Personal Competencies Overview

Helping the graduating students to choose a job

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INTRODUCTION

In the academic year 2004-2005, the Bologna structure was introduced in Flanders' higher education. One of the main implications was the switch-over towards competency-based education. Although many educations already employed modern techniques for the educations of students, the competencies to be achieved with the learning activities, were very often not formulated explicitly. Consequently, the competencies, or learning outcomes, were not scored individually. Neither were the students aware what the learning outcomes were.

As a result of the introduction of competency-based education, one of the main issues for the education Bachelor and Master of Science in engineering technology: electromechanical engineering (industrial engineer electro mechanics) at the KHBO Ostend (from September 2013 member part of the Faculty of Engineering Technology, KU Leuven) was to introduce new teaching and evaluations methods to make it possible to evaluate all the learning outcomes individually.

The activating teaching methods were increased, the evaluation methods modernized and formative and summative feedback were stimulated. On top of this, the education point of view was that the students have to benefit, on an individual basis, from competency-based education. A key element in this strategy is the Personal Competencies Overview (PCO), a formative feedback of a competency-based evaluation of the master thesis. The PCO is intended to help the graduating students to choose a suitable job at the start of their career.

1 CONCEPT

1.1 Preparation

The education started in the years preceding the introduction of the Bologna structure with a comprehensive study on competency-based education and the corresponding evaluation methods. As a result of this study the first thing to be done was to write down the learning outcomes (the competencies that have to be achieved) of the education. This work has been done, optimized and validated through frequent consultations with the with colleagues in real-life industry. *Table 1* shows an overview of the master learning outcomes.

Table 1. Master learning outcomes

code	**Learning outcomes (abbreviated) of the Master of Science in engineering technology: electromechanical engineering KHBO Ostend**
MAC1	To practice thinking and reasoning skills on his own
MAC2	To have analytical and problem solving capacity
MAC3	To reflect critically
MAC4	To have the ability to communicate information, ideas, problems and solutions in different languages, to experts as well as to laymen
MAWC1	To be able to implement and develop research methods
MAWC2	To be able to solve scientific technical problems in a creative/innovative way
MAWC3	To work in a multi-disciplinary team
MWC1	To understand the scientific disciplinary knowledge, characteristic of a certain scientific field
MWC2	To be able to contribute to the scientific technical knowledge
MWC3	To show specific research skills (ICT, using technical equipment, …) and cultivate lifelong learning
D1	To design or to do research in the electromechanical field

Subsequently, indicators (evaluation criteria) were added to the learning outcomes. Next, the activating teaching methods were increased, accompanied by competency-based evaluations. The evaluation methods make use of the indicators. The scientific project in the second year and the master thesis are fine examples of a fully competency-based evaluation.

In the course of this process, the idea grew to encourage the students to think in terms of competencies. Additional seminars were integrated into the curriculum in which external experts highlighted the content and importance of specified learning outcomes. Summative evaluations with accompanied feedback were introduced such as an 180-degrees assessment of the oral communication and a peer assessment of the students' leadership competence.

1.2 Basic idea

The basic idea was to give an added value to the students by providing thorough information on the learning outcomes (excluding the scientific knowledge competence MWC1) including the indicators, offering a limited personal coaching for a selected number of competencies during the education and to give additional individual feedback on summative and formative evaluations on the achieved level of the learning outcomes. The intention of the latter was to give the student the possibility to correct his self-image and to stimulate him in a further deployment of his talents.

1.3 Initial concept

The working-out of the basic idea is presented in *Table 2*. In each of the six bachelor semesters the students had an individual conversation with their mentors. With exception of the first semester, the conversations were about a specific competence which had been practiced in that particular semester. In the relevant semester the competence is emphasized by customized teaching methods and/or evaluation methods. Where necessary, the students were provided with additional training by means of seminars. The conversation in the first semester of the first year took place after the test exams (formative). The focus was on how the student experienced the transition to higher education.

Remark that this competency guidance was supplementary to the tutoring. The tutoring focus is on helping the student to understand his courses (the scientific knowledge).

Table 2. Initial concept

Semester	Focus of the guidance conversation
1	Transition to higher education
2	Critical reflection
3	Lifelong learning
4	Scientific writing (seminar on scientific paper writing)
5	Working in team and oral communication (seminar on team working and leadership by a HR-professional) (seminar on oral communication)
6	
Master year	Individual guidance of the master thesis ➔ Personal Competence Overview (seminar on scientific writing a research report by a scientific researcher) (seminar on the necessary competencies of a starting engineer by a senior engineer)

Due to the high workload of the teaching staff, this concept had to be changed after a trial period of two years. The individual conversations took too much time and were very difficult to schedule.

1.4 Current concept

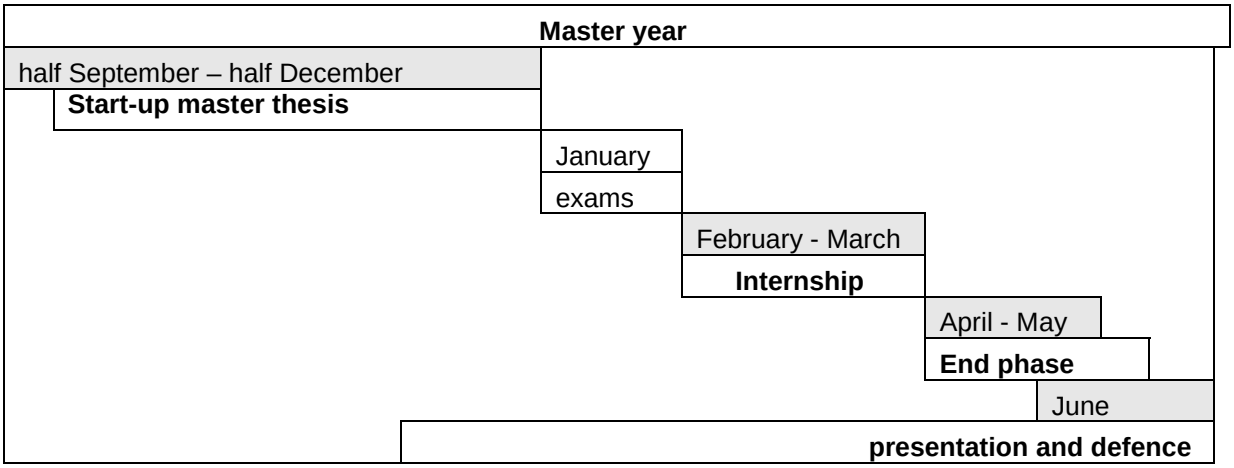
For the reason mentioned above, the initial concept had been altered. The time consuming individual conversations in the bachelor semesters were dropped. The emphasis on specific learning outcomes, including customized teaching methods, evaluations and the seminars have been withheld. The individual feedback in the conversations changed to a hardcopy feedback with a brief oral contact. Still, the students are encouraged to ask more information if they want to.

2 PERSONAL COMPETENCE OVERVIEW (PCO)

2.1 Master thesis

The master thesis is the capstone of the education. The student works on a project in collaboration with a company or research group. The subject of the master thesis must meet the quality standards of the education. The student is guided throughout the year by an external promoter, a company or research group staff member, and a member of the teaching staff. The student keeps in contact with both promoters on a regular basis. At the end of the academic year the student presents and defends his thesis before a jury of external experts and a selection of the teaching staff. The process evaluation during the year and the product evaluation is fully competency based. The assessors score each competence separately.

Due to the importance of the master thesis (20 credits) and the competency-based evaluations by internal and external experts, the master thesis can be considered as an assessment. With the master thesis the student proves that he possesses the learning outcomes on the level of a starting professional. *Fig. 1* gives an overview of the course and evaluation of the master thesis.



	December			March		May - June
Evaluation moments	(1)			(2)		(3) (4) (5)

(1) Evaluation of the start-up phase by the internal and external promoter (20%)

(2) Evaluation of the internship by the external promoter (10%)

(3) Evaluation of the written report by the internal promoter (10%)

(4) End evaluation proposal by internal and external promoter (40%)

(5) Evaluation of the presentation (10%) and defence (10%) of the master thesis and the end evaluation (based on the proposal, see (4)) by a jury of external specialist and members of the teaching staff

Fig. 1. The course of the master thesis [1]

The evaluations of the individual learning outcomes by several experts gives a reliable picture of the level at which each competency was achieved by the student. Often, the students only get the results for their master thesis as one figure, for example 14/20. The first added value of the Personal Competencies Overview is that the student also individually receives, on a formative base, the score for each competence in comparison with his peers. The range of the scores is from one to six, with six meaning that the student is outstanding for that particularly learning outcome.

The relative score is based on the standard deviation for each separate competence. A normal distribution of the scores is assumed. The score ‘6’ corresponds with three

times the standard deviation at the high end scores, the '1' with three times the standard deviation at the low end scores.

The PCO gives the student a good understanding of the perception the external experts and the teaching staff have of the achieved level of his learning outcomes. In this way he knows his strengths and the issues where some work has to be done.

At this level, the PCO can be considered as a SWOT-analysis for the individual student. But the PCO offers more than that. The PCO also mentions the so called engineer profiles.

2.2 Engineer profiles

The education leads to a large number of possible engineer functions. For example a project engineer, a maintenance engineer, … A study was made of three hundred published engineer vacancies. This leads to a first classification of eleven groups of engineer profiles. Each profile contains one or more engineer functions. The most important competencies were defined for each profile. This was done on the basis of the competencies asked for in the published vacancies and an internal consultation with colleagues interested in the matter. Both were taken into account for fifty per cent. The outcome of this exercise was a figure for each competence between zero and one hundred.

The result was presented to two engineer recruitment agencies. The necessary corrections were made. Especially the number of groups of engineer profiles was reduced to eight. *Table 3* gives an overview of the engineer profiles.

Table 3. Engineer profiles – Engineer functions

Engineer profile	Engineer functions
1	Product- , process and automation engineer
2	Maintenance engineer
3	Quality -, prevention-, environment- and safety engineer
4	Project engineer
5	R&D engineer
6	Planning and work preparation engineer
7	Method engineer
8	Commercial engineer

Next the absolutely most important competencies for each engineer profile were arbitrarily defined to those with a score of 67 or more. Very important competencies have a score between 34 and 66. Competencies with a score of 33 or less are considered as important.

The combination of the PCO mentioned in §2.1 and the engineer profiles gives the graduating student extra information on which engineer profile suits him best. This combination forms the final Personal Competence Overview.

2.3 Personal Competence Overview

It is obvious that the combination of the student's own knowledge of the achieved competency level and the needed competencies for each engineer profile is an additional asset for the graduating student. With this knowledge he can apply for an engineer function in line with his own strengths. Or he can work on improving his competencies, so that he can apply for a specific engineer function with a greater chance for recruitment.

Fig. 2 shows the essence of the Personal Competencies Overview. The first column is the list of the competencies. The second column mentions the relative scores of the student for each competence. The next eight columns are the groups of engineer profiles. As mentioned before, a profile can cluster a number of engineer functions.

		Engineer Profiles							
Engineer functions / **Competence** (abbreviated)	**score**	**Product- , process and automation eng.**	**Maintenance eng.**	**Quality -, prevention-, environment- and safety engineer**	**Project engineer**	**R&D engineer**	**Planning and work preparation engineer**	**Method engineer**	**Commercial engineer**
Individual thinking and reasoning skills	3			■		■	■		
Analytical and problem solving capacity	4	■	■		■		■		
Reflect critically	4								
Communicate	3	■	■	■					■
Implement and develop research methods	4								
Solve scientific technical problems in a creative/innovative way contribute to the scientific technical knowledge	3								
Work in a multi-disciplinary team	2	■	■		■		■		■
Scientific disciplinary knowledge	3	■	■	■	■	■	■		
Specific research skills (ICT, using technical equipment, …) and lifelong learning	3								
Design in the electromechanical field	3	■			■		■		■
Research in the electromechanical field									

■	Absolutely most important competence		Very important competence		Important competence
Score: the student's relative score for the mentioned competence. 1 is the lowest score, 6 the highest					

Fig. 2. Essence of the Personal Competence Overview [2]

Beside the information given in *Fig.2*, the PCO contains a brief explanation of the relative competencies scores and a description of the engineer functions and the necessary competencies.

3 CONCLUSION

As the Personal Competence Overview is also a strength-weakness report of the individual student, a good situating of the concept is necessary. In each group of students, there are outstanding students and mediocre students. But they are all graduating as Master of Science in engineering technology: electromechanical engineering. Therefore 'mediocre students' is a very relative concept. A student with mainly scores below '3' might have mixed feelings. How could these be anticipated? A solution could be to give the score for each competence, for example 14/20. But a mere figure doesn't tell much. A '14' is good unless all other students have scores well above. The average and standard deviation could be added. Giving the relative score instead of the absolute score, plus average and standard deviation seems a better idea, especially because each student has different assessors.

The normal distribution is assumed in the calculation of the relative score for each competence. A more profound statistical elaboration can refine the relative competence scores.

Another delicate point already mentioned is that each student has different assessors. The standards of each assessor can be different. Using evaluation forms reduces the risk of too great differences between the standards of several assessors.

All those disadvantages do not outweigh the benefit of a deeper self-knowledge provided by the relative scores for each competence. By providing a thorough overview of the achieved level of each competence the graduating student is able to work targeted to improve specific competencies. He knows also which competencies are very important for a specific engineer function and that companies in search of engineers will test these competencies.

The PCO is running now for the sixth year. In the course of time students have established an increasing interest for the competencies. This encourages the education to persevere with the PCO.

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