

Competence Development in Higher Agricultural Education

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Introduction

To date higher education plays a dominant role in the preparation of adolescents for the labour market. Job growth is strongest in the higher education segment, and is estimated that in the near future over 50% of employment consists of jobs which require higher education. The same holds for agriculture. Be it for management positions, consultancy, design or administration, the demand for higher educated employees is still growing.

The challenge of higher agricultural education is to address the 1. interests of students, 2. offering quality study programs which address the needs in science and society, and 3. which open opportunities for the graduates in terms of further study, employment and personal and career development. No doubt that this is an extremely complex challenge because interests differ, needs are heterogeneous, divergent or even contradictory, and opportunities vary with the economy. One thing is obvious however, which is that higher agricultural education needs to deliver graduates who are competent in their field of study and the application of their knowledge and skills in doing research, present their findings effectively, design, teaching, project and program management, consultancy, acquisition and policy work while taking requirements of integrity and sustainability into account.

Regarding the alignment of student interests, quality study programs and graduate opportunities it became fashionable during the last decades to think in terms of competence. The labour market demands competence graduates, education needs to provide the right competencies, students receive competence assessments, and the education programs are competence-based. Apart from the marketing purpose (or abuse) of the concept of competence, there is a genuine element in the competence development philosophy in higher education, which comprises of the integrated development and application of knowledge, skills and attitudes. The implementation of competence-based education has important implications for teachers, teacher education and teacher professional development.

Competence – the irresistible advance of a concept

Many colleagues get confused when the definitions of competence, competency and competencies are concerned (Biemans et al 2004). It is a difficult issue, and an essential thing to discuss in competence theory. The notion of a competent person is probably as old as mankind and not controversial in its meaning. It was all about who is 'good' in his or her work, can fix things or not, or is allowed by trade organizations, legal agreements, political powers, or institutions to perform certain activities, to take certain decisions or to give commands. However, after the start of the professional use of the concept of competence in various fields of society, many dimensions evolved by which the concept varies, many contexts became apparent in which it is conceptualized, and different functions emerged it fulfils. Nevertheless, the advance of the concept was irresistible, and its profusion immense.

To try to order the different meanings of the concept of competence the following levels of use of the concept can be distinguished.

Level 1. Competences as behavioristic functionalism

This meaning entails the detailed breakdown of competencies in list of trainable behaviors, for instance as was used in the 70s and 80s of the last century. Experience showed this approach was difficult to maintain in education as it was too fragmented, and actual behavior of teachers did not really change when they were trained in very many isolated skills.

Level 2. Competence as integrated occupationalism

This means that competence is seen as the integrated capability of persons to achieve results. This approach is very popular amongst educational policy experts who want to warrant that the outcomes of education are up to the standards defined in national competency-based qualification frameworks. The approach is called integrated because there is combined attention for the development of knowledge, skills and attitudes, often based on occupational profiles.

Level 3. Competence as situated professionalism

This means that competence only gets meaning in a specific context, in which professionals interact with each other. It is closely related to the theories and practices of professional development which showed that personal epistemologies have a stronger influence on professional behavior than isolated skills training. It also touches upon the notion that competence is heavily influenced by what important stakeholders expect of the professional in terms of wishful professional action. Professional associations (such as associations of medical specialists or captains in the aviation industry), but also local players (such as hospital directors, chefs de clinique, and airline executives) have a strong influence on the desired competence fields and the extent to which the professionals need to be proficient in these fields.

Agricultural education, or rather, education in the life-sciences, serves a wide variety and different levels of workers in the labour market. It ranges from low educated subsistence farmer to PhD-graduates in bio-nanotechnology or geo-information systems. The multitude of occupations which exists within these sectors is visible in the International Standard Classification of Occupations (1988 version), which lists over 100 occupations that exist in the agri-food sector. These are categorized in:

- elementary occupations, such as farm-hands and laborers;
- service workers and shop and market sales workers, such as shop, stall and market salespersons and demonstrators (in the food retail sector);
- skilled agricultural and fishery workers, such as gardeners, horticultural and nursery growers, and dairy and livestock producers;
- craft and related trades workers, such as agricultural- or industrial-machinery mechanics and fitters and bakers, pastry-cooks and confectionery makers;
- plant and machine operators and assemblers, such as wood-processing-plant operators, and dairy-products machine operators;
- technicians and associate professionals, such as safety, health and quality inspectors, life science technicians, agronomy and forestry technicians and farming and forestry advisers, buyers, and appraisers, valuers and auctioneers;
- professionals, such as biologists, botanists, zoologists, and agronomists;

- legislators, senior officials and managers, such as production and operations managers in agriculture, hunting, forestry and fishing, production and operations managers in manufacturing, supply and distribution managers,

In a previous publication we have given an overview of competencies which have become important for higher agricultural education (Mulder & Ernstman, 2006). The competencies were reviewed based on interviews with representatives of a series of institutions of HAE in Europe. Competence fields which can be based on that study are:

1. Dealing with the complexity of the contemporary society.
2. Decreasing the gap between science and society.
3. Increased competition in the global market.
4. Coping with the issues of internationalization.
5. Switching between general and specific issues.
6. Dealing with human resources management and development.
7. Responding to the wishes of the capricious consumer.
8. Decreasing the gap between the consumer and the agricultural sector.
9. Dealing with the citizen-consumer paradox in sustainability decisions.
10. Balance between life style, sustainable production and quality requirements.

Because of space limitations we will not elaborate this further here, but the competence fields mentioned were elaborated in a set of competencies which need to be addressed in HAE.

Competence development of professionals

Applied to the reorientation of certain farmers, who are for instance engaging in robust multifunctional farming (such as in fields like care farming, regional produce, rural tourism, and environmental education), competence development takes place by specific practical training, certain educational programs, for example to receive a license for new or additional activities, and the developing of knowledge, skills and attitudes by getting experience in their new fields of economic activity. In various studies we however showed that much of the learning of farmers takes place in an informal way (Lans et al, 2004) and in the workplace (Mulder et al, 2007). The same holds for open innovation specialists who are working in the field of manufacturing of food, detergents of life style products. Du Chatenier (2009) has reviewed the competencies of these professionals and distinguished a series of competencies within the categories of self management, interpersonal management, project management and content management.

The acceptance of the competence development philosophy in higher education

Although the megatrend of making education competence or outcome based, an important question is to what extent educational management is convinced of the value added or even the necessity of this educational philosophy? To answer this question we need to differentiate between professional and academic education. It is

obvious that professional education is more inclined towards preparing students for certain jobs. That is less obvious in academic education, for example in the hard sciences such as physics, mathematics and chemistry. The dominant philosophy in those sciences seems to be to introduce students in the discipline, and in many cases to prepare them for an academic career. It is surprising, however, that research in higher education in the Netherlands showed that the competence development philosophy (although not necessarily termed that way) is also embraced by a majority of university professors in the hard sciences (Mulder et al, 2009). The study on which these findings were based was done by interviewing representatives of eight universities and doing a participative case study in one university. From the open interviews it was clear that most respondents were in favor of the competence-based education philosophy, although some professors had negative experiences with the way it was introduced in their university or program.

Competence-based vocational-professional education

But how can competence-based education be implemented in HAE? For vocational education this is clear. In various countries there is a qualification framework in which competencies are integrated. This however is done in different ways (Mulder et al, 2007; Weigel et al, 2007). To give one example, from the Netherlands, a competence-oriented qualification structure is developed and implemented in all vocational education at the senior secondary level (MBO). Each program has its own qualification dossier, and these consist of many specifications such as core tasks, working processes, and competence specifications.

To determine the level to which the competence-oriented education philosophy is implemented, eight principles of competence-based vocational education were determined, and four levels of implementation were distinguished. This so-called matrix of competence-based vocational education is developed by Wesselink (2010). The principles are (see for an elaboration Annex 1):

1. The competencies on which the program is based are defined.
2. Vocational core problems are the organizing unit for (re)designing the curriculum (learning and assessment).
3. The competence-development of students is assessed before, during and after the learning process.
4. Learning activities take place in a range of authentic situations.
5. In learning and assessment processes, knowledge, skills and attitudes are integrated.
6. Self-responsibility and self-reflection/reflection is encouraged in students.
7. Teachers both at school and practice fulfill their roles as coaches and experts equally.

8. A basis for students to achieve an attitude of lifelong learning is realized.

The implementation levels are 1. not, 2. starting, 3. partially, and 4. competence-based, and completely competence-based. Experience from research is that this matrix is applicable and useful. A curriculum analysis with this instrument appears to lead to interesting discussion, and a common understanding of further development of the program. At present the matrix is available in various languages, including Spanish and Chinese. Further research is going on to improve the matrix. The principles are expanded, as well as the levels of implementation. Refinements are being made and a larger number of program teams are testing the expanded version.

It is clear by now that various programs can be positioned with this matrix, and program teams can formulate their development policy regarding the respective programs.

Competence-based university education

As said, implementing a competence development education philosophy in university is different. Not the same principles apply as the link between the educational programs and the labour market are more opaque, although university programs can have their working field committees which advises about the program on a annual or bi-annual basis. What is more, university programs have a stronger knowledge component, although this is also a student trap: programs can emphasize knowledge to such an extent that this goes at the cost of the capability of applying that knowledge in practical settings.

Principles of competence-based university education could read as follows.

1. The (core) competencies which are essential to include in the program are defined.
2. The (core) competencies are being positioned by educational level (e.g. Bachelor, Master and PhD).
3. The (core) competencies are being addressed in the educational outcomes of the program.
4. The courses of the programs are mapped using the overview of the (core) competencies (to see which competencies are addressed in which courses)
5. Competence-based learning lines are designed defining the preferred sequence of courses.
6. Certain competencies can be lifted to educational outcomes which need to be addressed by separate courses (this is often the case with skills training).
7. Certain authentic learning tasks, situations or periods are included (in or as courses) to stimulate the development of certain competencies.

8. Formative competence assessment of achievement (as feedback for improvement of student learning) is applied
9. Summative assessment (for grading purposes) of outcome mastery is applied.
10. In learning and assessment processes, knowledge, skills and attitudes are integrated.
11. Self-responsibility and self-reflection/reflection is encouraged in students.
12. Professors fulfill their roles as expert teachers and learning coaches in balance (if the student numbers allow for that).
13. Students are prepared for lifelong learning after graduation.
14. Assessment of student characteristics is made available to improve the choice for specializations and careers.
15. Employability competence is a special attention point in the programs.

Implementation of competence-based education in Higher Agricultural Education.

The implementation of competence-based education in Higher Agricultural Education is a complex innovation, and the question is how this teaching philosophy can be applied in practice. It is impossible to describe all variations that have been developed under the flag of competence-based education. Therefore some examples will be given which are developed in Wageningen University, especially regarding the study programs, the course of academic consultancy training, with modular skills training and the pilot project on assessment for study choice and career sensitization.

Competence-based study programs in Wageningen University

Making university programs competence-based is not new. Early experiments with this university education philosophy in the USA date back to the seventies of the last century (Grant, 1979). The critique was that this approach, with good intentions regarding the alignment of study programs and needs in society, suffered from over-specification. It was not unusual that hundreds of competencies were distinguished which were deemed necessary and which were taken as units for training. The general feeling was that this led to fragmentation of the curriculum and perceived irrelevance by the students. So gradually this education philosophy, which was linked to ideas of modular education and mastery learning faded away.

The movement of competence-based education came back by publications in the field of organization theory and strategic management in which the concept of 'core' competencies was introduced to refer to the unique expertise of organizations in which they excelled. This notion was transformed to the education and training sector in which these core competencies are now also known as core capabilities and qualifications of graduates.

Several countries have introduced a qualification framework, there is a European Qualifications Framework (European Commission, 2008) which holds for the whole EU education space and which provides reference levels for qualification frameworks of member states of the EU, and in all these frameworks the concept is integrated in a certain way, however, not necessarily in the same way (see Annex 2). In the European Qualifications Framework (op cit), competence is seen as ‘... the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development. In the context of the European Qualifications Framework, competence is described in terms of responsibility and autonomy’. This means that competence is the capability of persons connected to but apart from knowledge and skills, whereas in our conceptualization the competence of professionals is their combined body of knowledge, skills and attitudes, which enables them to perform at a required level.

Also, different universities use the concept of competence in different ways, or do not use the concept at all but follow the majority of the principles as has been listed before.

In this force field, Wageningen University has decided to engage in a competence course which has taken several years. The first step was an orientation towards the notion of competence-based education, and next key competencies were defined. The definition of these competencies was inspired by work of the three technical universities in the Netherlands which composed a competence framework for academic bachelor and master programs (Meijers, Van Overveld and Perrenet (2005) in which eight competence areas are distinguished, related to the domain of study, the methods being used, and the context in which one is operating (see Figure 1)

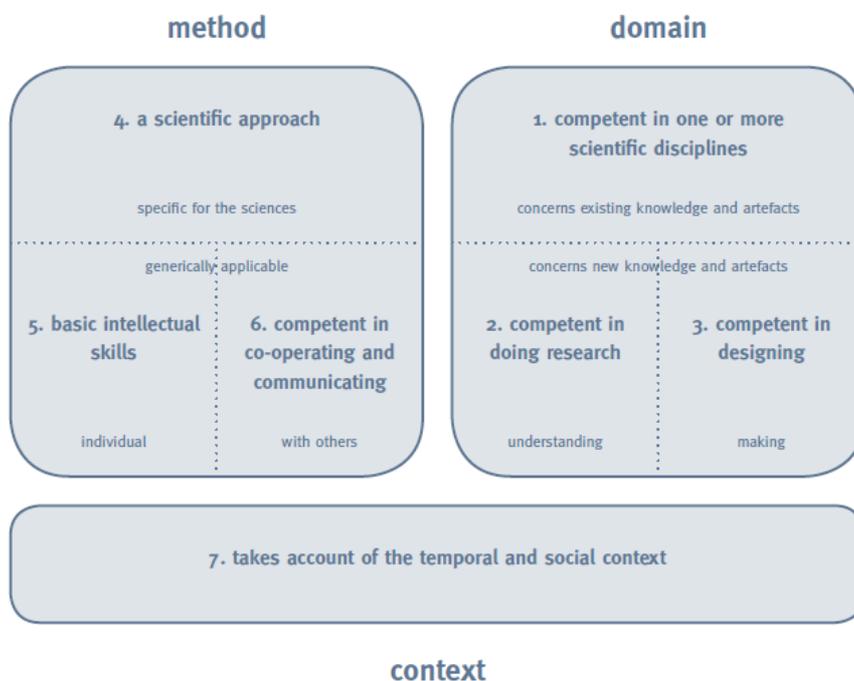


Figure 1 graphical representation of the areas of Bachelor and Master competence (source:Meijers, Van Overveld and Perrenet, 2005)

After the competence areas and competencies of Wageningen University study programmes were defined, study programs were analyzed to detect the presence of competencies in the courses within the programs. This was a tedious job which created quite some frustration since when this is done at a level which is too detailed, the exercise carries along a lot of paperwork and bureaucracy. Nevertheless, program teams went to this process which resulted in maps of courses by competencies. Needless to say that global maps of this kind are instrumental in arranging learning lines for competence development. Next a paper was produced in which the competence development pathways were described, which became the standard of Bachelor programs of the university. This process can be characterized as curriculum mapping, creating study lines and course alignment. It resulted in documents which were quite effective during program visitation and accreditation processes. The final step, to make in-course adjustments based on the competence-development approach was somewhat held back because of the general notion that academic programs need to be predominantly knowledge-oriented. And as knowledge was seen as part of competence, the general feeling was that with the competence descriptions and the competence development moments in various courses, the study programs were competence-based. However, special program elements were re-programmed to better comply with the competence development education philosophy. The compulsory course Academic Consultancy Training and the (optional) Pilot projects on assessment are good examples of this.

Academic Consultancy Training

The description of this example is based on the text in the digital Study Handbook 2009/2010¹. Academic Consultancy Training is a course (which is abbreviated as ACT) of 9 credits with a extensive practical training format. Before entering the ACT students are required to complete a minimum of 36 credits in courses at the Master-level courses or they have to have a first MSc-thesis completed.

Furthermore the students should be competent in information literacy, computer literacy and presentation skills at the level of the Modular Skills Training (abbreviated as MOS) modules which are available. Furthermore English communication skills (oral and written) should be on a level which enables student self reflection and giving and receiving feedback and independent working in student teams.

The ACT works as follows. Students teams of about 4 to 7 persons choose a project. A series of projects is invited by the course coordinators. The projects are all from a real organizations and are about authentic problems. These student teams operate as consultancy teams. The teams are interdisciplinary, and the disciplines included in the teams depend on the character of the project. The composition of the teams is also based on the interests of students. They have to express that in an application letter which they have to submit to the course coordinators. In their application letter students have to describe and explain the supposed value added of their disciplinary knowledge for reaching the project results. Process coaches as well as subject matter experts assist the students. Process coaches are assigned to the teams, but the students have to find a subject matter specialist on their own. Typically, the teams are

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https://csa.wur.nl/wpage8/xpage.aspx?xml=gids_xml.iread?Gidsjaar=2009&xsl=/bois/xsl/gids.xml&css=gids.css&lang=nl&app=bois (accessed 04-08-2010)

interdisciplinary and multicultural (over twenty per cent of the student population in Wageningen University is from abroad). The projects they conduct have a strong design character (taken broadly), that is they have to deliver a design of a solution for given problems for a client organization of which at least one person is the commissioner of the project. Designs may be varied, and include new technologies, policy papers, business plans, communication plans or draft research plans. The intention is that teams produce an interdisciplinary synthesis of the problem analysis and translate this into the project results as an advice for future actions of the client organization.

The outcomes of the course are about defining the goals of the project, making a project plan, developing a work breakdown structure, client-consulting communication in which project goals and the project plan are refined or revised, presenting and defending results, learning to work in an interdisciplinary project team including delivering (intermediate) project results as agreed, reflecting on experience, the performance of the team members and self-reflection of self-performance, both in writing and an assessment interview, and team member assessment and giving feedback.

The activities in the course are having team meetings, assuming team functions (which are assigned at the beginning of the course), meetings with the client, developing the work plan, carrying out project activities, producing project deliverables, the individual compilation of a compile a performance portfolio, and additional skills training.

The project meetings during the course have a formal character. The process coach regularly attends these meetings. Students reflect on their collective and individual performance and the team process and progress.

As to the roles of the team members, these are team manager, secretary, financial controller, and member; these roles have a clear task description.

Regarding the meetings with the client, it is expected that these are well-prepared. The subject matter experts is present as an observer in at least one of these meetings.

Regarding the project plan, the first draft is discussed with an expert in the field project planning and management. Project plans should at least include the mission and vision of the project team, a gantt chart, the stakeholder analysis, milestones in terms of go/no-go decisions and an analysis of risks involved. The plan is evaluated by the client and the subject matter expert before the project plan is finalized and approved. If needed, the group negotiates the project plan, intermediate results and intended end results with the client, complying with the academic standards which hold and project conditions which apply.

During the process of project activities task division is agreed, but the project teams should not divide the work over individual members and assign others to compile and integrated the information. The intention is to work in an interdisciplinary way, which implies that all project team members actively work on the synthesis of the different project results and take their share in and responsibility for the development of the final product and recommendations.

Regarding the project deliverables, the project teams have to give an oral presentation in English, to the client organization, fellow students and coaches involved in the ACT. For the rest, project deliverables are specified in the project plan and agreed with the client organization and coaches.

The performance portfolio, or (self) assessment dossier consists of the application letter, a paper in which students express their expectations, completed reflection forms, a mid-term reflection paper and a final reflection paper. During the interview which take place at the beginning, the middle and final stage of the project the coaches give feedback on the portfolio. Elements of this portfolio are also discussed during project team meetings.

The additional skills training consists of meetings on project planning, work plan development, communication, group dynamics, self-reflection, team building, and multicultural communication.

Examination of the ACT is based on 1. the midterm reflection paper which is graded by a specialized trainer as 'pass' or 'fail'. When students fail this paper they have to revise it until they pass it. 2. the project plan which is graded by the subject matter specialist and the expert in project planning and management; 3. the final oral presentations are graded by coaches who attend these presentations; 4. the project results (the 'design') is assessed by the subject matter expert, the process coach and the client; 5. the equality of the contributions and performance of the project team members are assessed by the process coach; 6. the contributions to the project process of the team members are individually assessed by both the member of project team and the process coach.

To indicate the interdisciplinary character of the ACT course, it is compulsory for Master of Science students in the fields of organic agriculture, soil science, hydrology and water quality, meteorology and air quality, forest and nature conservation, international land and water management, plant sciences, plant biotechnology, agricultural and bio resource engineering, leisure, tourism and environment, climate studies and applied communication science. It is optional for MSc-students in management, economics and consumer studies, biology, animal sciences, environmental sciences, molecular life sciences, nutrition and health, bioinformatics, international development studies, and aquaculture and fisheries.

Modular skills training

The text of this description is based on the online Study Handbook as well². Modular skills training (MOS) is linked to the ACT course. Students get 3 credits with which they can choose skills training courses of 1,5 credits each. The essence of MOS is that students acquire skills which they need as MSc-graduates on the labour market. The selection of the modules is supported by study advisors who analyze the education

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(accessed 04-08-2010)

history and mastery of the competencies of the students, and give advise regarding the competence development plan of the students. Giving the scheduling constraints students are advised to speak about their intentions with their study advisors early in their MSc program and to get agreement about their choice of modules.

There are three levels of MOS modules: 1. modules at the level of BSc graduation; they can be perceived as refresher courses for MSc-students; 2. modules at the level of MSc graduation; 3. modules for additional development of skills which are helpful for career development.

The list of skills courses is as follows:

Category 1:

Skills Assessment
Computer Literacy
Information Literacy
Basic presentation skills

Category 2:

Advanced Presentation Skills
Negotiation Skills
Intercultural Communication Skills
Argumentation Skills
Observation Techniques
Professional Ethics
Introduction Philosophy of Science
Scientific Writing Skills
Project Planning and Organization
Interviewing Techniques
Questionnaire Construction

Category 3:

Intuitive Intelligence
Career Development Planning
Train the trainer
Entrepreneurial skills
Consultancy skills
Management skills

For all MOS modules specific description are given in the Study Handbook.

Most MOS modules can be taken during the period in which the Academic Consultancy Training is scheduled. This results in peak pressure in the teaching load and staff capacity needed, but this also holds for the ACT course, since most of the teaching and learning takes place in small groups (although some MOS modules are taught for larger groups).

It is required that students should master all skills listed under category 1. From the 2nd category they can choose relevant modules which may be necessary for doing their thesis and internship. Students can choose modules from category 3 based on their

personal preferences and professional ambitions.

Competence assessment, study choice and career development

Another example of the implementation of the competence-based education philosophy is the introduction of competence assessment for supporting study choice and awareness raising of the issue of career development. This initiative which is now pilot-tested (Gulikers et al, 2010) was started during visitations of education programs at Wageningen University in which a former CEO of a large company in the food industry stated he had made some inquiries in his network about the professional profiles of graduates of Wageningen University. Generally speaking they thought the scientific preparation of the graduates was fine, but that their impact and career orientation lacked somewhat behind, which was the reason for the chairman of the board of Wageningen UR to assemble a high-level university working group, which included the former CEO mentioned, and which would address this issue. The assignment for this working group was to look for improvements of the career competence of students. During one of the first meetings the observations which were shared during the visitations were nuanced by stating that the visitations reports regarding the programs were positive, study programs had their working field committees, and only part of students were employed in the food industry after graduation. Students from plant sciences, environmental sciences and social sciences were not included in the observations. Nevertheless various suggestions were done to improve the career orientation of students, although there were also remarks that students in Wageningen University might not be interested in career issues because they are studying based on their interests and not primarily based on certain career ambitions, and that career competence could also be gathered in extra-curricular activities such as in student activity committees, study association boards, students union committees and boards, program committees and the student and university council.

After some meetings the composition of the working group was changed and was then chaired by the Rector Magnificus. Still a bit later it was agreed to conduct a pilot test in which students would be assessed. The idea was that this might help to sensitize them regarding career development issues with which they will be confronted directly after graduation. A distinction was made between BSc and MSc students. The idea was that an assessment for MSc students might be a bit late, although they might feel more urgency regarding this issue than BSc students. But it was concluded that assessing BSc students was preferable because then the assessment results could be taken into account in the choice of specializations and courses. Some programs differentiate between research, policy and education specializations for instance. This whole process took around three years, and the first results of two pilots tests are now available.

The pilots were implemented in a course which was offered to third-year BSc-students animal sciences (BDW) and business and consumer studies (BBC). The students at the point of the assessment needed to make choices regarding their MSc program, a topic for their BSc-thesis, or an internship, which are far reaching choices for students at that stage.

In total twenty five students from both studies were invited to voluntarily participate in both pilots. A private human resources (HR) company and an external professional career coach were included in the preparation and implementation of the course. The company delivered a widely used, tested and reliable online assessment tool. The assessment addressed three basic questions: 1. who am I? (this was measured by a self-assessment on eighteen competencies; 2. what do I want?:(this was also measured by a self-assessment, in this case of motives and work cultures; 3. how do I perform? (measured by a 360 degrees competence assessment, completed by the student and at least three other persons). Six roles were identified to share with the students to make them aware of the significant differences in career paths after graduation: researcher, consultant, policy maker, teacher/trainer, entrepreneur, and expert.

After the assessments students received assessment reports and feedback was given by teaching staff who were trained in assessment by the HR company. The training was given by the professional career coach, a teacher and a researcher. The study advisers, who monitor study progress of individual students, give information about courses and assist students to plan their study. These advisors spoke with the students about the meaning of the assessment results for study and career planning.

Summarizing, the course contained three steps: 1. the assessment; 2. the individual feedback conversation; 3. training sessions. There were three training sessions, each of which dealt with component of models for career decision making (see Hirschi & Läge, 2007; Van Esbroeck, Tibos and Zaman, 2005): 1 self-exploration; 2. then environment exploration; 3. identifying concrete choices and possibilities. The training sessions were conducted in plenary sessions. Individual, small group, plenary activities and home work were included.

At this stage results indicate that the assessment, feedback and further training activities have added value in terms of competence awareness, awareness of personal weaknesses, development of specific ideas for the remainder of the study, understanding of the professional roles and of finding out the personal preferences regarding the professional roles. Pilot 2 was improved based on experiences in Pilot 1 and included three measurement moments: 1. the beginning of the course, 2. after the assessment and feedback sessions with study advisers; 3. at the end of the course, thus after the training sessions. This enables evaluation of the assessment and feedback sessions and the training sessions separately. There appeared to be significant improvement of

Competence, weaknesses and strengths awareness, role understanding and role preferences improved significantly as a result of the assessment and feedback sessions. Strengths awareness, general awareness of things students never thought about before, specific idea generation for personal development, and development of specific ideas for planning the remainder of the study increased (further) as a result of the training sessions.

In general it was observed that the students appreciated the opportunity to take part in this 'serious' assessment course. The results however seem to be moderated significantly by the learning orientation of the students. The various experts who were working on this case all felt that student self-responsibility feeling makes a big difference in effecting results of the course.

This being said, the next steps are to scale this career competence assessment up, and to evaluate the effect of this on the longer term by comparing consciousness, certainty and satisfaction with study and career choices.

Implications for professional development of teaching staff

All developments in education ask for professional development of teaching staff. This is different for vocational, professional and academic education. It is surprising to observe that the higher the level of education in general the lower the requirements regarding teaching qualifications. There may be a logic in this situation, that is that in lower levels of education the emphasis is more on pedagogy, psychology and didactics, whereas in higher levels of education the focus is on subject matter. As a consequence of this graduates from secondary education who want to prepare themselves for a teaching license for lower levels of education, including secondary and senior secondary vocational education need to attend teacher training institutes, whereas graduates of universities who aspire a career in higher levels of secondary education need a shorter university program to get their teaching license. University graduates who want to teach at the university used to have no obligations whatsoever to teach Bachelor and Master students, although this policy has been changed. For instance, in Wageningen University staff members who have a significant teaching role in their job need to get a university teaching qualification, which is offered by a special unit of the university.

The introduction of competence-based education in vocational, professional and academic education has various consequences for the teaching staff. This holds for all educational innovations with which teachers are confronted. In many cases general agreements are made to implement certain innovations whilst the details of the innovations and the necessary conditions are not yet known or present. It is then expected that teaching staff have sufficient learning capacity to implement the innovations in practice. Since in many cases the innovations are quite fuzzy, teachers can be over-asked and may get innovation-tired. In the specific case of competence-based education, teachers in institutes for vocational education face more stringent implementation conditions than teaching staff in academic programs. In the Netherlands, where the implementation of competence-based education is agreed by law (for senior secondary education – MBO), teachers are being introduced in approaches for delivering competence-based education. Being more of a curriculum than an instructional innovation, this is quite hard. The starting point of the competence-based curriculum is already given by the fact that the social partners were responsible for delivering the job profiles, and the sectoral knowledge centers delivered the competence-based qualification dossiers for the various educational programmes. Nevertheless, there are principles for competence-based education which are relevant for teaching staff. They need: 1. to determine the vocational core problems and take them as the organizing unit for (re)designing the curriculum at the level of the educational institute; 2. assess student competence before, during and after the learning process; 3. introduce learning activities which place in a range of authentic situations; 4. integrate knowledge, skills and attitudes in learning and assessment processes; 5. scaffold and fade in self-responsibility and self-reflection/reflection in students along the program; 6. fulfill their roles as experts and

coaches equally; and stimulate the development of an attitude of lifelong learning is the students.

Teachers are being trained in these principles, but this is not an easy thing. Professional development is optional, educational institutions have the financing of in-service training programs in their lump sum budget. Although not intended, in various cases the budgets are being used for financing other priority areas. Also, much of the in-service training and professional development takes place on an individual basis, whereas a school-based approach is needed which is overarched by a strategic development plan of the educational institution and supported by targeted human resource management.

As said, this is not very simple. We have seen that in projects we carry out in Uganda and Ethiopia on the development of competence-based curricula in the field of floriculture and horticulture. Staff were trained in Training of Trainer (ToT) courses in the Netherlands. They were familiarized with the principles of competence-based education. However, transfer of these principles to other staff members in their organizations appeared to be difficult because of time constraints and other priorities. Furthermore, once the trained staff members leave (an quite a few did) the sustainability of the process is hampered (see for further elaboration of this issue Mulder & Pachuau, 2010). We believe that the situation in the Netherlands is not much better. However, there is a tendency to address the in-service training of teaching staff in a whole-school framework of mission, vision and strategy development, management of innovation and implementation, quality assurance and improvement, and human resource management and development.

For competence-based education it is especially important to implement this is a school-wide approach, including management itself. If it is important to develop competence for students and to start a process of life long learning, this equally holds for management and teaching staff. So there are implications for human resources management, which should be based on the same principles of competence development. Job profiles need to be developed (if not yet available), results areas specified, competence lists and mastery levels distinguished, which can be selected by superiors and co-workers, and for based on which management can assess themselves, and management and co-workers can assess the competencies of the co-workers together. If the culture in the organization is open enough, 360 degree feedback can be solicited. Results can be discussed in performance appraisals.

For green secondary agricultural-vocational education, which takes place in junior (VMBO) and senior secondary education (MBO) institutes, there is one teacher training institute, which is Stoas University for Professional Education, in fact a teacher education institute, with two establishments, one in Dronten and one in Den Bosch. This organization is part of the AERES group with its headquarters in Ede, near Wageningen. It was decided that the establishments in Dronten and Den Bosch will be move to Wageningen in the near future. For the time being they will not be a part of Wageningen UR, since the AERES group is not part of Wageningen UR. Wageningen UR has liaised itself with another University for Professional Education, which is Van Hall Larenstein, which has three establishments: Wageningen itself (this is the former Larenstein establishment from Deventer), Velp, and the Van Hall Institute (which is located in Leeuwarden).

In principle, teacher education provided by Stoas prepares students for a starting qualification as secondary education teacher. This is done within the framework of the Dutch Law on Professions in Education (Wet Bio). This law has specified seven competence areas for which the student teachers are prepared. After entering the profession, which is a gradual process which starts already during the teacher education program during internships or even paid contracts within schools of secondary education, beginning teachers gather experience and develop themselves in the profession. Step by step they are expected to perform more tasks which are somewhat or rather unique in the green education sector. For those green education specific roles, there is no real preparation or in-service training. Therefore Stoas and ECS are going to conduct a project in which competence clusters which are unique for green vocational education are generated. These competence clusters will not be too detailed, and will be used to develop calls for tender for in-service training or development programs, which can be provided by the many semi-governmental and private training and development organizations.

The research program on professional development of teachers in green education

This project is part of a wider research program which is running during the years 2010 and 2011 on professional development of teaching staff. Nine projects have been proposed on the following topics

For Agricultural Training Centers

1. What are the success and failure factors of professional development of teachers in green education?
2. Which specific guidelines are there for the pedagogical content knowledge for green education themes?

Universities for Professional Agricultural Education

3. Is there a need for a green standard for professionalism of teaching staff in Universities for Professional Agricultural Education (HAS)?
4. Is there a need for the development of a HAS minor in Education?

Stoas University for Agricultural Teacher Education

5. Does the development of an academic training school in the triangle School-Stoas-ECS have added value for the training and professional development of teaching staff?

Practical training

6. Which priorities are there concerning the professional development of teachers and trainers who work in the field of practical training (such as PTC⁺ and IPC)?

Teacher participation in inter-institutional knowledge arrangements

7. What is the added value of teacher participation in extra-curricular regional learning arrangements for their professional development, entrepreneurship and creativity?

Academization of green education

8. What possibilities are there to augment the number of PhD research trajectories conducted by teaching staff in green Education in cooperation with the lectorships in Professional Agricultural Education?

Green knowledge for non-green (ECS) education

9. Which knowledge about green themes which is generated in green knowledge institutes can be brought to non-green Education (elementary and secondary) and what are effective ways of doing that?

A Group Decision Room with representatives of green education and the green education service sector has been held in which priorities for conducting these projects were formulated. In a later stage we hope to be able to report about the projects which have been prioritized, which are in order of priority by education representatives, projects 3, 1, 9, 7, 6, 4, 2, 8, 5.

We hope to present the first outcomes of this research program in the course of 2011.

Conclusion

In this contribution we have stated that the introduction of competence-based higher education is a major innovation in education. It has important consequences for teaching staff and management in education. Teachers need to be prepared for this innovation, but they also have to work on its development and implementation from their own perspective. Practical examples from Higher Agricultural Education are given on the integration of the competence development education philosophy in the curriculum, cooperative authentic interdisciplinary consultancy courses, modular skills training and formative career assessments. These innovations have consequences for teaching staff and management involved. Their competence development is also at stake, and to enable this, a competence management philosophy is also needed in general management of educational institutions. Since as the simple saying goes: Verba docent, exempla trahunt, or: example is better than precept.

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Annex 1 Matrix for competence-based vocational education (source: Wesselink 2010)

	Principle	Variables	Not competence based	Starting to be competence based	Partially competence based	Completely competence based
Principle 1	The competencies on which the programme is based are defined.	<ul style="list-style-type: none"> - Putting together a job competence profile. - Using a job competence profile. - Interaction between education and vocational practice. 	There is no job competence profile put together.	There is a job competence profile without participation of the vocational practice. This (vocational) competence profile has been used during the (re)design of the curriculum.	There is a job competence profile with participation of the vocational practice and this profile is fixed for a longer period of time. This job competence profile has been used during the (re)design of the curriculum.	There is a job competence profile with participation of the vocational practice and this profile is tuned frequently with the regional and local vocational practice including the major trends. This job competence profile has been used during the (re)design of the curriculum.
Principle 2	Vocational core problems are the organising unit for (re)designing the curriculum (learning and assessment).	- The extent to which the vocational core problems determine the curriculum.	There are no vocational core problems specified.	There are vocational core problems specified, which are used as examples in the (re)designing of the curriculum.	There are vocational core problems specified. These core problems are the basis for the (re)design of some parts of the curriculum.	There are vocational core problems specified and these lead to the (re)design of the whole curriculum.

	Principle	Variables	Not competence based	Starting to be competence based	Partially competence based	Completely competence based
Principle 3	The competence-development of students is assessed before, during and after the learning process.	<ul style="list-style-type: none"> - Recognising earlier developed competencies. - Formal assessment. - Formulating feedback. - Flexibility in format and timing of assessment. 	Assessment is the final stage of a learning process and takes place at a fixed moment.	Assessment takes place at several moments. Assessment is used for formal assessment and does not play a role in the learning process of students.	Assessment takes place before, during and after the learning process. Assessment is used for both formal assessment and competence development of students.	Assessment takes place before, during and after the learning process. Assessment is used both for formal assessment and competence development of students. Students determine the moment and format of assessment themselves.
	Learning activities take place in a range of authentic situations.	<ul style="list-style-type: none"> - Authenticity. - Diversity. - Relation with learning at school and learning in practice. 	Learning in practice is of subordinate importance and there is no relation with learning at school.	Learning at school is in the lead. In some cases a relation is set up with learning in practice or experiences from practice.	Learning activities to a large extent take place in authentic settings, but the relationship with learning in school is insufficient.	Learning activities to a large extent take place in diverse authentic settings and learning activities are clearly related to the learning activities in practice.
Principle 5	In learning and assessment processes, knowledge, skills and attitudes are integrated.	<ul style="list-style-type: none"> - Integration of knowledge, skills and attitudes. 	Knowledge, skills and attitudes are separately developed and acknowledged.	Knowledge, skills and attitudes are sometimes integrated in the learning process. Knowledge, skills and attitudes are assessed separately.	Knowledge, skills and attitudes are integrated in the learning process or in the assessment procedure, not in both processes at the same time.	Integration of knowledge, skills and attitudes is for both learning and assessment processes the starting point and therefore applied.

	Principle	Variables	Not competence based	Starting to be competence based	Partially competence based	Completely competence based
Principle 6	Self-responsibility and self-reflection/reflection is encouraged in students.	<ul style="list-style-type: none"> - Self-responsibility. - Self-reflection. - Reflection on functioning in the vocational setting. - Learning needs of the student. 	Learning activities are characterised by external steering: students carry out assignments by means of elaborated instructions. There is no (self-) reflection.	In a limited part of the learning activities, students determine the way of learning themselves. There is hardly any reflection on the learning process and functioning in vocational settings.	Students themselves determine the way of learning, and time and place of learning, based on reflection on the learning process and functioning in vocational settings.	Students are after all responsible for their own learning processes based on their learning needs.
	Teachers both at school and practice fulfil their roles as coaches and experts equally.	<ul style="list-style-type: none"> - Way of supporting the learning process. - Support in the knowledge acquisition process. 	There is no question of support. Knowledge transfer is central to the learning process.	To a limited extent responsibility for the learning processes is handed to students. Teachers support through guidance.	Students enjoy a certain level of autonomy in determining their own ways of learning. Teachers observe when students need support and offer it.	Teachers stimulate students to formulate learning needs and based on self reflection determine their own learning process.
Principle 8	A basis for students to achieve an attitude of lifelong learning is realised.	<ul style="list-style-type: none"> - (Labour) identity development. - Development of learning competencies. - Focus on future career. 	There is no attention paid to competencies that are related to learning or (labour) identity development.	In the curriculum there is attention paid to competencies that are related to learning and (labour) identity, but these competencies are not integrated in the learning process.	During learning trajectories competencies related to learning and (labour) identity development are clearly related to vocational core problems and attention is paid to those competencies to a large extent.	During learning trajectories competencies related to learning and (labour) identity development are integrated and reflection on the future careers of students has taken place.

Annex 2 Knowledge, skill and competence specification in the European Qualifications Framework (EQF) (Source: European Commission, 2008).

Knowledge levels

1. basic, general knowledge;
2. basic factual knowledge of a field of work or study;
3. knowledge of facts, principles, processes and general concepts, in a field of work or study;
4. factual and theoretical knowledge in broad contexts within a field of work or study;
5. comprehensive, specialised, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge;
6. advanced knowledge of a field of work or study, involving a critical understanding of theories and principles;
7. highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research; critical awareness of knowledge issues in a field and at the interface between different fields;
8. knowledge at the most advanced frontier of a field of work or study and at the interface between fields.

Skills levels

1. basic skills required to carry out simple tasks;
2. basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems using simple rules and tools;
3. a range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information;
4. a range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study;
5. a comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems;
6. advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialised field of work or study;
7. specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields;
8. the most advanced and specialised skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or innovation and to extend and redefine existing knowledge or professional practice.

Competence levels

1. work or study under direct supervision in a structured context;
2. work or study under supervision with some autonomy;
3. take responsibility for completion of tasks in work or study; adapt own behaviour to circumstances in solving problems;
4. exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change; supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities;
5. exercise management and supervision in contexts of work or study activities where there is unpredictable change; review and develop performance of self and others;
6. manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts; take responsibility for managing professional development of individuals and groups;
7. manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches; take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams;
8. demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts including research.