

## **Developing comprehensive competence-based education and training – some practical guidelines**

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This contribution aims at informing readers about a current education and training design approach which is based on theory building (Mulder, 2001; 2004; 2011), empirical research (Mulder, 2004; Biemans, Wesselink, Gulikers, Schaafsma, Verstegen & Mulder, 2009; Gulikers, Biemans & Mulder, 2009; Wesselink, Dekker-Groen, Biemans & Mulder, 2010; Mulder, Eppink & Akkermans, 2011) and practical experience (Mulder & Gulikers, 2010). It is about the development of comprehensive competence-based education, which is different from earlier attempts to develop competence-based education.

In many education development projects the notion of outcome-based or competence-based education is taken as a starting point. The advantage of the current (comprehensive and holistic) approach is that education and training programs will become more practice-oriented and relevant for finding or creating employment. The question however is what this education philosophy entails and how to go about the development of this kind of education. There are many questions about this approach, and we hope that this contribution will help university leaders, staff of education and examination quality departments, curriculum developers, faculty development staff, chairs of departments and department staff to understand the essence of the approach, see its potential, but also appreciate the complexity of the development and implementation process.

### **Comprehensive competence-based education and training**

In the dissertation of Wesselink (2010) the competence-based education philosophy is clearly described. The title of this dissertation indicates that there are more forms of competence-based education, and that we are dealing with a specific form of it: the comprehensive way of looking at competence-based education. That means that education and training should not be behaviouristic and comprise of a series of fragmented and atomized behavioural learning items. On the contrary, education and training should be meaningful and consist of larger units of related courses and course elements, which are aligned with the needs of the learners and society. For this reason the dissertation speaks about 'comprehensive' competence-based education and training. All components of that type of education should be viewed-seen from a holistic point of view, in which integral personal identity and professional development go hand in hand. Not only needs this to be an education philosophy, but it also has to be translated in to the components of curricula and courses: the definition of outcomes, selection and organisation of learning content, the organisation of teaching and learning, and the testing of educational achievement should be specified in a coherent way. That means all aspects of

the planning of education and training need to be taken into account, and no component should be forgotten, as this would influence the quality of the education and training program negatively.

This reflection is especially important since competence-based education is developed in the 1970s and since then accused for exactly that what we like to dismiss: the behavioural nature of competence. However, the competence-based education philosophy was introduced because of the linkage between education and the labour market. Universities and colleges in the United States had observed a disconnect between what was taught at school and what was needed in the labour market. Curricula were mostly content-driven, which led to one-sidedness. More emphasis on the ability to apply knowledge in practice was needed.

However, the elaboration of this education and training philosophy went wrong in many ~~places~~ ways. Series of small tasks were listed ~~and~~ sStudents were expected to perform these and tick the boxes. This went against broad coherence, broad development, integration, interdisciplinarity, and higher levels of reflection.

Then why do we stick to the concept of competence-based education and are we not using a different concept which represents the notions we have about education and training? That is because competence is a powerful concept, indicating that students have to be capable of understanding the content of education and training programs and to apply the knowledge they have gained during these programs in practice. We see competence as a holistic concept. It is about the integral capability of persons to perform adequately in a given context. This is important to understand, since many universities, schools and training ~~centers-centres~~ teach students, pupils and trainees certain knowledge and; test whether they master that knowledge, without assuring that they can apply that knowledge in the real world ~~of their present or future jobs or professions. This situation has been amplified by t~~The structural ~~systems~~ disconnection between the world of education and training and the world of work and the society has amplified this situation. However, graduates should not only be certified (as tested based on their knowledge), they should also be capable to perform according the expectations of the society and the labour market.

The current critique on competence-based education is that it over-emphasises self-regulation, problem solving, project-based education, portfolio-development and assessment. More emphasis on knowledge ~~would be is~~ needed. However, these critiques are largely based on implementation practices which are confounded with austerity measures. Various directors of especially vocational and professional education institutes embraced the notion of competence-based education as they believed that this would ~~go together with allow~~ a lower number of teaching hours and less emphasis on educational testing. This resulted in *laissez-faire* education practices against which students (and parents) protested. This implementation practice of competence-based education however went against principles of comprehensive competence-based education as defined by Wesselink (op. cit).

## Competence-oriented and competence-based education

A distinction that is not being made often, is that between competence-oriented and competence-based education. With competence-oriented education it means that an education or training program aims at achieving competence. The learning outcomes include competence-statements. The curriculum-design and learning tasks may be enriched with competence elements, and educational testing may include these as well. Competence statements of this nature are often behavioural statements, like students need to be able to think analytically, have a certain level of stress-tolerance in performance situations, be creative, etc. Although these competence domains are very relevant, the disadvantage of this approach is that competencies are defined without specifying them further and relating them to a specific context, which results in rather vague intended learning outcomes and a limited elaboration of the curriculum and instructional design consequences.

Competence-based education however takes competence statements as starting point for the design, revision or innovation of education and training programs. Occupation and competence profiles are the foundation upon which the design of curriculum and instruction are based. Content, job and task analysis are very often the starting point of the development of comprehensive competence-based education. The results of those analyses are taken into account for making decisions regarding education and training content. Content analysis has to be taken into account carefully, as it represents the supply-side of education and training, or to put it differently: the subject matter which is relevant to learn. Neglecting this would lead to the major pitfall of needs analyses in which wishes of the client system of education and training are being collected. We have experienced this pitfall in education development projects in the field of horticulture in East Africa. We wanted to find out the needs of farmers and went into the farms to and asked them what content they wished to include in education and training programs. We discovered that farmers were expressing their wishes based on the state of their business, which were sub-optimal in several instances. Uncritical inclusion of the wishes of farmers would then lead to sub-optimal curriculum and instruction content. Education and training institutes have to combine information from job and task analysis with content analysis, which in turn has to be based on the current state of disciplinary knowledge in the field. In other words, there should be a balance in terms of demand and supply thinking in the development of comprehensive competence-based education and training.

## Design principles

The comprehensive competence-based education design principles we have developed are the following (this version is from Mulder & Gulikers, 2010; see for further elaboration of the principles Wesselink, 2010; and for a further validation and the expansion of the principles Sturing, Biemans, Mulder & De Bruijn, 2011).

1. The occupational profiles and competencies that are basis for the curriculum are defined.

This principle means that an occupational profile is put together with participation of actors in the sector and occupation, and that this profile is frequently aligned with regional and local

actors in practice, including and reviewed against the major trends. This profile has to be used during the (re)design of the curriculum. In an academic program one may have to deal with various occupational fields, from research and management, to engineering, teaching and extension. Then the program has to accommodate the variety of these occupational fields by internal differentiation based on interests of students in the program.

2. Vocational core problems are the organising unit for (re)designing the curriculum

This principle means that core professional problems or essential responsibilities and tasks in the occupations have been specified and that these are leading for the (re)design of the whole curriculum of a training program.

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

This principle implies that assessment of the experiences of students is done before they enter a program or even a course, during the courses, and at the end of the courses or at the end of a semester, year or program. Assessment at the entrance of a program can help to accommodate the study trajectory or even learning tasks for the individual student. Assessment during the courses is taking place all the time, and helps the teacher to fine-tune feedback and next learning steps for the students. Assessment after the course is also taking place already, because those are the exams. Competence-based assessments however may be of a different nature than the traditional paper-and-pencil exams.

4. Learning activities take place in several authentic situations.

This principle means that learning activities take place in a diversity of authentic settings (which means: in practice) as much as possible. These learning activities should be clearly related with the theoretical learning activities in the classrooms. This kind of practical learning increases the practical experience of students which can increase their motivation significantly.

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

This principle means that graduates will perform learning tasks in which they will develop theoretical knowledge, practical skills and working attitudes together. These three aspects of competence will have to come back in the curriculum design process, in the learning process and during the assessment.

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

This principle means that students are responsible for their own learning process based on their own learning needs. Approaching students in this way, as self-responsible adults, will increase their ownership of the educational program and their motivation.

7. Teachers both in schools and practice fulfil their roles as coach and expert in balance.

This principle means that teachers stimulate students to formulate learning needs and to manage their own learning processes based on careful self-reflection. For many teachers this is not easy, since they are trained as stand-up deliverers of knowledge. Much research has shown that plenary instruction for large groups is not always very effective. How to change this, to act as coach, within programs with limited resources, is not easy, but certainly feasible in my opinion.

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

This principle means that during the educational program learning skills and (labour) identity are developed, that reflection on the future career of the students has taken place, and the willingness for further professional development is a natural given. The diploma of an MSc, or BSc should not be perceived as the license to perform for a life-time, but that it is just the entry point for a further life-time learning itinerary.

## **Job level stratification and occupational profiles**

As stated, an essential analysis to be performed in comprehensive competence-based education development is about the occupations for which an education and training program is established and the competence needed for effective performance in those occupations. This analysis is of multi-method nature. It results in the definition of the levels and nature of jobs for which given education and training programs (want to) prepare. In a project in East Africa in the field of horticulture at Diploma and Bachelor level we distinguished the following job levels and jobs.

### **Supervisory level**

Greenhouse supervisor (GS) – A greenhouse supervisor is in charge of one or more greenhouses. Within each greenhouse (s)he is responsible both for the flower production and the people working there. The main tasks of a greenhouse supervisor are to supervise the workers, to control the whole flower production from the nursery till the flowers are sent to the grading hall, and to maintain a proper administration on everything that occurs in the greenhouses.

Fertigation supervisor (FS) – A fertigation supervisor is responsible for the irrigation and the application of fertilizers to the flowers. (S)he has to make sure the right amount of the right fertilizer is being applied at the right time. Besides, other main tasks are to supervise the workers that are within the fertigation department and to maintain a proper administration on the inputs and outputs related to fertigation.

Spraying supervisor (SS) – A spraying supervisor is responsible for the prevention, identification, and control of pests and diseases. Furthermore (s)he is responsible for the health and safe work environment of his workers, and has to prevent any damage that could be brought to the environment.

Post-harvest supervisor (PHS) – The working area of the post-harvest supervisor consists of the grading hall and the cold store. The post-harvest supervisor is responsible for a correct packing of the cut flowers, making sure the flowers are ready for export. (S)he should supervise the workers and take care of proper hygiene and temperatures.

Trial supervisor (TS) – The trial supervisor is responsible for the correct execution of the trial protocol. (S)he makes sure the trial is set up according to the specifications, the crops are correctly taken care of, the data is reliably collected and documented, and takes care of the data analysis and interpretation. Furthermore (s)he supervises the workers that care the crops involved in the trials, with special emphasis on the specific evaluation parameters of the trial (spraying/post-harvest/production/etc). (S)he reports the results to the production manager.

### **Managerial level**

Farm manager (FM) – A farm manager can be seen as the replacement of the owner. A farm manager in fact manages the whole farm, covering the areas of finances, human resources, public relations, and strategic development. And (s)he should control all departments (production (via production manager), administration, accountancy, maintenance, etc).

Production manager (PM) – A production manager is in charge of the whole production process of the flowers. (S)he steers all supervisors and has regular meetings with them. Moreover (s)he is responsible for the training programs of both the supervisors and (indirectly) the workers. Furthermore (s)he should continuously follow the development of new varieties, research/developments on new production processes, know the export market and, when necessary sets up on-farm trials.

Based on in-depth interviews with a representative sample of multiple stakeholders task and competence lists were developed as listed below.

Task list for supervisors within the floriculture sector

Responsibilities	Tasks	GS	FS	SS	PHS	TS
Supervise workers						
	1 Train workers (on-the-job)	++	++	++	++	++
	2 Check the workers on (removing the open flowers, removing the suckers, bending, removing fallen leaves, hard/soft pinching, weeding, sweeping the floor, keeping the beds clean, cutting the dry stems, nipping, dipping secateurs in chloride)	++				+
	3 Check the workers on (mob the leaves, measure the length, sort, bunching, trimming, bring flowers to cold store)				++	+
	4 Have daily meetings with workers	++		++		
	5 Cross checking flower quality	+			++	+
Technical tasks						
	15 Identification of pests and diseases / scouting	++		++		+
	16 Take care of a uniform cut stage	+				+
	17 Store flowers				++	+
	18 Quality control				++	+
	19 Packing				++	+
Reporting and administration						
	35 Register harvest quantities per person and per type	++				
	36 Make report of pests and diseases	+		++		+
	37 Keep records (inputs, outputs, production)	++	++	++	++	+
	38 Make weekly and monthly spray reports			++		+
	39 Make pack list for every export				++	

Competence list for supervisors within the floriculture sector

Core competence	Competence	GS	FS	SS	PHS	TS
Social domain						
	1 Training skills	++	++	++	++	++
	2 Leadership skills	++	++	++	++	++
	3 Communication / interpersonal skills	++	++	++	++	++
	4 Intercultural communication skills + Know how to deal with tribalism	+	+	+	+	+
Technical domain						
	5 Able to apply basic computer skills	+	+	+	+	++
	6 Able to use irrigation computer systems		+			*
	7 Able to store flowers properly before export				+	*
	8 Know the life cycle of pests and micro-organisms that cause pests and diseases			+		*

	9	Able to identify pests and diseases and their stage (scout)	++		++		*
<b>Other</b>							
	33	Able to speak and understand English and a local language (preferably Luganda or Swahili)	++	++	++	++	++
	34	Ability to meet deadlines	++			++	++
	35	Accept responsibility and liability for results of actions	++	++	++	++	++
	36	Open to instructions	+	+	+	+	+

\* The TS must be a reasonably all-round person with general knowledge of the different farm activities. Special competences (indicated by an \*) might be required depending on the type of trial to be conducted: fertilization trial, pesticide trial, post-harvest trials, etc.

Since occupational stratification, tasks listing and competence profiling are normative activities (they state how occupational, task and competence profiles *should* look like), they need to be validated, which is usually done in curriculum workshops or conferences. This is not new; and [it is](#) a conditional element in the process of accreditation of educational programs in many countries around the world.

### Curriculum and training program design and revision

When a totally new education program is being developed, the job, task and competence information can be used in a free way to define the key educational objectives, course titles, learning outcomes and to specify course content and assessment strategies. In many education development projects however, a curriculum needs to be revised, which is far more complex than developing a new one. Changing a given curriculum has implications for the contributions of departments, teams and teachers, and often goes against the regarding interests of the groups and individuals involved. Therefore, curriculum revision goes hand in hand with resistance against change, and advocating current practices or at least defending the contribution of the given content-matter domains. We have experienced [this](#) in changing horticulture education programs towards the task and competence needs as listed above. Especially the necessity of inclusion of social science courses in the field of management, economics, communication, marketing, human resources, training and entrepreneurship was debated to a large extent by pure horticulture scientists in the programs, although including these courses seemed to be obvious for enabling the preparation of students for supervisory and managerial roles in horticulture.

### Curriculum formats

Regarding curriculum formats for comprehensive competence-based education, there are many varieties. The number of varieties increase the more specific the curriculum development level. At the level of a study handbook, courses can be described by the following *course descriptors*:

- title;
- contact person;
- lecturer(s);
- examiner(s);
- level (phase or year of the study program);
- number of credits ;
- the nature of the course in the study program (compulsory, restricted optional, optional);
- assumed prerequisite knowledge;
- continuation course(s);
- content (as an abstract of the course content);
- learning outcomes (specifying content and attainment level);
- learning activities (lecture, practical, self-study, projects, etc.);
- examination (attendance, written exams, practicals, output of exercises, papers, case analysis, authentic task performance, etc.);
- literature.

The description of one course can be around 40 lines.

Each course can be specified using the following format for *course guides*:

- Course code
- Credits
- Teacher(s)
- Semester (or other unit of the period system)
- Place and time
- Course website (if any)
- Date and place of exam
- Content specification
- Target group(s)
- Learning objectives
- Literature
- Teaching and learning activities
- Examination strategy (listing of components of exam and the weight of the components in the final mark)
- Time allocation (by classes, self-study, assignments and exam)

A course guide can be around 4 pages A4.

The planning below the course guide is seen as a matter of the lecturer. He/she has ample freedom to elaborate the course guide into lesson or lecturing plans. The formats for these also vary.

### **Number of credits**

It is remarkable that in many countries the number of credits of a course indicates the number of lecturing hours. This is not compatible with the European Credit Transfer System. In this system one credit equals 28 hours of *study time* (of students). Lecturing hours is a component of that. But self-study (studying literature and lecturing notes for instance) or project work is also included. A Bachelor program of three years generally is 180 credits, a Master program of two years 120 credits. Internships and Thesis research ~~is~~are also included in the credits. An



internship may count for 24 credits, and a master thesis can also count for 24 credits, although these figures may vary. A typical basic compulsory course is 6 credits. But this may vary as well. Project education in the Master program may be 12 credits. A minor (a series of 4 related courses) in the Bachelor program may be 24 credits. As will be clear, all these figures may vary.

### Assessment

To finalise this contribution, some guidelines about assessment ~~will be~~ are given. As stated, competence-based education intends to contribute to the development of the capability of students to apply (academic) knowledge in practice. If this is taken seriously, the examination strategy has to be adjusted to this aim. That means that it is not sufficient that students are able to answer written exam questions. They need to show that they are able to perform more authentic tasks. Of course (academic) knowledge is needed, but the application of that knowledge in simulated or authentic situations should be assessed as well. This can be done in a formative way (assessment for learning) and in a summative way (assessment of learning results). When competence is assessed in a real context, we speak about authentic assessment. To develop authentic assessment and to include trained assessors to evaluate student performance additional expertise is needed. In many cases teachers who regularly develop exams are not used to develop authentic formative or summative assessment. Intensive professional development of lecturers is needed in this respect, or else assessment development has to be outsourced~~s~~, which can be an expensive solution.

### Conclusion

Preliminary research (Mulder, Eppink & Akkermans, 2011) has shown that the comprehensive competence-based curriculum development process is complex but rewarding. It is complex because of the fact that multiple stakeholders have to advise a curriculum development team about an education plan which does not exist yet, for a society and labour market which is rather dynamic, in a context of education which is bound by regulations and procedures, accreditation processes which are not always transparent, and innovation resources which are limited. It is rewarding since the development process is based on a firm foundation regarding labour market and occupational analysis. Job and competence profiles are instrumental to align potential curriculum content to needs in the society and the world of work. As such, the resulting curriculum is regarded as being relevant for personal, career, community and sector development. Furthermore, graduates seem to get jobs in the sector in which they can develop themselves. Impact assessment however also shows a number of challenges regarding labour conditions, the added value of qualifications in a developing economy, and the sustainability of graduate retention within the sector. Further research is needed and planned to look into the impact of comprehensive competence-based education on employability, career development and sector development.

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