

Improving working life competences in a project work course – self assessment as a tool to improve self-confidence

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INTRODUCTION

Teaching generic working life skills as an integrated part of curriculum is one of the main targets in the Aalto university strategy, and originates from graduate surveys and common feedback from industry co-operation. Future employers of graduates from technical universities require a wider variety of engineering skills in order to expedite an engineering career in industry [1, 2, 3]. The target to integrate generic working life skills into the curriculum of the Master's degree programme of automation and electrical engineering was evaluated in various ways. One outcome of the process has been to include a new programme-wide project work course to improve working life skills and to learn how to integrate in practice the knowledge obtained from the theory courses. Project-based learning offers a good framework to gain experience in problem solving, social interaction and management, to mention just a few benefits. The teachers and instructors of the project topics offer support, by facilitating the learning process and helping to overcome the common pitfalls that may happen in any project.

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Failure is not only an option but a useful experience that is helpful later in the professional career.

1 GENERAL

1.1 Aalto University and the AEE programme

Aalto University consists of six schools, which offer a large number of study programmes ranging from different fields of engineering to economics and arts. These programmes cover Bachelor as well as Master and Doctoral levels, with a clear emphasis on multidisciplinary collaboration and entrepreneurship. At undergraduate and graduate levels, the focus is on the relevance of the programmes to working life, whereas the Doctoral level programmes focus on high quality scientific relevance. In its strategy, Aalto University aims to educate game changers, developing the programmes towards integrative thinking and engaging the students in societal challenges. The Master's programme in Automation and Electrical Engineering is one of three Master's programmes offered by the School of Electrical Engineering, and is completely administrated by the Department of Electrical Engineering and Automation.

The programme is a legacy of a previously offered five-year Finnish engineering programme, which has been merged with an International Master's Programme in Electrical Engineering. The merger and renewal of the two programmes started in 2015 and was successfully implemented for the academic year 2015-2016. The development of the new program was carried out in close cooperation with various enterprises, students, teachers and professors, as well as teaching and learning experts from the School's Learning Services, considering both the strategy of the university and the strong theoretical background of the various research groups in the department. The programme consists of three majors, and has a very flexible structure as it consists of 15 ECTS compulsory for all students and 20 ECTS of specific courses for each major. The rest, 30 ECTS, are freely selected by the students in one of the optional pre-designed study paths. Further, the students need to take a minor consisting of 25 ECTS, which is also freely selectable. The Master's thesis is also a compulsory part of the programme and accounts for 30 ECTS.

One of the major compulsory courses in the programme, the focus of this paper, is the 10 ECTS Project Work course, in which working life competences and skills have been embedded. The course and its objectives are described in the next subsection.

1.2 Project work course

As described above, the AEE Master degree program consists of common mandatory courses for all majors, mandatory courses in majors and optional courses offered in various study paths. The Project work course (10 ECTS) is a common, mandatory course for all majors, ideally positioned to develop working life skills. As the official language of the degree programme is English, the language of this course was the same.

The students work in projects offered by the various departmental research groups. Each research group offered two project topics and the target size for each group was five students plus one official instructor working in the department. The topics were related to either research or the educational development needs of the research group and the variation in the topics reflects the multidisciplinary focus areas of the department.

For the first year, 98 students registered for the course and they were allocated to 21 project topics, leading to groups with three to six students. The course consists of common activities, such as lectures and seminars focusing on project planning,

management and business aspects, as well as project topic specific activities such as meetings with the instructor and working to reach the goals. In all project topics, the expected output is some tangible system, from software and algorithm development to sophisticated robotics.

The course duration is a full calendar year. The students started the project in the first half of January and the final gala will be mid-December. However, in the first edition, three of the projects were organized as “sprint track” projects for students that had requested the option to complete the whole course in January-May, due, for instance, to justified absence in the coming autumn semester. The group size of these projects was slightly smaller than the regular project topic groups.

The allocation of the students into the projects was based on matching the results of a technical skill query with the requirements and aims of the proposed projects. Therefore, the students could not group themselves with their peers. Furthermore, the allocation was neutral in terms of gender, nationality, race, religion or other personal features. After the first couple of weeks, each group selected a project manager.

The new project work course for the Master’s degree programme was a challenge for the teachers, due not only to the multidisciplinary nature of both the researcher and teacher pool of the department but also the diversity of the students. The diversity comes from the various entry points to the programme, the various study paths available in the programme and the multicultural backgrounds of the students. The programme has very few common mandatory courses before splitting into three majors and the study paths include a vista of optional courses with which it is possible to complete the master’s study courses, besides the master’s thesis.

To evaluate students’ experiences in terms of working life skills, we have established an underlying concept, “self-assessment of working life skills”, when collecting user data to cover the perceptions of the students. This self-assessment, which also examines self-confidence, is kept separate from the official course feedback, as it will be used for purposes other than course development. There were two motivations behind setting up this new process: a) to quantify the students’ assessments of their competence level in the various working-life skills and, on the other hand, to increase their awareness of such self-assessment, and b) to increase their awareness of this aspect of the project work course.

The self-assessment was carried out in late April 2016, when most groups had completed approximately 40% of the course, but the sprint track groups had completed 80%.

Awareness of working-life skills is of increasing importance, as Academic Engineers and Architects in Finland (TEK) in collaboration with Finnish technical universities perform an annual graduate survey to aid university assessment and teaching development.

2 RESEARCH METHODOLOGY AND DATA COLLECTION

2.1 The background of the data collection

Data collection was partly based on the national TEK feedback survey for engineering graduates [4]. It consists of a large set of questions focusing on various themes, such as employment situation, competencies gained by the degree and work experience during studies, as well as overall satisfaction and open feedback regarding the performance of the universities. In order to be able to compare the results, we used the same set of competencies (altogether 26) and the same scale to assess the competencies (where 5 is the best option) that are used in the national feedback

survey. In the national feedback survey, the competencies do not have an attached definition, but students assess them based on their own individual perception of each competence.

Competences in the national TEK graduate feedback survey:

1. Know-how related to my own field of studies (C1)
2. Knowledge of the research in my own field of studies (C2)
3. Mathematical and natural science skills (C3)
4. Skills in practical application of theories (C4)
5. Knowledge in sustainable development (C5)
6. Knowledge of the basics of business operations (C6)
7. Entrepreneurial capacities (C7)
8. Problem solving skills (C8)
9. Information retrieval skills (C9)
10. Skills in foreign languages (C10)
11. Skills related to international work environment (C11)
12. Project management skills (C12)
13. Skills in time management and of prioritizing tasks (C13)
14. Attitude towards developing own skills in working life (C14)
15. Career management capacities (C15)
16. Written communication skills (i.e. project plans, articles) (C16)
17. Oral communication skills (i.e. presentations, negotiation skills) (C17)
18. Leadership skills (C18)
19. Team working skills (C19)
20. Social skills (C20)
21. Self-knowledge (C21)
22. Self-confidence (C22)
23. Creativity (C23)
24. Critical thinking skills (C24)
25. Analytical thinking skills (C25)
26. Ethicality (C26)

2.2 Sample, data collection and data analysis

The data for the study were collected with a quantitative survey and qualitative, semi-structured focus-group interviews. The survey was sent to all 98 students.

Interviews are one of the most common ways of collecting qualitative data [5, 6]. The sample of interviewees was gathered with purposeful sampling [7], asking three groups of students (four students in each group) to participate in the focus-group interviews. However, two students out of 12 could not join the interview due to overlapping timetables. Two lecturers interviewed them in English and the interviews were recorded, with the participants' permission, in order to better analyse the data. The interviews were transcribed into 5 pages of contextual data by the interviewers. The qualitative data were analysed with the thematic analysis approach [6]. Eventual references to persons, units or departments mentioned in the interviews have been replaced with acronyms. Recurring themes were identified through an iterative process from the transcribed data. Quotations representing and illustrating the various themes have been selected from the interviews.

3 RESULTS

3.1 In general

As described earlier, in each competence area up to three questions were asked: “How important do you find this competence for your future working life after graduation?”, “How well has the project work course supported your development in this area?” and “Overall, how well have all the courses in the master’s program that you have passed so far supported your development in this area?”. The results are presented in Tables 1 to 3, respectively.

Table 1. Answers to Question: “How important do you find this competence for your future working life after graduation?”

Competence	Not at all (0)	Very little (1)	Little (2)	Somewhat (3)	Much (4)	Very much (5)	Unable to answer	Average (0-5)
C1	0	1	5	10	44	36	2	4.1
C2	0	0	8	39	35	14	2	3.6
C3	0	1	13	33	42	8	1	3.4
C4	0	1	1	15	33	47	1	4.3
C5	1	3	6	39	34	12	3	3.5
C6	1	4	7	29	28	29	0	3.7
C7	2	7	18	27	26	16	2	3.2
C8	0	0	0	3	20	75	0	4.7
C9	0	0	1	10	39	47	1	4.4
C10	0	0	3	13	34	48	0	4.3
C11	1	0	7	25	37	26	2	3.8
C12	0	1	3	16	52	25	1	4.0
C13	0	0	1	14	30	53	0	4.4
C14	0	0	0	11	40	46	1	4.4
C15	0	1	5	35	30	18	9	3.7
C16	0	0	9	20	49	20	0	3.8
C17	1	1	2	15	37	42	0	4.2
C18	0	1	7	30	35	24	1	3.8
C19	0	1	0	6	28	63	0	4.6
C20	1	0	2	16	38	40	1	4.2
C21	1	1	4	26	35	26	5	3.8
C22	0	1	2	15	37	43	0	4.2
C23	0	0	4	25	42	26	1	3.9
C24	0	0	2	12	43	41	0	4.3
C25	0	0	1	11	42	44	0	4.3
C26	2	5	10	37	26	16	2	3.3

Table 2. Answers to Question: “How well has the project work course supported your development in this area?”

Competence	Not at all (0)	Very little (1)	Little (2)	Somewhat (3)	Much (4)	Very much (5)	Unable to answer	Average (0-5)
C1	3	12	20	35	24	4	0	2.8
C2	12	9	24	38	13	2	0	2.4
C3	17	20	26	25	10	0	0	1.9
C4	5	12	20	27	28	5	1	2.8

C5	20	9	30	25	8	2	4	2.0
C6	0	11	19	39	23	6	0	2.9
C7	8	14	21	31	18	3	3	2.5
C8	1	8	8	37	37	7	0	3.2
C9	1	8	13	39	29	7	1	3.1
C10	12	10	15	27	26	7	1	2.7
C11	8	14	17	32	19	7	1	2.6
C12	1	8	10	34	28	15	2	3.3
C13	2	4	15	36	31	10	0	3.2
C14	8	7	11	42	29	0	1	2.8
C15	15	13	33	23	3	1	10	1.9
C16	0	5	12	32	38	11	0	3.4
C17	0	6	13	40	28	11	0	3.3
C18	8	11	26	32	15	4	2	2.5
C19	0	3	3	23	38	31	0	3.9
C20	2	4	14	38	26	12	2	3.2
C21	7	7	22	39	17	2	4	2.6
C22	5	8	18	39	26	2	0	2.8
C23	5	16	18	32	21	5	1	2.6
C24	4	9	18	39	25	3	0	2.8
C25	3	13	20	38	23	1	0	2.7
C26	13	20	30	20	11	1	3	2.0

Table 3. Answers to Question: "Overall, how well have all the courses in the Master's programme that you have passed so far supported your development in this area?"

Competence	Not at all (0)	Very little (1)	Little (2)	Somewhat (3)	Much (4)	Very much (5)	Unable to answer	Average (0-5)
C1	1	4	6	34	39	12	2	3.5
C2	1	3	12	47	30	5	0	3.2
C3	2	4	9	37	37	9	0	3.3
C4	1	5	16	41	31	4	0	3.1
C5	9	11	19	40	12	3	4	2.5
C6	6	22	33	29	4	4	0	2.2
C7	10	21	36	20	6	2	3	2.0
C8	1	1	3	33	41	19	0	3.7
C9	1	0	6	37	37	16	1	3.6
C10	5	8	11	30	31	12	1	3.1
C11	4	8	16	45	19	5	1	2.8
C12	3	15	24	42	11	3	0	2.5
C13	1	3	11	47	27	9	0	3.3
C14	4	6	7	49	25	5	2	3.0
C15	8	16	31	28	4	2	9	2.1
C16	1	4	13	46	22	12	0	3.2
C17	2	7	24	44	17	4	0	2.8
C18	9	18	34	27	7	2	1	2.1
C19	1	5	7	44	27	14	0	3.4
C20	2	11	15	45	15	8	2	2.9
C21	4	11	22	33	22	2	4	2.7

C22	4	11	13	42	25	3	0	2.8
C23	3	13	22	42	15	2	1	2.6
C24	2	7	8	47	29	5	0	3.1
C25	1	4	7	37	39	10	0	3.4
C26	8	23	24	30	10	1	2	2.1

3.2 Deviations by project topic

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
C1	1.2	-0.8	0.2	-0.5	0.0	0.2	-0.8	0.0	0.2	0.0	-0.8	0.0	0.4	-0.4	0.5	0.2	-0.4	-1.2	-0.3	0.6	0.7
C2	0.6	-0.4	0.4	-0.1	0.0	0.0	-1.4	0.8	0.4	0.4	-0.6	-0.2	0.6	0.4	0.4	-0.4	-1.0	-1.2	-0.1	-0.6	1.1
C3	0.7	-0.7	1.1	-0.9	0.4	-0.3	0.1	0.3	-0.7	0.5	0.6	-0.5	-0.1	-0.5	-0.4	-0.3	-0.1	-0.1	0.3	-0.5	0.8
C4	0.6	-1.0	0.2	-0.8	0.7	-0.8	-0.8	0.6	-0.5	0.2	-0.3	-0.4	0.0	-0.2	1.2	0.0	0.2	-0.6	0.0	0.8	-0.1
C5	0.4	-0.5	-0.2	0.0	0.4	-0.4	-2.0	1.3	0.8	0.6	-1.2	0.4	0.4	-1.0	0.8	-0.6	-1.0	0.0	-0.5	-0.5	1.2
C6	0.1	-0.7	-0.4	0.3	0.6	-0.9	-1.3	0.5	-0.4	0.1	-0.7	0.3	0.3	0.3	0.3	0.5	0.3	0.1	0.8	-0.1	-0.3
C7	-0.7	-0.2	0.0	-0.5	1.0	-1.1	-1.2	0.0	0.0	0.3	-1.2	0.1	-0.3	0.1	0.5	0.9	0.1	-0.5	1.5	0.3	0.2
C8	0.8	-1.0	0.5	-1.0	0.6	-0.4	0.4	-0.4	0.0	-0.4	0.3	-0.6	0.0	-0.2	0.3	0.0	-0.2	0.2	-0.2	1.0	0.6
C9	-0.1	-0.4	0.4	0.1	0.4	-0.1	-1.1	0.5	-0.1	-0.1	-0.9	0.1	-0.1	-0.1	-0.1	0.3	0.3	-0.3	0.4	-0.3	0.6
C10	0.1	-0.2	-0.7	-0.4	0.3	-0.1	1.0	0.1	0.1	0.7	-1.9	-0.4	0.5	-0.5	-0.4	-0.3	0.3	0.1	-0.7	0.5	1.0
C11	0.2	0.1	1.1	0.1	1.4	-0.4	0.7	0.6	-0.9	0.6	-0.9	-0.2	0.2	0.0	-0.3	0.4	-1.4	-0.2	-0.9	-0.6	0.2
C12	0.1	-0.6	0.2	-0.8	0.7	-0.5	0.0	0.7	0.7	0.7	-1.6	0.5	-0.7	0.3	-0.1	0.3	-0.5	-0.7	0.2	-0.1	0.5
C13	0.2	-0.2	0.3	0.3	-0.1	-0.4	0.4	0.0	0.0	-0.2	0.0	-0.2	-0.6	0.6	-0.2	-0.2	-0.2	-0.6	0.5	0.4	0.6
C14	0.2	-0.5	0.5	-0.5	0.4	-0.6	-0.8	0.0	0.7	0.0	-1.0	0.8	-0.8	0.6	0.5	0.0	-0.2	-0.8	0.7	0.0	0.5
C15	0.5	-0.2	0.1	0.1	1.5	-0.5	-0.9	0.3	-0.4	-0.1	0.5	-0.1	-0.1	-0.1	0.4	0.1	-0.2	-0.5	-0.1	-0.9	0.5
C16	0.0	-0.1	-0.1	-0.4	-0.1	-0.8	0.3	0.2	-0.4	-0.8	-0.1	0.2	-0.4	0.4	0.4	0.2	0.0	-0.2	0.4	0.6	0.6
C17	-0.5	0.0	-0.3	0.0	0.4	-0.7	0.4	0.1	-0.3	0.1	-0.5	-0.3	-0.5	-0.5	0.0	-0.1	0.1	0.1	1.0	-0.1	0.9
C18	-0.1	0.0	0.0	-0.7	0.2	-0.3	-0.2	-0.5	0.3	0.3	0.0	0.9	-0.5	-0.5	-0.7	-0.1	-0.3	-0.1	1.0	-0.1	0.8
C19	0.5	-0.9	0.1	0.3	0.2	-0.9	0.4	-0.5	0.3	-0.1	-0.4	0.3	-0.1	-0.3	0.1	0.3	-0.1	0.1	-0.4	0.5	0.7
C20	0.6	-0.5	0.3	-0.2	0.6	-0.4	0.4	-0.7	0.5	0.0	-1.5	0.2	-0.2	-0.2	0.0	0.2	-0.4	0.0	0.3	-0.2	1.1
C21	-0.2	0.4	0.1	0.0	1.2	-0.8	-0.1	0.2	0.4	0.4	-0.4	0.2	0.2	0.2	0.4	-0.6	-0.8	-0.8	0.4	-0.6	0.2
C22	0.2	-0.3	-0.6	-0.8	0.5	-0.6	0.2	0.0	-0.1	0.4	0.4	0.4	0.2	-0.4	-0.1	0.2	-0.6	-0.6	0.7	-0.2	0.7
C23	0.6	-0.1	-0.6	-0.9	1.0	-0.2	-0.6	0.1	-0.1	0.0	-1.1	0.0	0.0	0.2	0.4	-0.6	-0.2	0.2	0.6	0.4	0.7
C24	0.2	-0.1	-0.1	-1.1	0.2	-0.8	0.2	0.4	-0.1	0.0	-1.6	1.0	-0.4	0.4	0.2	0.4	-0.2	0.0	0.2	0.0	0.8
C25	0.3	-0.2	0.8	-0.7	0.6	-0.9	0.0	0.1	-0.4	-0.1	0.1	0.5	-0.1	0.1	0.6	-0.3	-0.3	-0.5	-0.2	0.1	0.3
C26	-0.2	-0.2	0.5	0.0	0.7	-0.7	-0.3	1.0	0.0	0.6	0.0	0.6	-0.8	0.2	0.0	0.0	-1.4	-0.6	-0.2	-0.5	0.8

Fig. 1. Deviations from the average by project topic. The project topics are labelled A to U. Labels G, I and K were the sprint track project topics.

3.3 Interviews

Sprint-track group interviews were conducted to complement and better analyse the quantitative data gathered from the course quiz. Qualitative methods such as group interviews are believed to provide a deeper understanding of social phenomena [6]. The fact that only sprint-track groups were invited to the interviews is relevant, as this format has been proposed for all students the following year. Nine of the eleven students agreed to participate in the interviews (i.e. 3 students per group). The interview was intended to be semi-structured in order to allow collective and free conversation when necessary, while promoting a safe and relaxed environment for the students. Therefore, equal chances were given to all students to participate in the discussion. The interviews were conducted around the three questions of the quiz and focused mainly on the working life skills C4, C7, C13, C19 and C22.

A general introductory question was made at the beginning of each interview on the students' plans after graduation. None of the students had any specific idea about their employment after graduation, even though many of the students are working part-time.

This implies that the evaluation of the specific working life skills in terms of perceived needs in working life has a rather dubious foundation at this stage of the students' career. There may, however, have been some unwillingness for individuals to reveal too much to their peers. Group I seemed to have a clearer view of how their education and skills can be applied in the work-place, and they exuded more confidence about their prospects than groups G and K.

After a short discussion, we felt that most groups started to fathom the usefulness of skill development, both in their education generally and in the project specifically. Whilst they initially couldn't recognise that, for example, they had applied theory in practice (skill C4), some examination revealed otherwise (this was especially relevant for group I). Student A from group G, for example, initially stated that his self-confidence was not improved by the project course, but after some discussion, realised that the seminar presentation did give a significant boost in self-confidence and in fact, was a significant event in his academic career thus far.

The practical application of theories (C4), met with various responses. Student C from group G implied that practical application is generally missing from university curricula (this may in part be due to severe budget cuts), which was agreed by student A, although he stated that this is to be expected in a university generally considered to place a strong emphasis on theoretical-based teaching. Student C seemed to feel that the lack of practical skills is problematic, both in his Master's thesis and in the work-place. We could also draw out, for example, group I, who felt their project work was academically trivial, but then admitted that they did apply basic theory learnt at high-school and the first year of university. Group G tended to complain that their project didn't give much opportunity for practical application of theory – in fact one student had to learn and apply statistical analysis with MATLAB. Group K had a lot of new things to learn, and only student C in group K mentioned applying programming theory to something tangible (e.g. programming of microcontrollers).

It seems that all students realised the necessity and indeed inevitability of entrepreneurial skills (skill C7) in the workplace of tomorrow. However, only two students indicated some willingness to take an entrepreneurial mantle. Student C in group G said he "wouldn't say no" if such a chance occurred and student B in group I was non-committal "maybe yes, maybe not". It was generally stressed that entrepreneurship is not for everyone, and should not be forced on people, but that all students should understand its role in the workplace, and perhaps understand how entrepreneurship works. Student B from group 38 proposed what seemed to be an idealised model for an entrepreneur (someone who "has overall vision, charisma etc., but also a deep skill base"). Most of the students admitted that time management (skill C13) is crucial and it's something everyone should develop. The project course, with all its milestones, was highly beneficial in order to develop the competence of prioritising tasks and time management. The peer-group pressure inherent in their group work encouraged group members to stick to deadlines. Group K had significant setbacks due to their industry cooperation, or lack thereof. With one notable exception (student B from group K, who does everything in good time), all other students stress that they do things at the last minute. Some mentioned that this stressful tendency of most humanity does have some efficiency advantages.

All students realised the importance of developing team working skills (C19), whether they liked it or not. Group I introduced an interesting multi-cultural perspective, where student A, a Finn, openly admitted that he was worried about student C, an international student, would not deliver, but his worries were assuaged when he realised that student C did perform well. Student C laughed, and opened up a bit about his culture, sharing that in his country even regular self-study courses are approached

by informal groups, where individuals learn part of a course and then teach it to their peers. i.e., for some cultures, team work is a given, whereas in Finland it is seen as a necessary skill that needs developing. The students reassured us, however, that we don't need to stress too much about multi-cultural issues; the younger generation are growing up with this. The project course provided a good 'sandbox' environment, for practising not only team work but also multi-cultural competencies. International student C from group I noted that teamwork is more organised in Finland, like the sharing of views, and seeing from another's point of view. Student A from group G noted that team working skills also support socialising, which he sees as very important.

A tentative and subjective observation, certainly suggested by student C in group K, is that the younger generation may be less disturbed by interruption (e.g. from social media). The same student noted that team work in group K was strong, and everyone was committed to achieving the same goal. We asked students what they understood by "self-confidence" (skill C22). It seemed that they had a good multi-dimensional grasp of self-confidence. They mostly agreed that achieving results, passing courses, etc., helped in developing one aspect of self-confidence, although the rather taciturn student B in group G indicated that scraping through most courses and not attending many lectures hadn't boosted her self-confidence very much. However, her bachelor work was a positive experience, and she surprised herself in performing well. They mentioned a lack of correlation between their perceived mastery and self-confidence in a given course and the grades they sometimes are awarded. All groups identified the public presentations as being good test vehicles for developing self-confidence. Student A in group I in particular, although extrovert and outwardly confident, mentioned the palpable difficulty in speaking publicly, and the need to practise this uncomfortable task. The project work provides this opportunity very well, although all students stressed (especially in the fast-track), that the number of stipulated tasks or milestones should be reduced.

In summary, the two interviewers were impressed by how much the students opened up. They showed a strong ability for self-reflection and were generous with their responses in this qualitative investigation to put some depth and context to the quantitative quiz. One may ponder whether it would be better practice to have informal group conversations about quiz content before the students fill out questionnaires.

4 DISCUSSION AND ANALYSIS

The results presented in Tables 1 to 3 show that expectations for the competences in working life are high, as only competences 3, 7 and 26 result in significant hits at levels from "not at all" to "little" in Table 1. In addition, if the expectations are compared to the students' views about how well the project work course and the master program so far have supported the development, the following conclusions can be made. The three competences where the differences between expectations and development during the course and master program are lowest are C12, C16, C19 and C2, C3, C16, respectively. On the other hand, the highest corresponding differences are observed from C10, C15, C25 and C6, C12, C18, respectively. As expected, the students realise that they have obtained significant development in competence areas such as "*Knowledge of the research in my own field of studies*" (C2), "*Mathematical and natural science skills*" (C3) and "*Written communication skills*" (C16), which are generally considered strong teaching areas in technical universities. On the other hand, development in the competences that are not directly related to the objectives of the

course or the program, such as “*Career management capacities*” (C15) and “*Leadership skills*” (C18), is difficult for the students to internalize. It is also interesting to notice that there is a large difference between the significance and development during the course in “*Analytical thinking skills*” (C25). This is most probably due to the fact that during the time when the assessment was made most of the students (except those who belong to the “sprint track” projects) had only concentrated on the planning, management and business aspects of the project and the practical realization of the projects had not started.

“*Problem solving skills*” (C8) is a key competence that a project work course should develop in a technical school. As Table 1 indicates, expectations for the university studies in the Master’s programme are very high in this competence. Table 2 shows clear development in the project work course so far, but the average in the programme (Table 3) is higher, which shows that the students find that other courses are supporting this competence development. However, as can be seen from Figure 1, the students belonging to the “sprint track” projects indicate slightly more development in this competence than the other students.

Competence C11, “*Skills related to the international working environment*” is rated high in the expectations for the university studies. Based on the self-assessment, 8 students found that the course failed to support development in this area and 14 students found very little advancement. However, Figure 1 reveals that there is clear deviation between the projects, especially project topics I, K, Q and S rate this skill low and closer inspection reveals that in these three project topics all students and the instructor have Finnish nationality.

Project management skills (C12) is by definition the competence the project work course should develop. Comparing the course average (Table 2) to the programme average (Table 3), the students clearly find the course has supported their development in project management skills. Taking into account that this self-assessment was carried out at only 40% of course completion, the course will provide even more experience during the last stages. However, even though the students have only completed about one third of the Master’s program (i.e. on average 44 credits out of 120), it is interesting to note that this competence was the only one where the difference between expectations and development was one of the lowest in the course and highest in the programme.

Team working skills (C19) are also highly rated in the expectations for the university studies (Table 1), and both the project work course and the program generally support these based on the averages. Figure 1 shows relatively small deviations, so every project has been successful in this aspect.

Self-confidence (C22) is one of the competences queried in the national TEK survey. As TEK does not give any definition for this competence, everyone has their own interpretation. The university teachers associate this with professional self-confidence related to career, but for the students it is a rather vague term and might also be associated with grades and success in studies in general. The expectations are high for the university studies and both the course and programme offer similar development. Naturally, self-confidence is a competence influenced by every hour of learning and living, but can be positively developed in a well-supported project course.

One of the most important focus areas of the university strategy is to support entrepreneurship. This is related to C7, but again without definition it is hard to understand what “*Entrepreneurial capacities*” mean for the students. For that reason, or for some other reason, C7 ranks the least important in expectations for the university studies (Table 1) in terms of averages. Based on Table 2, the course has supported this area but there is room for development. Figure 1 reveals that project topics F, G and K get lower ranks. These project topics were defined to develop either educational equipment or data analysis tools, thus the project topics did not offer clear business aspects to be studied, as some other research groups have offered in similar project courses. Again, it must be recognized that the majority of students answered the self-assessment at the 40% completion stage. The sprint-track interviews indicated that many students contemplate entrepreneurial aspects quite deeply, with one student mentioning being a little “freaked out” at the barrage of entrepreneurial schemes and initiatives posted around the campus.

The competences used in this self-assessment study were the same as TEK and Finnish technical universities utilize in their competence survey at different career stages (graduation). TEK does not provide any definitions for the competences besides the title. Hence, the lack of proper definition leaves some room for interpretation and it is likely that competences such as “creativity”, “ethicality”, “skills related to the international work environment” or “career management capacities” are understood in various ways. Tables 1 to 3 show a significant number of “Unable to answer” responses for the competence “*Career management capacities*”, perhaps because some students do not understand the competence without additional definition. The interviews indicated that many students may well be very unclear about their career possibilities. We could suggest that the national feedback survey (TEK in collaboration with Finnish technical universities) could include some generally accepted definitions for the working life skills, and it is still clear that teaching, in general, needs to provide links to context and prospects, which would also motivate students in their study.

5 SUMMARY AND ACKNOWLEDGMENTS

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Perhaps the most telling response from the sprint-track students is the uncertainty of students, more than half way through their studies and often with some work experience, about their future prospects. This places an imperative on the courses, right throughout the bachelor and master level studies, to provide context and meaning. The students need to be prepared for the working environment they are likely to encounter, but also be prepared for an uncertain future where “40% of the current jobs are likely to disappear in the next 20 years” [8]. We are talking about a generation that needs a good academic and ethical foundation to shape the future.

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