

**ACQA as an Instrument for Self-Assessment:
Experiences at the Faculty of Engineering Science at KU Leuven**

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1. Abstract

In the last decennium learning outcomes became a key factor in accreditation procedures in higher education in Europe. Competence profiles are considered to be crucial in the evaluation of study programmes. In this paper we describe the use of the ACQA framework when evaluating learning outcomes of engineering programmes at the Faculty of Engineering Science at KU Leuven.

Experience learns that the resulting competence profiles are actively used in self-assessment reports and are well received by visitation committees. The use of the ACQA framework at several European universities also allows international benchmarking. Next to lecturers' intentions, also stakeholders' opinions can be formulated and discussed based on the ACQA framework. In the future, a more quantitative approach of the employers' and graduates' vision is needed for further fine-tuning of the use of the ACQA framework within self-assessment reports.

2. Introduction

Since the Bologna declaration, Higher Education in Europe focuses increasingly on learning-oriented education. Curricula are to be specified by learning outcomes. Competence profiles, i.e. the knowledge, skills and competences graduates have acquired after successful completion of the study programme, become essential parts of self-assessment procedures. Several outcome oriented schemes are available in the domain of engineering: Dublin Descriptors, ABET criteria, Tuning project descriptors, European Qualification Framework, EUR-ACE Framework Standards.

One other interesting outcome oriented framework is ACQA (Academic Competences and Quality Assurance), co-developed at TUDelft, TU/e and the University of Twente (The Netherlands) (Meijers *et al.*, 2005). The ACQA criteria for academic Bachelor's and Master's Curricula can be regarded as a translation into operational terms of the far broader Dublin descriptors. With designing and application included in the framework, it is considered to be very suitable for characterising engineering curricula. The ACQA framework is also well appreciated for its accompanying methodology resulting in quantitative based competence profiles (Heiss and Raue 2009; Londers *et al.*, 2011).

With one of the objectives being the use of ACQA within self-assessment reports and accreditation procedures, the Faculty of Engineering Science at KU Leuven generates and evaluates ACQA based competence profiles for more than three years now. Several Bachelor and Master Engineering Programmes are involved in the study.

This paper describes the ACQA approach to generate the competence profile of study programmes. It introduces the methodology and presents some specific results of its' application at the Faculty of Engineering Science at KU Leuven. Further on, it critically evaluates the use of these results within a self-assessment report and accreditation setting. Finally, it looks ahead and suggestions for further implementation of competence profiles in self-assessment reports are formulated.

3. The ACQA framework

The ACQA framework is twofold: a conceptual framework consisting of seven competence areas and a level-based description of the activities of analysis, synthesis, abstraction and concretisation (Meijers *et al.*, 2005; Meijers, 2006). This paper focuses on the first part of the framework.

The fields of competences are defined as following:

1. Competent in one or more scientific disciplines
2. Competent in doing research
3. Competent in designing
4. A scientific approach
5. Basic intellectual skills
6. Competent in co-operating and communicating
7. Takes account of the temporal and social context

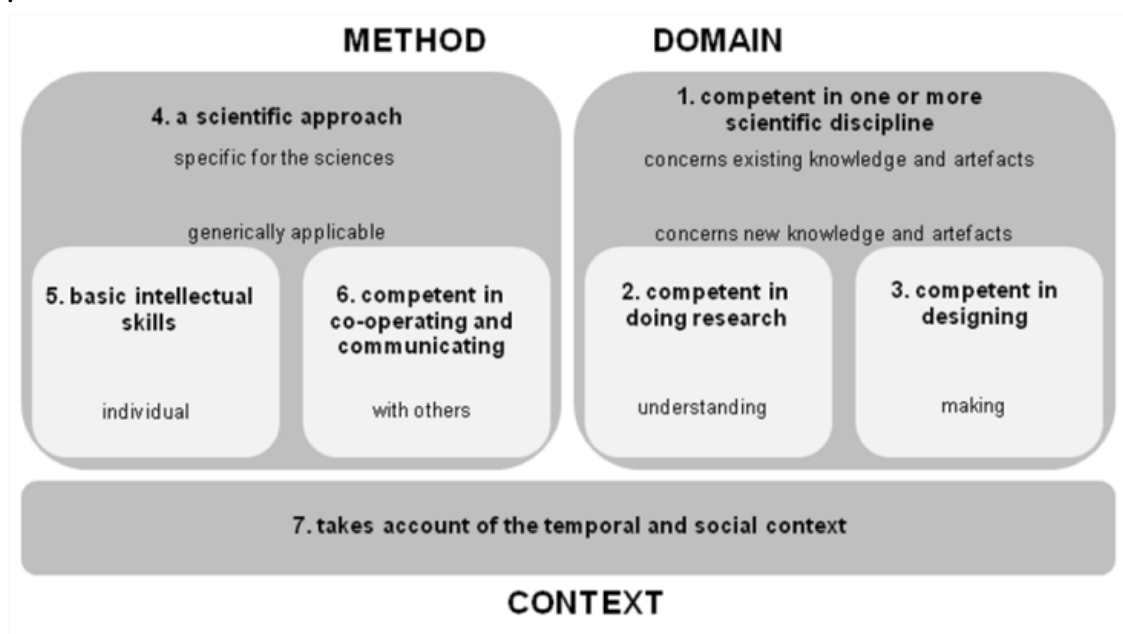


Figure 1. The areas of competence according to Meijers *et al.* (2005).

There are relations between the areas of competences mentioned above. They concern the domain of the university graduate, the academic method of thinking and doing and the context of practical science. Figure 1 gives a graphical representation of the areas of competence.

For each of these competence areas five to eight competences have been defined, with a distinction between the bachelor and master versions of these competences.

4. Evaluating learning outcomes based on ACQA

When evaluating the learning outcomes of a study programme, different study programmes can be defined, e.g. the programme as intended by the educational committee, the programme as intended by the lecturers, the programme as realised in the learning situation and the programme as the competences obtained by the students (Meijers, 2006). This paper is built around the definition based on the lecturer's intentions which are collected with interviews.

Evaluating a study programme, all compulsory and relevant optional courses are individually discussed with the responsible lecturers. In the interview, they are asked to specify those competence areas to which they seek to contribute substantially by means of the course and whether these competence areas are part of the examination. Next, they are asked how they intend to divide the study load in their course over the areas selected. The intended distribution has to be indicated in percentages, with a total of 100. For the key competences in these areas a yes/no indication needs to be given.

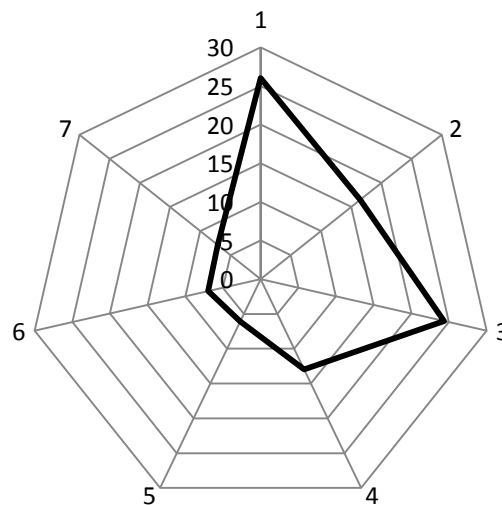


Figure 2. Competence profile of a master engineering programme at the Faculty of Engineering Science, KU Leuven. 1=competent in a discipline; 2=competent in research; 3=competent in designing; 4=a scientific approach; 5=basic intellectual skills; 6=competent in co-operating and communicating; 7=takes account of the temporal and social context. Radial axis=percentage of time.

Based on these data, competence profiles can be constructed. The software used allows the visualisation of any profile wanted, e.g. individual course, a particular track of the programme or the programme as a whole. Constructing a profile, data per course

involved are aggregated as a weighted average. An example of a profile of a master engineering programme at the Faculty of Engineering Science, KU Leuven is given in Figure 2. By showing the distribution of time as a shape, it is possible to see at a glance how the focus of the programme is divided over the seven areas of competence.

5. ACQA versus self-assessment report and accreditation setting

Within the context of self-assessment reports and accreditation visits, the ACQA framework and the resulting competence profiles can be in great favour of the process, and this for several facets.

- The areas of competence will not have the same relevance for all engineering programmes. Within self-assessment reports, competence profiles are helpful *defining and visualizing essential aspects of the study programme* as well as minimum levels in terms of academic competences.

One good example is the description of the specific competence areas addressed in the project based module ‘Problem Solving and Engineering Design’ as shown in Figure 3.

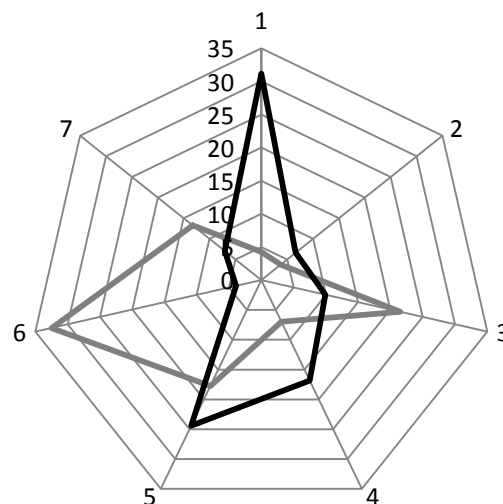


Figure 3. Competence profile of a bachelor engineering programme at the Faculty of Engineering Science, KU Leuven, without the module ‘Problem Solving and Engineering Design’ (black) and of the module itself (grey). Axes as described in Figure2.

Parallel to the regular coursework, all students of the bachelor engineering programme have to take this module which introduces them into real engineering practice and teamwork. The concept of this course is to integrate basic principles of the regular scientific course while working in small groups on design projects. Through the increasing complexity of the assignments, the students are gradually confronted with technical and social skills (Heylen, 2010).

The competence profile visualises the uniqueness of the module through its explicit communication and design characteristics.

- Competence profiles are also useful for *international profiling and benchmarking*. Using a strict analysis protocol, ACQA based competence profiles of different universities can be compared. At the TU/e, 17 programmes have already been described (Perennet *et al.*, 2011). The ACQA methodology is also in use at other European universities, e.g. TU Berlin. As an example, Figure 4 presents and compares the competence profile of a master engineering programme of electrical engineering both at KU Leuven and TU Berlin.

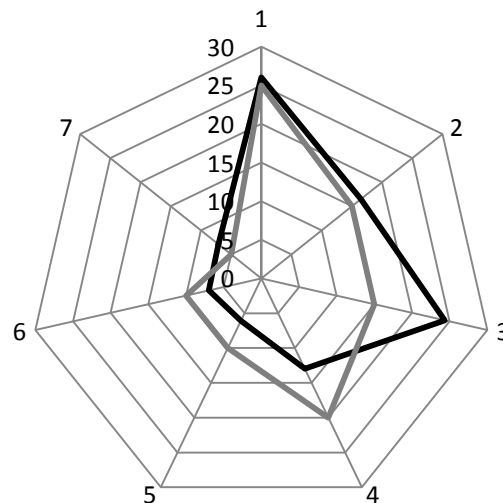


Figure 4. Competence profile of a master engineering programme (electrical engineering) at KU Leuven (black) and at TU Berlin (grey-adapted from Heiss and Raue, 2009). Axes as described in Figure2.

- In general, self-assessment reports should also give evidence of the *stakeholders' opinion* on the education delivered. During recent self-assessment procedures at the Faculty of Engineering Science, graduates and employers were questioned in terms of the ACQA framework and based on the ACQA competence profiles generated. Round tables were organized for the specific target groups, varying from 10 to 16 persons present. First the ACQA framework and the ACQA methodology were presented. Then the completeness of the framework was discussed. Finally competence profiles were discussed, based on stakeholders' experiences in the professional world. Both graduates and employers described the framework as comprehensible and very useful for study programme outcome related discussions. Concrete suggestions for further competence development in the study programmes were formulated.
- Not only the resulting competence profiles, but also the framework itself was experienced to be extremely useful in the context of self-assessment procedures and accreditation visits, providing a standard language for all actors involved. Having a *common language*, lecturers were able to discuss more efficiently on

study programme competence related topics. As such, all actors were also able to express themselves more precisely towards the accreditation visiting committee when discussing study programme objectives and outcomes.

6. Conclusions

At the Faculty of Engineering Science at KU Leuven, ACQA based learning outcome evaluation of study programmes has been done for more than three years now. Resulting competence profiles have been actively used for self-assessment reports. After a critical evaluation, all actors involved confirmed their support for further implementation of ACQA in self-assessment procedures. Their main argument was the significant enhancement of the quality of the discussions during the self-assessment process, mainly due to the common language available and to the quantitative based competence profiles generated. Recent visitation commissions expressed their explicit support for the further use of ACQA competence profiles within self-assessment reports and quality assurance in general.

It is important to notice that all competence profiles generated until now, are the result of the accumulation of competences intended by the lecturers. Educational committees are very aware that for further fine-tuning of the use of ACQA competence profiles, also graduates' and employers' visions should be approached in a more quantitative way.

7. Acknowledgement

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8. References

Heiss H, Raue C, **Outcome Analysis of Bachelor and Master Curricula in Electrical Engineering and Computing**, Proceedings of the 20th EAEEIE Annual Conference on Innovations in Education EIE, Valencia, 2009.

Heylen C, **Problems Solving and Engineering Design. Introducing Students to Engineering Practice**, Ph.D. Thesis, KU Leuven, Leuven, 2010.

Londers E, Berbers Y, Buyse M, De Proft M, Froyen L, **ACQA: an instrument for accreditation and quality assurance in engineering curricula?**, Proceedings of the SEFI Annual Conference, Lissabon, 2011.

Meijers A, van Overveld C, Perrenet J, **Criteria for Academic Bachelor and Master Curricula**, Technische Universiteit Eindhoven, Eindhoven, 2005.

Meijers A, **Academic learning outcomes: A conceptual and empirical approach**, Proceedings of the Accreditation Board for Engineering and Technology (ABET) Annual Conference, Florida, 2006.

Perennet J, Borghuis T, Meijers A, van Overveld C, den Brok P, **Het academisch profiel van universitaire opleidingen: de kwaliteit van de ACQA-meting**, Proceedings OnderwijsResearchDagen, Maastricht, 2011.