Fig. 4 Example of one of the personas created

REFERENCES

- [1] Cohn, M (2004) *User stories applied: For agile software development*, Boston, Addison Wesley
- [2] Cooper, A (1999) *The inmates are running the asylum*, Indianapolis, SAMS
- [3] Cooper, A (2003) "The origin of personas", Journal August 1, 2003, accessed as an electronic resource at [http://www.cooper.com/journal/2003/08/the_origin_of_personas.html] 09-04-08
- [4] Cooper, A (2004) "Using Personas to create user documentation", Journal December 2, 2004, accessed as an electronic resource at [http://www.cooper.com/journal/2004/12/using_personas_to_create_user_documentation.html] 09-04-08
- [5] Crawley, E, Malmqvist, J, Östlund, S and Brodeur, D (2007) *Rethinking engineering education: The CDIO approach*, New York, Springer
- [6] Grudin, J and Pruitt, J (2003) "Designing for user experiences", *Proceedings of the 2003 conference on Designing for user experiences*, ACM Press
- [7] Mulder, S and Yaar, Z (2007) *The user is always right: A practical guide to creating and using personas for the web*, Berkeley, New Riders
- [8] Ottemo, A (2008) "Delrapport: Rekryteringsarbete och genuspönster i rekryteringen till Chalmers utbildningar på EDITZ-området", Chalmers tekniska högskola, unpublished
- [9] Pruitt, J and Adlin, T (2006) *The Persona Lifecycle: Keeping people in mind through product design*, Amsterdam ; Boston : Morgan Kaufmann Publishers, an imprint of Elsevier, c2006, accessed as an electronic resource at Books24x7 - ITPro & BusinessPro (e-book collection) through Chalmers Library