

Curriculum Development in the Floriculture Sector in Uganda: a Design-Based Validation-Research Study¹

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Abstract

This chapter describes an Educational Design Research (EDR) project on curriculum development in agriculture aimed at analysing the impact and efficacy of competence-based educational design principles in floriculture education in Uganda. The purpose of this study is to generate a better understanding of these principles. The competence-based education design philosophy was chosen because of the necessity to firmly align the content of the curricula that needed to be developed for senior secondary agricultural-vocational and higher agricultural education with the national, regional and international developments in the floriculture production chain. An asset of competence-based education is the strong relationship between the demands in the labour market and the design of the educational program. In previous studies, principles of competence-based education (Biemans et al 2004; 2009) have been proposed (Mulder, 2004), elaborated (Wesselink, 2010) and further explored in vocational education (Sturing et al, 2011) and higher education (Nederstigt et al, 2011). In various stages of the research process, the principles of competence-based education emerged from practice and theory. In the study reported in this chapter, curricula for two educational institutions were developed and implemented. The validity of the design principles and the effectiveness of the educational program were evaluated by various stakeholders, including graduates and their employers. Based on the employment and evaluation data, it can be concluded that the project has been successful, although there are concerns about the sustainability of the practical component, especially the field attachments of the program. The competence-based design principles were working as intended. Further research is necessary to identify the efficacy and impact of the design principles independently.

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Introduction to the problem

Professional and vocational education need to be well-aligned to the needs of the labour market and society at large. The competence-based education philosophy (Mulder, 2011; 2014) addresses this issue and tries to establish insights as to how to design curricula that meet these needs (Mulder, 2012a; 2012b). The approach is applied in many professional fields, like in medicine (Frank and Jabbour et al, 2005), purchasing (Mulder, Wesselink and Bruijstens, 2005), extension (Karbasoun, Mulder and Biemans, 2007) and agriculture and rural development (Pant, 2012). A matrix of principles and implementation levels of competence-based education was constructed which is based on an extensive literature review and expert consultations (Wesselink, 2010; see Box 1). This matrix is being validated in Dutch vocational education, but wider validation of the efficacy of the competence-based education design principles is necessary. Furthermore it is important to evaluate the outcomes of a competence-based curriculum. A problem in vocational and higher education is that the alignment of many education programs with the needs of the labour market is limited or even non-existent.

Regarding the notion of competence-based education, we would like to point at the fact that the competence-movement started in the USA in the fifties of the last century with publications of White (1959, McClelland(1973), Gilbert (1978), Boyatzis (1982), Spencer and Spencer (1993) and many others. Grant et al (1979) reviewed a series of the early competence-based attempts to align higher education to the labour market. The competence-based education movement of this period were heavily criticized because of their behaviouristic nature (Mulder, Weigel and Collins, 2007). In a later stage competence theorists pointed at the necessity to stress the interpretative (Sandberg 2000), holistic (Velde, 1999) and comprehensive (Wesselink, 2010) nature of competence. These notions of competence are more related to integrated occupationalism and situated professionalism (Mulder, 2014) and object against the reductionist behaviouristic nature of the early competence-based education programmes. In the matrix of competence-based education, these considerations have been taken into account.

The validation of the principles of competence-based education took place in a curriculum development project in the field of floriculture (flower-growing, mainly roses and chrysanthemums) with two educational institutions and the flower production and export association in Uganda. In Uganda, like many in the South, the agricultural sector dominates the economy. Currently,

agriculture employs 80% of the workforce in Uganda. Commercial floriculture in Uganda started in the early 1990s and employs around 6,000 persons. The number of people supported directly and indirectly by floriculture is around 30,000 persons. Good training and education provision in the field of horticulture was lacking, whereas Oyelaran-Oyeyinka and Sampath (2007) attributed fluctuations in Uganda’s performance among others to education and training issues. The lack of up-to-date education programs in agriculture is not unique for Uganda. Comparable projects were and are being conducted in Ethiopia, Indonesia, and Kenya. The lack of a dedicated and current education program in the field of floriculture (CBFU, 2010) was the main reason for starting a capacity building project in that field in Uganda, which started in 2006 and ended in 2010.

Within this sector, three main stakeholders were identified: the flower farms, research institutes and education and training institutes. Together, these stakeholders were expected to cooperate in the development of various ways to develop competence in the sector: learning on the job programs, knowledge exchange between flower farms and research institutes, knowledge exchange between research institutes and education or training organisations, and activities for knowledge construction in action (see Figure 1).

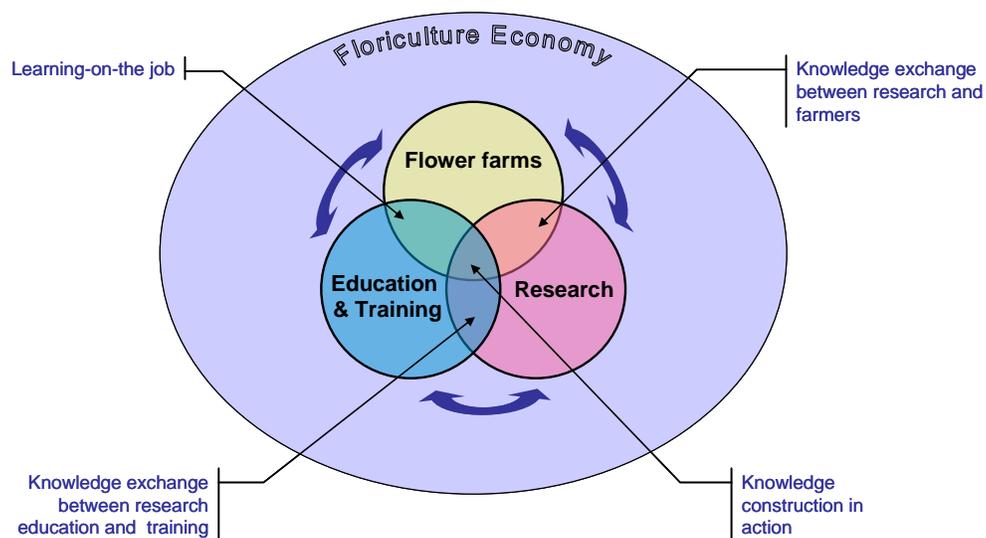


Figure 1. Cooperative learning activities at intersections of stakeholders

The interest in the capacity development project was to initiate and facilitate knowledge construction in action between the three parties involved: farms, the Ugandan Flower Export Association (UFEA), Bukalasa Agricultural College (BAC) and Mountain of the Moon University (MMU) and

education and research institutes from the Netherlands (Wageningen University (WU), Agricultural Economic Institute (LEI), Practical Training Centre (PTC+), Applied Plant Research (PPO)).

The curriculum development was embedded in a larger project. The other components of the project (see Figure 2) were capacity building, applied research, investments and smallholder floriculture. Capacity development was aimed at developing course guides and materials together with and for the lecturers, who, as said, got training for their new role.

For all parts of the project, there were four development phases: (1)Needs assessment, (2)Design, (3)Implementation and (4)Evaluation.

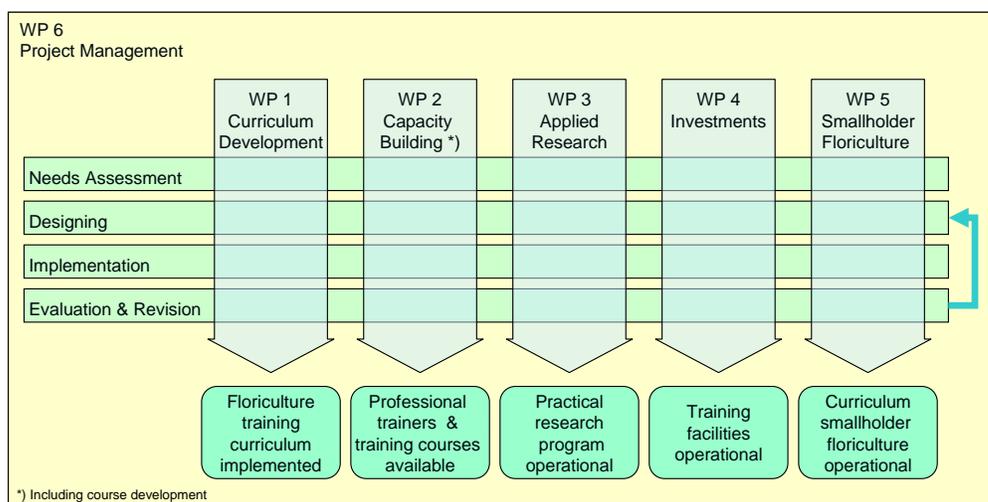


Figure 2. Phases in the floriculture capacity development project (WP=Working Package)

The curriculum that was developed was defined at Diploma level. The Diploma programme was designated for training future managers and aimed at registering A-level graduates with low grades who did not qualify for a degree (Bachelor) programme. The duration of the programme was decided to be two years. The idea was to also develop a one-year Certificate programme, and short tailor-made courses with a modular character. The research reported in this chapter is based upon the development of the Diploma program.

In the next sections of this chapter we will elaborate the education design problem and research questions, the validation research design, the design research methods and data collection, the context of the curriculum development project in context, the implementation of the principles of

competence-based education in the case, the results, the validation of the principles for competence-based education, and the lessons learned.

Education Design Problem and Research Questions

As stated, this chapter describes an EDR project on curriculum development in the field of floriculture in Uganda and analyses the underlying competence-based educational design principles to generate a better understanding of these principles. The curricula were developed because of the need for floriculture education felt in the sector of flower production and export. Many flower farms were and still are depending on expatriates, especially from Europe, Kenya and India for managerial and supervisory jobs. The standard and volume of floriculture education in these regions and countries is higher. Therefore the floriculture sector in Uganda decided to apply for a NUFFIC capacity development project, which was granted in an open competition.

From a curriculum research perspective this case of capacity development provided a good context to experiment with a specific curriculum development approach, which is based on competence theory. As stated, the competence-based education design philosophy was chosen because of the necessity to firmly align the content of the curricula that needed to be developed for senior secondary agricultural-vocational and higher agricultural education with the national, regional and international developments in the floriculture production chain. This production chain is characterized by high competition, quality, technology and international scope. As with most floriculture produce, export is oriented towards the large auctions and retailers in Western-European countries. A strong asset of competence-based education is the strong relationship between the demands in the labour market and the design of the educational program, which is the main reason as to why this approach was employed in this case. In previous studies, principles of competence-based education have been proposed (Mulder, 2004). Wesselink (2010) elaborated this and constructed a so-called matrix of competence-based education. This matrix consists of 8 principles of competence-based education with four implementation levels, ranging from no to maximum implementation of those principles. Teacher teams can use this matrix to portray where their program is in terms of the implementation of the principles of competence-based education (Wesselink, Dekker-Groen, Biemans and Mulder, 2010). We call this the actual 'competentiveness' of the curriculum. They can also define the development policy regarding the curriculum. In this way

teacher teams can use the matrix as an articulation instrument. It appears that using the matrix in teacher teams evokes constructive communication about the present and desired level of competentiveness of the curriculum. Currently, the matrix is further evaluated in vocational education (Sturing et al, 2011). It has also been studied in higher education in Indonesia (Nederstigt et al, 2011).

So the purpose of this chapter is twofold.

1. To describe the curriculum development project on floriculture in Uganda and to assess its impact on graduate employment.
2. To further test the validity of the design-principles of competence-based education in this curriculum development project.

This leads to the following research questions:

1. What was the impact of the new education programs in floriculture on graduate employment?
2. What was the efficacy of the principles of competence-based education in the design process of the competence-based floriculture curriculum?
 - a. How did the curriculum developers use the eight principles of competence-based education?
 - b. What challenges were encountered in using the principles of competence-based education as a guide for curriculum design and development in Uganda?
 - c. What adaptations are needed in the principles of competence-based education based on this validation study?

Research Design

According to the work of Nieveen, McKenney and Van den Akker (2006) and Plomp (2009) this chapter can be seen as an example of a *validation study* with elements of effectiveness research. It is still a validation at small scale, or a so-called beta-trial, which means that the research is conducted in a carefully chosen site and that support is given, which will be elaborated below. The research is problem-driven, the problem being the disconnection between the curriculum (as in many Southern educational programs) and the needs for national and regional socio-economic development. The research has gone through several stages. In the first stages of the research the emphasis was on the

development of curricula based on principles of competence-based education, whereas in the current stages principles of competence-based education are being tested in a series of curriculum development projects which serve as case studies to validate the educational design knowledge accumulated.

The design research project in this case consists of the following phases:

- Preliminary research
In this phase the context of the curriculum design process was analysed. It also included a phase of labour market, job and competence analysis. In this phase the principles of competence-based education were already applied, by developing a competence profile of graduates of the horticulture education programmes.
- Curriculum Design
In this phase the components of the curriculum were drafted. These were defined by course titles, learning outcomes and first specification of the course content and assessment strategies. Again, in this phase, principles of competence-based education were used, for instance the identification of core occupational problems, the specification of competence assessment strategies, the identification of authentic learning situation (amongst which internships or field attachments), the integration of knowledge, skills and attitudes, and the gradual development of self-regulated learning. During accompanying teacher professional development, emphasis was put on the coaching role of the lecturers, and the development of a life-long learning attitude.
- Curriculum Development
In this phase the components of the curriculum were further specified. Also during this phase the design principles were applied and further deepened.
- Assessment Stage
In this phase the impact of the curriculum and the use of the competence-based education design principles were assessed. This was done in a participatory way. The researchers were part of the curriculum design project. During the assessment stage the educational design principles were validated. Furthermore, adaptations of these principles were identified for future use of the principles in other contexts.

The use of the principles of competence-based education design will be elaborated below.

Although Nieveen et al limit validation research to the advancement of *instructional theory*, we believe that validation research is equally important in the field of *curriculum theory*. We believe that curriculum design principles emerge from deliberate attempts to use certain design guidelines in consecutive cases studies. It is the continuous reflection on the experiences with implementing the

guidelines that shapes the confidence in the efficacy of these guidelines over time. In sum, what Nieveen et al suggested was exactly done: to develop and implement specific learning trajectories to test the theoretical basis of the design.

Design Research Methods and Data Collection

The research method used to answer the first research question (on program impact) consisted of interviews with the 30 stakeholders in the educational program: lecturers from the respective education institutes, managers and supervisors from twelve flower farms in Uganda and graduates. The interviews were structured according to certain main questions for each stakeholder group (see below). The stakeholders were selected based on their involvement in the curriculum project and access. Access was especially an issue for interviews with employers and graduates as they are in remote areas which are not easily accessible. Furthermore, making appointments via email or mobile phone is in most cases not possible, so site visits are needed to make appointments. Making these site visits may take a full day. Furthermore, when appointments for interviews are made, it is not still not always sure that the interviews will go on. This means that data collection in the field is extremely time-consuming. Arriving at a response group of 30 persons is therefore quite satisfying. The interviews were aimed at tracing the work places of the graduates, views of lecturers on the impact of the program, perceptions of employers of regarding the quality of graduates, and experiences with and view of graduates the program and their employment situation. Data of lecturers, employers and graduates were collected within the first year after graduation of the first batch of students.

To answer these questions, data were collected about the perceptions of the various stakeholders with the training programs and the labour market entry of the graduates. At the time of the assessment, only one group of students had graduated. Data was analysed using descriptive quantitative and qualitative analysis techniques. The following categories of questions were asked to the different stakeholders in this evaluation (NPT/UGA/172 Management Report, 2010; Kintu, 2010; see Gulikers, Biemans and Mulder (2009) for a comparable multi-stakeholder evaluation of competence-based education):

- Graduates were asked a series of questions, aimed at their current job, their satisfaction with the education program, competencies they did develop during the programme, aspects of the program that had most impact, and the activities they did after they finished the study program.
- Employers (general managers or owners) were asked fourteen questions, including questions as to whether the graduates were properly prepared to work at their flower farm and whether they could smoothly start working.
- Internship supervisors were partly asked the same questions as the employers. Other questions for them included their satisfaction with the students and graduates.
- Interns were asked fourteen questions, including questions about their satisfaction with the internship.
- Lecturers were asked twenty-one questions, amongst which questions about their satisfaction with the program, and their perception of the effects the programme had on students.

The research method used to answer the second research question (about the efficacy of principles of competence-based education) also consisted of participatory interviews with the curriculum developers and lecturers. Special attention was given to the way in which the curriculum developers used the principles of competence-based education and challenges which were encountered in using these principles.

Prior to the job and competence analysis, a training on floriculture and competence-based course development was provided for the nine selected lectures at Practical Training Centre (PTC+) in Ede, the Netherlands, for a period of 2 months. Six persons of this group were lecturers from the respective education institutes in Uganda, and three were trainers from the flower industry. They were equipped with principles of competence-based education and floricultural skills for developing and implementing a competence-based curriculum. The lecturers and trainers defined and helped in selecting the courses to be taught as well as the training materials to be used during the learning trajectory. They were involved in the design of the training and greenhouse facilities that were constructed at the university and college. On their return, these nine persons together with their colleagues and project-partners from the Netherlands designed and developed the curriculum, teaching guides and hand-outs for all the modules to be taught.

The principles of competence-based education used were represented in the matrix for competence-based education mentioned above (after Wesselink 2010).

Table 1. Principles of competence-based education

1	The competencies, that are the basis for the curriculum, are defined
2	Core occupational problems are the organizing unit for (re)designing the curriculum (learning and assessment)
3	Competence development of students is assessed before, during and after the learning process
4	Learning activities take place in different authentic situations
5	In learning and assessment processes, knowledge, skills and attitudes are integrated
6	Self-responsibility and (self)-reflection of students are stimulated
7	Teachers both in school and practice fulfil their roles as coach and expert equally
8	A basis for a lifelong learning attitude for students is realized

These principles were divided in four levels of implementation: (1) Not; (2) Starting; (3) Partially, and (4) Completely competence-based. The meaning of the principles at the various levels was semantically specified, based on examples like the model for quality improvement of the European Foundation for Quality Management. See for the complete model Box 1.

Description of the curriculum development project in context

In this section the curriculum development project will be described which is necessary to understand the context of the research.

The curriculum development activities were divided in a series of steps.

- a. The core curriculum development, staff were trained in and exposed to the floriculture sector and principles of competence-based education development in the Netherlands.
- b. Informal curriculum evaluation with key players of the floriculture program to evaluate the present programs and materials (there were hardly any).
- c. Identification of stakeholders (Mulder, 2006) (such as producers, farm owners, the UFEA, research institutes, universities, governmental bodies and non-governmental organisations (NGOs)).

- d. Needs assessment with various representatives of the stakeholders by site visits and interviews. This was the actual *needs assessment* phase. Essentially, an inventory of future tasks and competencies was made of the graduates of the Diploma and Certificate program. This led to the identification of representative *job roles* with *occupational profiles* and the specification of *job tasks* with *competence lists*.
- e. A concise labour market analysis was incorporated in this study (which turned out to be quite complicated as many farms and governmental bodies do not want to disclose that kind of information for various reasons, or they simply did not have that information; visiting farms appeared to be extremely labour-intensive because of the lack of reliable telecommunications and large distances to remote places).
- f. Literature analysis to see what is going on in the field of horticulture training and development and the floriculture sector.
- g. Courses developing by completing course formats. The process was an iterative and collaborative process between the teaching staff of and consulting experts, all bringing in their own expertise. During this process a deliberative approach was followed.
- h. Program implementation. In both education institutes, the BAC and MMU, the curriculum was implemented, based on teaching guides and teacher materials developed under the supervision of PTC+.
- i. Lastly, continuous interactive alignment with stakeholder needs and preferences was implemented.

Step (f): course development, took most of the time during the whole development process. Based on the competence descriptions curriculum components were formulated and described. This was the basis of a tentative list of course titles and a table of credits per course, including various specifications as to the amount of time dedicated to theoretical and practical learning and assignment and sequencing of courses within the various study years and semesters. During this process various drafts emerged on which advice was solicited from the project partners, and based on that successive insights and suggestions were taken on board. Finally the process resulted in the curriculum which was elaborated and later implemented. During the whole process of needs assessment, curriculum design and development, and the implementation, the principles of competence-based education played a guiding role in decision making. How this worked will be described in the next section.

The principles of competence-based education

The competence-based education principles which were tested in the floriculture curriculum development project are presented in Box 1.

Box 1: Principles of competence-base education (After Wesselink, 2010)

	Principle	Not competence-based	Starting to be competence-based	Partially competence-based	Completely competence-based
1	The Job Competence Profile (JCP) that is the basis for the study programme is defined.	There is no JCP.	There is a JCP, but it was constructed without input from the professional practice. This JCP was used during the (re)design of the study programme.	A JCP was constructed with input from the professional practice and this profile is fixed for a longer period of time. The JCP was used during the (re)design of the study programme.	A JCP was constructed with input from the professional practice and this profile is synchronised frequently with the regional and local professional practice including the major trends. This JCP was used during the (re)design of the study programme.
2	Core Occupational Problems (COPs) are the organising unit for (re)designing the study programme (learning and assessment).	There are no Core Occupational Problems specified.	COPs are specified and used as examples in the (re)design of the study programme.	COPs are specified and are the basis for the (re)design of some parts of the study programme.	COPs are specified and these are leading factors in the (re)design of the whole study programme.
3	Competence development of students is assessed before, during and after the learning process.	Assessment is the final stage of a learning process and takes place at a fixed moment.	Assessments take place at several moments, is used for formal assessment and does not play any role in the learning process of students.	Assessments take place before, during and after the learning process and is used for both formal assessment and competence development of students.	Assessment takes place before, during and after the learning process and is used both for formal assessment and competence development of students. Students determine the moment and

					format of assessment themselves.
4	Learning activities take place in different authentic situations.	Learning in practice is of subordinate importance and there is no relation with learning in school.	Learning in school is leading. Sometimes, by means of cases a link is made to learning in practice or experiences from practice.	Learning activities take place to a large extent in authentic settings, but the relationship with learning in school is insufficient.	Learning activities take place to a large extent in a diversity of authentic settings and are clearly related with the learning activities in practice.
5	Knowledge, skills and attitudes are integrated in learning and assessment processes.	Knowledge, skills and attitudes (K,S and A) are separately developed and assessed.	K,S and A are sometimes integrated in the learning process. K,S and A are assessed separately.	K,S and A are integrated in the learning process or in the assessment procedure.	Integration of K,S and A is the starting point for both learning and assessment processes and therefore operationalised.
6	Students are stimulated to take responsibility for and reflect on their own learning.	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 for themselves the way they learn. There is hardly any reflection on the learning process and functioning in vocational settings.	Students themselves determine the way they learn, and the 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.
7	Teachers both in school and practice fulfil their role as both coaches and experts.	Knowledge transfer is central to the learning process.	To a limited extent the responsibility for the learning processes is handed to the 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 to determine their own learning processes.
8	A basis for a lifelong learning attitude for students is realised.	In the study programme no attention is paid to competencies that are related to learning or (labour) identity development.	In the study programme attention is paid to competencies that are related to learning and (labour) identity development, but these competencies are not integrated in the learning process.	In the study programme 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.	In the study programme competencies related to learning and (labour) identity development are integrated and reflection on the future career of students takes place.

These principles were used in the training of staff and the support of the curriculum development process.

Results

In this section the results of the study will be presented. This will be done in the order of the research questions. First, the results regarding the study program impact will be presented, and next the results regarding the validation of the competence-based design rules. In actual practice program implementation and impact are strongly related. We address the impact issue first because we believe that, from a validation perspective, this issue precedes the implementation, although in time the implementation process precedes the impact of the study program.

Study program impact

Regarding the impact of the study program on the employment outlook of graduates, the first signs were positive. Thirteen out of fifteen of the graduates from the first graduate generation were working in the flower sector. One graduate was employed by the college itself, and two were dealing in agricultural products and independent entrepreneurs. One graduate was enrolled in further studies. The main conclusion of this study therefore was that the impact of this two-year Diploma course had significant impact in the floriculture sector, as it enabled practically all students to find a job in the sector, and the sector retained the vast majority of these graduates.

However, a meeting was held with a small delegation of the group of graduates. This meeting showed that the graduates were very dissatisfied with the labour conditions in the farms in which they were working. It appeared that the salaries paid by the farms were very different, and in general very low, considering the graduates had a Diploma-level qualification. Some farms paid a monthly salary of as little as 80,000 Uganda shillings per month for the graduates (100,000 Ushs = US\$ 41.49; 14-03-2011). Regarding their career development, graduates feared that they would have to wait several years (5-7) before they would be promoted to a higher job level with significantly more

income. This picture was confirmed during on-site in-depth interviews with graduates, supervisors and managers.

Validation of the competence-based design rules

Regarding the educational design results, the competence-based education philosophy was appreciated by the various stakeholders. Especially the practical nature of the curriculum was applauded. Based on these observations (which were confirmed during participatory design and implementation processes), it was concluded that the application of the competence-based design rules had a positive effect on the total curriculum quality.

Though many of the stakeholders involved in the designing, development, implementation and assessment of the curriculum felt that it required a lot of time and effort to design and maintain its functionality. This was partly due to the difficulty in coordinating the large number of stakeholders involved who were located in different areas of the country as well as the reluctance of stakeholders to re-assess and re-design the curriculum periodically. In education development cooperation this can only be stimulated by extensions of projects, as ownership of education programs which are trade related and go along with process of deep educational change is not easily transferable, although the official philosophy behind these projects is that Southern stakeholders already are the owners of the educational programs. Inasmuch as the general consensus applauded the practicability of the curriculum, the sustainability remained questionable. This is also a matter of resources, as internships are costly for the participants and in this case not included in the fees.

As stated, teaching staff interviews included questions about the perceptions of and experiences with the eight design principles. The responses of these questions were aggregated, and summarized below.

1. The competencies, that are the basis for the curriculum are defined.

The job profile was instrumental for defining the content of the curriculum. Curriculum components could be linked to job tasks and competencies. The flower farms clearly defined the job

profiles, tasks and competences needed for the two education institutes (BAC and MMU) involved in the project.

2. Vocational core problems are the organizing unit for (re)designing the curriculum (learning and assessment).

The intention was to use COPs as the organizing unit for (re)designing the curriculum. The final curriculum, however, is still predominantly based on science fields, although there are ample practical training moments, including internships. It appeared that thinking in traditional subjects appeared to be strong. MMU was more flexible and willing to adopt new approaches in (re)designing of the curriculum as compared to BAC, because it was a young institution and privately managed. On the other hand, BAC that was older and publicly managed had to adhere to government regulations. At the end, MMU that was at University status was given the responsibility of coordinating the design and development of the curriculum.

3. Competence development of students is assessed before, during and after the learning process.

This is accomplished by continuous formative assessment. Assessment methods that were used were case studies, presentations, reports, oral exams and written exams. Authentic assessment appeared to be new and challenging. This principle however resulted in specifications of the assessment methods in the curriculum units. Both MMU and BAC set and moderated their own assessments because of the time difference at assessment, but the final diploma certificates were issued by the university because of its higher status.

4. Learning activities take place in different authentic situations.

This principle resulted in inclusion of greenhouse practice, practical sessions in the classroom and workplace learning in different flower farms. There were 3 internships in the curriculum; The 1st internship was 2 weeks and was an orientation for students. The 2nd internship was 1 month, and students specialized in 2 departments. The 3rd internship was 2 months and was a kind of research that should be carried out at a flower farm. The sustainability of the internships seemed to be a challenge.

5. In learning and assessment processes, knowledge, skills and attitudes are integrated.

A deliberate attempt was made to integrate knowledge, skills and attitudes in the curriculum. In various courses this resulted in more attention to practical skills and attitudes than usually was the case. Traditional exams are still prevalent, however, also because of national exam regulations.

6. Self-responsibility and (self)-reflection of students are stimulated.

At the university this was emphasised more than at the college. This was the consequence of the fact that the college was part of secondary education, and thus bound to the rules and regulations regarding of the Ministry of Education and Sports. Gradual augmentation of self-regulation was promoted throughout the curriculum as a result of this principle. At the College students were working independently in the greenhouses.

7. Teachers both in school and practice fulfil their roles as coach and expert equally

This principle has not fully been realized. Teachers are basically not coaching the students, also because there are only very limited educational materials to enable independent and collaborative learning. At the flower farms supervisors are not always aware of what the students need to be doing at their farm.

8. A basis for a lifelong learning attitude for students is realized

During the training of lecturers and trainers, they were made aware of continuous learning lines in floriculture, from initial education to continuing vocational training or human resource development. Due to the limited contacts lecturers have flower farms; the implementation of this principle is quite difficult.

The principles are conceived of as guidelines for good practice, but in reality they imply educational innovation and change, which is resisted in general because of various reasons such as repressive regulations regarding education by the state and institution, the mandatory national curriculum, administrative teacher control and lack of development resources. In the college with which we cooperated there was basically no local human resource management and there were almost no

facilities for human resource development. Grants to teachers to participate in further education (abroad) were regulated by the Ministry of Education and Sports on an individual basis.

In a comparable horticulture curriculum development project in Ethiopia (Mulder and Gulikers, 2011), in which the same educational design principles were used, the experiences are highly similar, and it is expected that in a project running in Kenya, again with the same design principles, the same processes will occur (Mulder, 2012a; 2012b). Efforts will be made to accommodate the principles to the local situation.

The results of this design-based curriculum research study show the mixed experiences with using the principles of competence-based education in practice in the South. The results need to be taken into account when using these principles in next projects. Apart from that, we maintain the conclusion that implementing (part of) the set of principles (even to a limited extent), has a positive effect on the impact of education programs in higher agricultural education. The curricula are better aligned to labour market developments and needs, and as a consequence, students are likely to have a better labour market perspective. However, various amendments are suggested for using the principles of competence-based education in a wider perspective. These will be addressed in the following section.

Lessons learned

Having answered the main research question, regarding the impact of the floriculture education programs on graduate employment, which was found to be positive, and the validation of the design principles of competence-based education, which appeared to be instrumental in the development of the curricula, it was also clear that the use of the principles of competence-based education was not without challenges. The most important findings have been reported above, under the list of principles. The last (specific) question was what adaptations were needed in the principles of competence-based education based on this validation study. These adaptations are important when the set of principles are being used in other (culturally varying) contexts. In the Table below the adaptations are being addresses by principle.

Table 2. Amendments on the principles of competence-based education

1	<p>The competencies, that are the basis for the curriculum, are defined.</p> <p>A suggestion for amendment of this principle is to speak about the Job Competence Profile (JCP) and indicated in Box 1. Working with a competence profile, model or framework goes further than just presenting a list of competencies which are relevant for the curriculum. Having a profile has the advantage that it also can co-structure the curriculum.</p> <p>Furthermore, in this case (and similar previous cases) it appeared to be necessary to stratify the job. This is important to determine whether specialisation in the educational program is needed, or that a common program will suffice.</p>
2	<p>Core occupational problems are the organizing unit for (re)designing the curriculum (learning and assessment).</p> <p>Suggestions for amendment of this principle are:</p> <ul style="list-style-type: none"> • To speak about occupational problems as these are more general than vocational problems, and to explain the nature of the problems, being core problems in occupational practice; persuasive examples of problems which are used to define programme components may help to understand the power of this approach. • The problem-based nature of the competence-based curriculum conflicts with mono-disciplinary interests and perspective of lecturers. Special attention needs to be given to the importance of interdisciplinary education and the extent to which mono-disciplinary introductions to given science fields is necessary. The competence profile resulting from labour market and competence analysis should be used to guarantee that all disciplines which are relevant for the occupational profile get a fair share in the curriculum. It is the tasks of curriculum management to warrant this. • The issue of authentic assessment (next principle) should be related to the occupational reality. This needs stronger emphasis.
3	<p>Competence development of students is assessed before, during and after the learning process.</p> <p>Amendments of this principle which were suggested by the validation are the following:</p> <ul style="list-style-type: none"> • The value of assessment for learning needs to be incorporated in the description of this principle. • Assessment is typically seen as examination of knowledge and skills, whereas competence assessment also includes the component of attitude towards the professional field. • There are many assessment strategies; however, in the specification of the

	<p>assessment strategy special attention has to be given to the strategic alignment of the learning objectives, the curriculum content, the learning activities and the assessment methods.</p> <p>The level of competence assessment also has to be taken into account. The pyramid of Miller (1990), in which levels of knowing, knowing-how, showing-how, and doing are distinguished. In competence-based education students have to show their mastery of crucial competencies by authentic task performance.</p>
4	<p>Learning activities take place in different authentic situations.</p> <p>The latter finding needs further reflection in the future, as, if there are no facilities or resources to implement authentic learning e.g. via internships or field attachments, the nature of the competence-based education approach is considerably compromised. Experiencing the reality of the occupational field and practicing and further developing key competencies in an authentic working/learning environment is deemed essential in competence-based education. So if internships etc. are not possible, forms for simulated practice need to be in place, although these also require specific resources such as in this case educational greenhouses, fertigation systems, integrated pest management facilities and plots for field trials.</p>
5	<p>In learning and assessment processes, knowledge, skills and attitudes are integrated.</p> <p>In competence-based education which is preparing for jobs, occupations or professions, knowledge and skills are naturally included, but the integration of professional attitude development is not always obvious. Nevertheless, the professional attitudes of graduates of vocational and professional education are important in selection and placement processes of employers. As stated above, the integration of knowledge, skills and attitudes in learning and assessment is therefore a necessity. The way in which this can be achieved puzzles many educational practitioner however. But when designing competence-based curricula around core occupational problems, the integration of occupational attitudes is self-evident. Addressing attitudinal development in educational practice needs specific attention, and for these, specific learning outcomes can be formulated and assessed. So this principle does not need adjustment; the implementation of this principle however needs clear explanation, supported by examples.</p>
6	<p>Self-responsibility and (self)-reflection of students are stimulated.</p> <p>This principle clearly needs adaptation; in fact it needs adaptation in two ways. Firstly, self-regulation is dependent on the maturity and motivation of students. So in higher grades and education levels, there is more opportunity for and inclination towards self-regulation than in lower grades and levels. Individual differences also need to be taken into account as well. Secondly, culture plays an important role, since in certain cultures it is not common or even not just to have an independent interpretation of reality and plan one's own study career. In those contexts it is highly unlikely that self-responsibility and (self)-reflection are being valued, let alone supported. Nevertheless, if</p>

	students are being prepared for a competent professional life, a certain degree of self-regulation is necessary.
7	<p>Teachers both in school and practice fulfil their roles as coach and expert equally.</p> <p>The adjustments regarding the previous principle are also pertinent for this and the next principle. These principles imply a certain vision on the professional in society. They are seen here as independent practitioners, who need a certain set of key competencies, and who need continuous further professional development. According to this vision, lecturers should therefore support the development of the future professionals, and guide the learning process of their students. In this sense, lecturers should not only be content-matter experts who explain subject matter to students. They should also value the role of being a coach of the students, who helps them with their learning process. The adjustment here is that this vision needs to be shared; if not, the implementation of this principles is hampered, as well is the competence-based nature of the educational design.</p>
8	<p>A basis for a lifelong learning attitude for students is realized.</p> <p>This principle does not require further adjustment, albeit that it is difficult to realise in a resource-wise challenging educational environment. However, the teaching staff can easily explain to students that getting the diploma does not mean that they will stay competent as graduates. Further development is needed as the world of work is constantly changing, also in the South. Obviously, the inclusion of the development of a life-long learning attitude in educational programs is not easy, and needs special attention. Just mentioning that it is important for the future does not really help in most cases.</p>

In this validation study, in which stakeholder perceptions and labour market effects of design specifications were tested via replication logic, further longitudinal studies are needed. The development of the principles behind the matrix of competence-based education and the subsequent matrix took several years. The research was carried out in various PhD-projects and further validation of the matrix is still going on. Projects in which the matrix is tested serve as case studies. The validation research questions that guide the implementation continually circle around the efficacy of the design principles. By doing that we are building the knowledge base on the main characteristics of competence-based curricula.

During EDR as in the project we described there is ample opportunity to communicate with designers, users, recipients and general stakeholders of programmes in higher education about the meaning of certain principles, levels and further specifications as in the cells of the matrix we used.

An international education development cooperation context of the EDR project we conducted creates new perspectives as well as challenges. It is interesting to see that many educational problems are the same around the globe, but it is equally remarkable how teacher development teams are bound by their educational cultures and systems. In another publication (Mulder and Pachau, 2010) we have elaborated on the challenges of this project, which are about the long road to public approval of curricula in secondary and higher education which is not only caused by bureaucratic red tape, but also by sequencing of project activities, Human Resource Management (or rather: the lack thereof), teacher professional development and the benefits of international exposure to the floriculture sector, the sustainability of internships in relationship with lack of sources for financing transportation, accommodation and living expenses.

Notwithstanding the many hurdles the project had to take, it was very rewarding to see that the graduates of the first group all got employed, although some were dissatisfied with the labour conditions of their job. This indeed is an issue which would need to be solved by the association of flower exporters at sector level, but the question is whether collective labour agreements are feasible in this era of neo-liberalism. However, priority needs to be given to this issue to make the project results sustainable over time, because when the majority of the graduates feel that they did not make the right choice, this will have far-reaching repercussions on the floriculture programmes.

Two further lessons learned have to do with the broad needs assessment phase (including preliminary research, including needs assessment, context analysis, and literature review) in our project and with the cooperation between two different educational institutes. Regarding needs assessment, in Western societies the general is that experts and representatives from a certain industry can determine the curriculum requirements to a large extent. They are often requested to articulate education and training needs which are then aggregated to job, occupational, professional or competence profiles. However, it can happen that 'experts' do not have access to state-of-the-art information about an international sector as floriculture. It is also possible that the industry does not employ 'ideal' business models. Therefore, information of several stakeholders always needs to be considered against the background of the educational philosophy of the college or university. It is recommendable to find this out during the context analysis or as part of the preliminary research.

Regarding the cooperation of two different educational institutions, certainly when they are of different levels, such as a vocational college and a university, educational design terminology can be confusing. What the one would call a module, another would call a course unit, etc. In our project this problem was – partly – solved by proposing standard terminology from educational science and practice, so that both institutions could refer to that. As long as others do not have to work with the concept this works well, but during implementation of the programmes, when lecturers and administrators are involved who were not part of the design team, it gets more difficult. So, also in this project participation in educational design appeared to be essential, although participation has its borders.

Finally we would like to list the specific research methods which are recommended in follow-up research:

1. Qualitative multi-perspective iterative interviews for needs analysis; this has been done by interviewing individual stakeholders from their own perspective, and to use insights in the first interview in the later ones.
2. Stratification of the profession, group interviews for generating and structuring task and competencies lists; this was also done, resulting in the specification of various job profiles.
3. Large scale task performance surveys to triangulate the qualitative data; this was not done in this study because job holders population descriptives were not available, nor are large groups of individuals hard (if not impossible) to reach in rural areas in the case we described.
4. Testing sector-specificity of job profiles; in this case the stratification of the job profiles was sufficient, as it coincided to a large extent with the sectors at stake.
5. Job profile mapping; this was done in this study. For each job there one profile was developed.
6. Job picture development; this was not done in this case as the job and competence profiles were sufficiently clear.
7. Competence mapping. This was also done, resulting in the competence profiles described in this chapter.

Space in this chapter does not allow us to elaborate on that, but interested readers are referred to Mulder, Wesselink and Bruijstens (2005).

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