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Chapter 50

Competence Theory and Research: A Synthesis

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50.1 Introduction

The parts and Chapters in this volume illustrate the fact that competence-based vocational and professional education is a worldwide innovation. Part I showed that there are many conceptual foundations and theoretical perspectives and that various authors have different views on the pros and cons of competence-based vocational and professional education. Especially Part II contains contributions from all parts of the world, like America, Europe, Asia and Africa. Chapters from Australia are included in Part I. Part III showed that the competence-based education philosophy cuts across many key aspects of education systems, such as the use of competence frameworks for curriculum development, the recognition of prior learning, quality improvement and effectiveness measurement, the areas of learning and the fields of knowledge and skills, as well as teacher support, teaching and learning. Part IV showed that the competence movement entered practically all subject matter domains in vocational and professional education.

The volume has also shown the features of competence-based education. These are:

1. The availability of a competence framework which specifies the competencies which are required for effective performance in an occupation or job (e.g. the Chapter of Perrenet et al.).
2. A framework to assess the current level to which an educational programme is competence-based and to facilitate the decision-making process regarding the quality improvement of the programmes in the direction of CBE (e.g. the Chapter of Wesselink et al.).

3. A strategy for revising existing curricula in the direction of CBE, with sufficient attention for the integration of theory and practice (e.g. the Chapter of Gessler).
4. Measures to make competence-based learning attractive, such as by gamification, and profound, such as by supporting argumentation competence development (e.g. the Chapters of Sailer et al. and Noroozi et al.).
5. Measures to enhance self-regulated learning in CBE (e.g. the Chapter of Nokelainen).
6. A system for the assessment of prior learning, which can measure the competencies a candidate for a training, education or development programme already masters; such an assessment should lead to a personal study advice and where possible and appropriate lead to exemptions from certain classes or courses (e.g. the Chapter of Bohlinger).
7. A system for formative competence assessment, to monitor competence growth, and a system for valid and trustworthy authentic summative assessment, to test the actual mastery of the key competencies for a job or occupation of the candidate (e.g. the Chapter of Van der Vleuten et al.).
8. An instrument for the laddering of competencies across several education levels to distinguish the meaning of those competencies at these different levels (e.g. the Chapter of De Jong et al.).
9. A system of mature competence management for the directors, managers, teachers and support staff in the organisation, with adequate competence feedback and development instruments (e.g. the Chapter of Runhaar).

This Chapter will give further recent examples of developments in competence-based vocational and professional education. It will then answer the questions regarding this innovation which were raised in Chapter 1. Next, common misunderstandings about competence-based education are discussed. Subsequently, further research for competence-based vocational and professional education is presented. Next, further observations and comments are given, after which the final conclusions of this volume are formulated.

50.2 Competence-based Education: A Global Innovation

This volume shows that the competence movement is more alive than ever. Not only are the member states of the European Union using this educational philosophy, countries in the Americas, Australia, Asia and Africa are also working with it for the development of their national qualifications frameworks, their curriculum design and assessment practice. During the last 10 years, and even today, there have been and still are many new competence-based initiatives in vocational and professional educational policy-making and competence framework building. There are many examples of this.

50.2.1 European Union

First of all, in 2006 the EU defined eight key competencies (or competences; as has been said in Chapter 1, the European Commission uses the spelling ‘competences’ instead of competencies) (<http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=URISERV:c11090&from=EN>), which are (1) communication in the mother tongue, (2) communication in foreign languages, (3) mathematical competence and basic competences in science and technology, (4) digital competence, (5) learning to learn, (6) social and civic competences, (7) sense of initiative and entrepreneurship and (8) cultural awareness and expression. The Commission stated that the key competencies are interdependent and they include ‘...critical thinking, creativity, initiative, problem solving, risk assessment, decision taking and constructive management of feelings’.

Next, in 2008 this was followed by the Communication of the Commission ‘Improving competences for the 21st Century: An Agenda for European Cooperation on Schools’, which reiterated the Commission’s focus on key competencies. The Communication proposed to ‘increase levels of reading literacy and numeracy..., reinforcing transversal as well as subject-based competences, particularly learning-to-learn; and adopting a comprehensive approach to competence development, encompassing curricula, learning materials, teacher training, personalised learning, and assessment techniques’ (op cit, p. 7).

In the ‘Synthesis Report on Peer Learning Activities in 2007’ from 2008, being part of the Education and Training 2010 Work Programme of the European Commission, the first lessons were shared on the status of key competences in member states’ lifelong learning strategies and curricula, referring to that as a change of educational paradigm, on the challenges schools were facing regarding the introduction of key competencies, and on support measures which could be used by schools to implement a competence-based education approach. The theme of key competencies was followed up in the Education and Training 2020 work programme of the EC. As part of this programme, the thematic working group on ‘assessment of key competences’ published a literature review, with a glossary of terms and examples of assessment practice (http://ec.europa.eu/education/policy/school/doc/keyreview_en.pdf). In another working document of 2012, the commission published policy guidelines on the assessment of key competencies in initial education and training (<http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52012SC0371>). Interesting to see is that the authors of this document define key ‘competences’ as ‘...a combination of knowledge, skills and attitudes appropriate to a specific context’. This definition is in line with the definitions given in Chapter 1, but different from how competence is defined in documents regarding the European Qualifications Framework, where ‘competences’ are seen as juxtaposed to knowledge and skills.

Currently, the theme of key competencies is included in the 2015 Riga Conclusions (http://ec.europa.eu/education/policy/vocational-policy/doc/2015-riga-conclusions_en.pdf). These conclusions are on the new medium-term deliverables in vocational education and training policy-making until the year 2020. These deliverables are a follow-up of the review of the deliverables which were set out in the Bruges Communiqué of 2010. Key competencies are mentioned in the fourth policy option to ‘...further strengthen key competences in VET curricula and provide more effective opportunities to acquire or develop those skills through I-VET and C-VET’ (op cit, p. 9), which are initial and continuing vocational education and

training. The Riga Conclusions suggest quite wide opportunities for key competencies as policy option. According to the Conclusions, ‘Concrete actions could, for example, include assessing the place of key competence in VET curricula, work on improving levels of basic skills of VET students as exemplified by PISA and PIAAC, strengthen provision of key competencies in VET, particularly in work-related training, promote innovative approaches to provide combined key competencies and work-specific skills, devote special attention to the development of entrepreneurial skills, etc.’ (op cit, p. 9).

50.2.2 Sectoral Initiatives

Next to the generic European key competence agenda, there are also initiatives by sector organisations which are focused on certain competence domains, such as information and communications technology (ICT) (CEN 2014). Developed by CEN, the European Committee for Standardization and published in 2014, the e-Competence Framework 3.0 (<http://www.ecompetences.eu/>) is developed to map the competencies for ICT jobs. The e-Competence Framework defines competence as ‘...a demonstrated ability to apply knowledge, skills and attitudes for achieving observable results’, which is similar to the definition given by Cedefop (2014 p. 47): ‘The ability to apply learning outcomes adequately in a defined context (education, work, personal or professional development)’. The e-Competence Framework distinguishes 40 competencies defined on five mastery levels and is developed to give a transparent picture of what is needed in ICT professions in organisations in the private and public sector.

Another example of a sectoral competence framework is the European Qualification Standards for Logistics Professionals, developed by the European Logistics Association (ELA 2014). Developed and agreed by the logistics industry, this competence framework (<http://www.elalog.eu/elaqf-qualification-standards>) also pictures the needs of professionals to be able to deliver effective workplace performance. The standards included in the framework are outcome based and the foundation for competence assessment. As in any accreditation of prior learning programme, the assessment is conceived of as being independent from education trajectories.

50.2.3 Beyond the European Union

There are also examples of competence work beyond Europe, such as the OECD competency framework (OECD 2014). The Organisation for Economic Co-operation and Development (OECD) applied a competence approach to map the competence requirements of its own staff (http://www.oecd.org/careers/competency_framework_en.pdf). The OECD categorises its jobs in three broad families: (1) executive leadership; (2) policy research, analysis and advice; and (3) corporate management and administration. All jobs need certain competencies, and these are divided into technical competencies and core competencies. Technical competencies are specific for a certain job, whereas core competencies are the capabilities that are relevant

in all jobs within the organisation, although their importance may vary by job. There are 15 core competencies, divided in delivery-related, interpersonal and strategic competencies. The delivery-related competencies are aimed at achieving results and are analytical thinking, achievement focus, drafting skills, flexible thinking, managing resources and teamwork and team leadership. The interpersonal competencies are aimed at building relationships and consist of having a client focus, diplomatic sensitivity, influencing skills, negotiation skills and organisational knowledge. The strategic competencies are aimed at planning the future and comprise of developing talent, organisational alignment, strategic networking and strategic thinking. For all core competencies behavioural indicators are defined at five job levels. Level one includes jobs like assistants, operators and secretaries, whereas level five includes heads of departments, counsellors, deputy directors and directors.

The United Nations Development Programme (UNDP) also includes policy recommendations in the direction of competence-based education. In the 2015 contribution to the United Nations Economic and Social Council (ECOSOC), is recommended ‘...provision of appropriate learning quality, skills development and education-to-work transitions is critical in order to establish strong links between education and employment outcomes, particularly for youth. This can be accomplished through the establishment of a competency-based system for training and retraining in the short to medium term to increase the coverage and scope of formal economy-sector led education and training programmes and through partnerships with employers. This will enable the poor to access jobs in higher productivity sectors with increased wages in the longer term’ (ECOSOC 2015).

Another United Nations organisation, the International Labour Organization (ILO), also implements competence-based education initiatives, such as in the competency-based technical-vocational education and training (TVET) project in Bangladesh (ILO 2012). This project was part of the TVET reform which was initiated by the Bangladesh government.

Individual countries are also active in implementing competence-based education, such as Ethiopia, which is revising its higher education curricula, using principles for modular education (HESC 2013). It is remarkable that this TVET policy document contains much of the thinking of what has been named in Chapter 1 as ‘functional behaviourism’. It seems as if the newer waves of conceptualising competence-based education have not entered the debates in TVET policy development in this case.

UNEVOC is supporting TVET reform in many developing countries, and competence-based education is one of the themes this organisation promotes. Wahba (n.d.) developed competence standards for TVET, and via the search engine of UNEVOC, many examples of implementing competence-based TVET initiatives can be found (see <http://www.unevoc.unesco.org/gosearch.php?ie=UTF-8&q=competence-based&hl=en&sa=ok>).

50.3 Answers to the Questions in This Volume

In Chapter 1 eight questions were listed which were thought to be relevant to discuss. Answering these questions should help to advance the field of competence-based vocational and professional education. The parts and Chapters of this volume offer a wealth of information to address the questions, which will be done in this section.

The questions were:

1. What are the key drivers for the competence movement and competence-based education?
2. What are the key dimensions by which conceptions of competence differ? What are the theoretical backgrounds and origins?
3. Are international and national policy debates on the competence-based education agenda sufficiently focused and coherent?
4. What is the value added of competence-based education for increasing the alignment of education and the world of work and the transition of graduates into (self)employment?
5. What is the role of competence frameworks and standards in the redesign of vocational, professional and higher education programmes?
6. Which models for competence assessment are helpful for the measurement of student achievements in vocational, professional and higher education programmes?
7. What are distinct regional/national approaches of competence-based education and development (the UK, Continental Europe, the USA, Australasia, Africa)?
8. What is the state of research regarding competence-based vocational, professional and higher education and what outcomes can be reported?

These questions will be answered in the following sections.

1. Key drivers for the competence movement and competence-based education

There is one major driver of the competence movement, which is to align education with the world of work. Labour market needs – or more generally, societal needs – are very often mentioned as being relevant for educational planning and curriculum development. Furthermore, competence is seen as an important factor of competitive advantage. Not only does this hold for (the metaphor of) the core competence of the organisation, key competencies of individuals are also seen as their personal strengths with which they can function and excel and find a place in the labour market.

However, there are some remarks to be made. The relationship between education and the labour market is of dynamic nature. There are constant changes in the world of work, caused by crises in the economy, reorganisations of companies, the organisation of work, changes in technology and declining labour rights. But there are also permanent changes going on in education, such as broadening or focusing educational programmes, reprogramming and renaming study programmes, mergers and scale enlargement of educational institutions, internationalisation of study programmes, commodification of education, online learning, peer learning and authentic assessment. The world of work does not have a one-way influence on the world of education; the relationship is reciprocal. Education prepares young generations

for society, who have their influence on what is being done in the world of work. Young graduates take their innovative ideas along into society and use and develop these further during the course of their early career. This concurs with the view of Vonken in his Chapter where he speaks about the two sides of competent action as (1) coping with a given situation and (2) generating a situation itself. This view is consistent with the term Gestaltungskompetenz, or shaping competence, which enables people to shape their environment and the future, which is particularly applied in the context of education for sustainable development.

Furthermore, especially vocational and professional education institutions play a role in the innovation in regions by providing their expertise in the supervision of internships and applied research and development projects. These forms of regional collaboration of stakeholders, collective knowledge co-construction and hybrid learning configurations are getting more and more popular.

Apart from the dynamic relationship between education and work, education has to deal with a multiple set of stakeholders, amongst which are the students and their parents, the teachers, the state and various administrative institutions and nongovernmental organisations. Educational programming is a political process in which the interest of all stakeholders involved needs to be taken into account. This makes that the needs of the world of work should not dominate educational policy and practice; societal needs, scientific developments, students' interests, talents and personal needs and life skills in general should also be reflected in decisions around the content and practice of vocational and professional education.

Finally, alignment of the world of work and education should not be done in terms of preparing students for the labour market only, since the labour market itself is structurally changing. Receding employment rights, reorganisations and migration, but also creativity and market opportunities, make entrepreneurship becoming an interesting alternative or deliberate choice for employment. Gradually, older teachers, who have in fact avoided risk taking in their career by choosing for a relatively safe employment contract, are gradually getting convinced that there is an enterprise market next to the job market for which vocational and professional education can prepare. Younger teachers who are suffering from the fact that they are getting temporary labour contracts for ever longer periods of time may not perceive education as a safe employment provider at all anymore. As a consequence of this, they may also find education for entrepreneurship more important although their premier interest may stay to get a permanent employment contract.

A key argument for maintaining a competence focus in vocational and professional education is that knowledge alone is not enough. Graduates must also be able to apply that knowledge in professional task or problem situations. So institutions for vocational and professional education should not only focus on knowledge delivery, they must include practicums, field attachments, internships and projects in their programmes by which the students learn to apply their knowledge in reality and assess their competence by authentic assessments as

much as possible. In this way only can education protect itself against criticisms that it produces graduates who are licensed but not at all competent.

2. Key dimensions of conceptions of competence, theoretical backgrounds and origins

There are many differences in the definitions, theoretical backgrounds and origins of the competence-based education philosophy. The key dimensions by which conceptions of competence differ are the following:

1. *Centrality*: the degree to which a competency is part of the central competence base of a professional. This dimension refers to the position of competencies in all professional competence of an individual, which can range from central to peripheral. Central competencies are essential for effective performance and being used frequently, whereas peripheral competencies are less important.
2. *Contextuality*: the degree to which the meaning of competencies is generic or context specific. There are rivaling approaches to search for situation-specific or generic competencies to explain or predict performance (see the different approaches of Bartram and CanMeds as indicated in Chapter 1). There are no strict rules to determine whether competence needs to be generic or specific. The answer to this question lies in the context in which the competencies are being used. Human resource instruments tend to emphasise the generic nature of competence (see also Bartram and Roe 2008), educational programmes the specific nature of them. There is a high consensus though that competencies actually get meaning in a specific situation.
3. *Definability*: the degree to which desired competencies can be defined. There are critics who contend that it is impossible to define competencies, which resemble the critiques of opponents of the learning objectives movement in the 1970s; however, education has defined educational outcomes already for decades, and based assessment practices on these outcomes by which educational achievement was measured.
4. *Developability*: the degree to which a competency is developable or seen as a fixed trait. Trait psychology tries to explain human behaviour based on relatively fixed personal characteristics, whereas competence theory emphasises the developmental nature of competence; obviously, competence development which is not based on talents of individuals will go at a high cost.
5. *Dynamic nature*: the degree to which competence is triggered by or expressed in certain circumstances. There are various factors which make that competence is actually being used in specific situations, which include for instance culture, trust, opportunity, affordances, expectations, power, perceptions, intentions and rewards.
6. *Knowledge inclusion*: the degree to which knowledge is considered to be important in professional competence. Implementations of competence-based education may have neglected the role of knowledge in competence, but it is obvious that a sound knowledge base is an essential ingredient of professional competence.

7. *Measurability*: the degree to which competencies can be measured. According to some it is utterly impossible to measure competence; others claim that competence can be validly and reliably be inferred by observing behaviour, by self-assessments or by performance tests.
8. *Mastery level*: the level to which competence is achieved. According to some critics, there is a tendency of focusing on minimal mastery levels by using competency standards, leading to the risk of minimalism in education. On the other hand, there is a difference between mediocre, sufficient, adequate, good, very good and excellent mastery of competencies.
9. *Performativity*: the degree to which competence is related to performance. Since many relate competence to effective or superior performance, there is a risk that education is exclusively oriented towards achieving higher levels of performance in only those domains which are observable and measurable.
10. *Transferability*: the degree to which competencies can be successfully applied in professional situations. Transferability is related to the generality of competencies; the more generic, the more transferable they are.

However, there seems to be a common understanding that competence can be seen as a set of capabilities (or capacities as indicated by Roe 2002) which are necessary conditions for effective performance, although there are variations on this understanding, such as proposed by Weinert (2001) (as mentioned in the Chapter of Seeber and Wittmann), who saw competencies as necessary prerequisites for successfully meeting complex demands and who added motivational, moral and volitional components to the construct of competence, which leads Seeber and Wittmann to the conclusion that personal traits, capabilities, knowledge and skills are included in the construct. Adding complexity to the definition of competence is in principle not wrong, although it is a restriction, as competence is also needed while meeting noncomplex demands. Adding a moral dimension is also correct, as it is consistent with the taxonomy of the affective domain (Krathwohl et al. 1973), within which the highest level is internalising values, and related to the attitudinal dimension of the definition of competence in Chapter 1 of this volume. But adding motivational and volitional components to the definition seems to be inconsistent with the theory of White (1959), which states that competence is a motivation-and-will-driver, but not the motivation and will itself. Children want to learn to walk and speak, but that wanting is not the competence of walking and speaking itself. Furthermore, in the context of high-performance work systems, Appelbaum et al. (2000) also differentiate ability (cf. competence), motivation and opportunity (to participate), which by discretionary effort lead to firm performance (Paauwe and Boselie 2004).

In mathematical terms Appelbaum et al (op cit) say $P = A \times M \times O$, whereby P (Performance) is a product of A (Ability), M (Motivation) and O (Opportunity).

Translating this to this Volume on which is focused on competence as performance requirement this formula can be extended to

$$P = C_{ksa} \times O_{rpt} \times M_{ieo}$$

whereby P (Performance) is a product of C (Competence, consisting of knowledge, skills at attitudes), O (Opportunity, including resources, positions, task assignments), and M (Motivation, including incentives, expectations, objectives).

However, there seems to be disagreement about the use of standards related to competence. Much of the criticism from the UK (as formulated in the Chapters of Hyland and Day) seems to be concentrated on this. On the other hand, there are advocates on the use of standards in competence-based education, such as Fukahori (2014), who point at the increased international transparency and comparability of qualifications. In his Chapter, Vonken even states that everyone can be considered to be competent, only to different degrees. So he sees competence as a continuum of mastery.

Although competence and performance standards may have played a dominant and questionable role in the UK debate on competence-based education, competence mastery in itself is not limited by standards; on the contrary, competence can be mastered at varying levels, including levels of excellence and brilliance.

Theoretical backgrounds and origins described in this volume are manifold. Theories of social constructivism and learner agency (Billett), action theory (Vonken), professional expertise (Evers and Van der Heijden), capabilities (Cairns and Malloch), epistemology (Bagnall and Hodge), mindfulness (Hyland), professional development (Day), critical economy (Avis), integration (Hager) and alignment (Mulder) show the wide variety in this respect. Various of these theories go back to early notions of industrial competency (Dewey 1916), motivation psychology (White 1959), interpersonal competence and competence acquisition (Argyris 1962, 1965a, b, 1968), the lack of potential assessment in promotion (Peter and Hull 1969), the lack of prognostic validity of intelligence testing (McClelland 1973), worthy (cost-effective) performance (Gilbert 1978), education quality improvement (Grant et al. 1979) and competence in various domains, such as language and communication (Chomsky 1965, 1968), mathematics (Gelman and Green 1989) and intercultural communication (Hampden-Turner and Trompenaars 2000). These latter themes relate to part IV of this volume in which many authors have addressed developments in discipline-oriented and transversal competence domains.

Disciplinary backgrounds of competence theories treated in this volume are also many, such as sociology and learning psychology (Billett, Nokelainen, Harteis), philosophy and action theory (Vonken), occupational psychology and expertise (Evers et al.), educational theory (Cairns et al., Hager, Mulder, Wesselink et al., De Jong et al., Perrenet et al., Lassnigg), philosophy of science (Bagnall et al.), spirituality (Hyland), professional development studies (Day), economics (Avis), labour relations (Stokes), cultural sciences (Popov et al.), psychometrics (Van der Vleuten, Sluijsmans and Joosten-ten Brinke, Blömeke), behaviouristic psychology (Barrick) and management theory (Barabach). This variety shows that competence theory is truly an interdisciplinary theory or, rather, a collection of various multidisciplinary theories.

3. Focus and coherence in policy debates on the competence-based education

As a first observation, it can be said that at the level of international vocational and higher education policy development, there are many joint efforts, but at the country level, there are many differences. At the decentral level, the focus and coherence of the debates seem to be lacking. At the international level, there are a number of common themes, such as the alignment of vocational and professional education with labour market needs, transparency of vocational and professional education, the development of qualifications frameworks, the improvement of quality and equality of education, teacher education and professional development, authentic competence assessment, the accreditation of prior learning, etc., but at the level of individual countries, there are major differences in the debates. It also seems that the competence-based education innovation initiative has been, and still is, spreading across the globe in various versions. This makes that different countries are experimenting with certain versions of competence-based education which are already succeeded by newer versions in other countries. It seems as if the initiative originated in North America and was taken up in the UK and that there are trails from there to other countries within Europe, Australia and New Zealand and the other parts of the world: Latin America, Asia and Africa. This makes the international debate about competence-based education extremely difficult, and hence there are many miscommunications, as different countries are working with different versions of competence-based education in different stages of implementation and evaluation. On top of that, different scholars within certain countries have different interpretations of the competence concept.

Furthermore, due to country-specific legislation and politics, international vocational and professional education policy agendas are quite often meeting considerable resistance at national levels. A good example of this is the reception of the European Qualifications Framework (EQF) in various EU member states. The older and larger states have significant problems with aligning their educational frameworks to the EQF. Examples of this are the UK, France and Germany as described in this volume. Even at a lower level, there are more differences. See, for instance, the German debate on ASCOT in the Chapter of Dietzen and the three approaches to competence-based education in Germany as indicated by Ștefănică, which are the holistic approach by Rauner et al. (2009), the company-based competence approach which includes the use of competence frameworks with mastery levels which are being used for employee assessment as described by Erpenbeck and von Rosenstiehl (2003) and Heyse et al. (2004), and the approach to model professional competence using item response theory as described by Nickolaus and Seeber (2013).

There is no easy way out of this situation. It would be naive to propose that all countries should embrace one model of competence-based vocational and professional education, as differences between national cultures, legislations, educational systems and available resources make that impossible. However, what is suggested here is that more efforts are being made to arrive at common understandings and long-term education development policies which contribute to the effectiveness and societal appreciation of vocational and

professional education. Various Chapters in this volume show that there is still a long way to go, but that a consistent system of competence-based education can help in achieving that.

4. Value added of competence-based education

This is probably the most difficult issue regarding the current state of competence-based education (CBE). Not only is there hardly any international evidence which shows that CBE has added value for increased alignment of education and the world of work and the transition of graduates into (self-)employment, it also is a very difficult thing to empirically prove.

Regarding increased alignment of education and work, there is a wide practice in competence-based vocational and professional education to work with competence-based qualifications frameworks. These frameworks describe occupations or jobs which are being used for curriculum development, test development, and textbook or learning materials development. Teachers and students use these in teaching and learning. Given the many competency frameworks developed and used, it may be concluded that the competence movement has had a positive effect. It is not a coincidence that for teacher education and for many other vocations and professions national competence frameworks have been established by law.

Given the key driver behind the competence movement, the alignment of education and work, the crucial question of course is whether CBE had resulted in better transition of graduates into (self-)employment. In more general terms, it is necessary to know whether CBE is more effective than non-CBE. As the literature review of Lassnigg and the Chapter of Wesselink et al. in this volume have shown, there is some, but not a convincing volume of, evidence of a relationship between CBE and its desired effects. This finding obviously leads to the next question, which is, why there is so little empirical evidence of the success of CBE. Is there any evidence that it is not effective? No, this is not the case; there is just very little research on the relationship between CBE and desired effects of it. Or is it that empirical analysis of the effectiveness of CBE is too difficult or hardly possible? Asking this question is answering it. The empirical study of CBE requires longitudinal comparative approaches, preferably controlling for moderating factors. However, how simple this thought, it is quite difficult in practice to realise it:

1. CBE is a system innovation which takes several years. Research funding hardly allows for projects to run longer than 4 years, whereas education programmes for nurses, engineers and accountants alone already take four or more years. So, a longitudinal research design that can start at the development stage, and continue during the implementation and evaluation stage, is practically impossible. It would not fit in a regular third money funded research programme nor in a PhD project.
2. If a country decides to 'go' CBE, it tends to do that for a whole education subsystem. That means that there is no comparison group available, which means that a comparative approach (how well is CBE doing compared to non-CBE?) is impossible. Theoretically it would be possible to compare the performance of an educational

subsystem of one country with that of another country, but such an international experiment, which is used in development economics, is problematic in education, as the education systems differ significantly in structure, culture, legislation, quality and politics.

3. Furthermore, there are no baseline data regarding the dependent variables of CBE, which makes it actually impossible to study real effects of CBE.
4. Apart for all these complexities, it would be difficult to handle counterfactual validity threats. Longitudinal within-country studies on school-to-work transition have to deal with macroeconomic and international development factors, which are essentially very difficult to account for. For instance, the effect of the banking crisis and the following economic recession has had much more influence on employment opportunities of graduates than any educational innovation, let alone the introduction of CBE.

Since it is also clear that CBE practices differ across countries, it would be more realistic to conduct case study research in which the development, implementation and evaluation of CBE are studied in a context-specific way. An international, longitudinal multiple case study design would be complex and costly, but certainly be worthwhile and viable.

5. The role of competence frameworks and standards

This issue is addressed in Chapter 11 in this volume. It can be treated here shortly. As stated in the answer on question 4, competence frameworks play an important role in the redesign of vocational, professional and higher education programmes. That is why so much effort is made to develop these frameworks for education programmes, professions and jobs. In many countries specific organisations are responsible for the design and approval of new education programmes, for the revision of courses and for quality control. In some cases inter-institutional frameworks have been developed which can be used by other institutions (see, for instance, the Chapter of Perrenet et al. for higher education and the Chapters from Germany on competence modelling). Professional associations are typically responsible for the development of competence frameworks for their professional groups. Examples of this can be found in this volume (see, for instance, the Chapter of Ten Cate on the medical profession). Many large companies and public organisations have also developed, adapted or implemented competence frameworks for their employees. Large human resource consultancy firms have been very active in providing standard competency frameworks and dictionaries for their clients to support their recruitment, assessment and competence management and development practices. These frameworks and standards have provided transparency in the collective expectations regarding professional performance and competence which is required for that.

6. Models for competence assessment

This theme has been treated at length in various Chapters in this volume. Van der Vleuten et al. have given a review of methods for competence assessment, and Blömeke has added to that by pointing at the possibilities of item response theory and generalisability theory, acknowledging that competence is a multidimensional construct. Many competence assessment practices are based on self-assessment of students and perceived competence growth assessment by teachers. However, independent assessments by professional experts based on work samples using mastery rubrics seem to be more trustworthy when it comes to high-stake licensure for key professional tasks with inherent levels of high risk. The German cases in Part IV of this volume (e.g. by Ștefănică et al., Spöttl et al., Wuttke et al.) show interesting examples of how to deal with competence assessment. Some authors rely on cognition-based computer-supported assessment of competence, while others stress the importance of context-based socio-constructive competence assessment. Whatever the assessment practice, it seems that from a practical perspective and trust in professional competence, authentic assessment of student performance on relevant work samples, conducted by certified domain-specific expert assessors, is essential.

7. Regional/national approaches of competence-based education and development

As can be derived from the country Chapters in Part II in this volume, there are quite distinct approaches in CBE across the world. In the UK the National Vocational Qualifications approach has been dominant, followed by the skills development agenda. This is described well in the Chapters of Stokes and Evans et al. France was early to implement a national strategy for competence assessment, but the development of competence-based education or, rather, the alignment of the national qualification system to the European Qualifications Framework (EQF) is still complicated and in process (see the Chapter of Le Deist). Germany has followed the competence movement later and has problems with the EQF as well. During the recent years, Germany has invested a lot in the development of competence models and measurement systems. This has resulted in fierce national debates about the way in which to measure competence development. For the time being, this debate seems to be won by those who have argued for the context validity of competence assessments at the detriment of those who have insisted on high levels of reliability and sophistication in data analysis. Smaller countries within the EU have implemented their own versions of CBE during the last two decades. Former candidate and present new EU member states have followed the EU guidelines for enhanced cooperation in vocational education quite precisely and have implemented their versions of CBE as well (see, for instance, the Chapter of Tütlys et al. in this volume).

The developments in the USA have been well described by Barrick in this volume. It can be seen that the CBE movement actually started in North America. It was taken up in the UK and related to the development of national qualifications frameworks (with variations for England and Wales, Scotland and Northern Ireland as described in Chapter 11).

It was also taken up quickly by the Australian and New Zealand VET systems (see the Chapter of Cairns et al.), which resulted in quite considerable resistance. Approaches of capability-oriented vocational and professional education and frameworks of graduate attributes seem to have been received better there.

Other countries have followed the developments, also based on student mobility and international education development cooperation. Students from South and East Asia doing masters and doctoral programmes in Educational Sciences in Australia, Europe and North America have taken competence-based education ideas along to their home institutions and countries. Once in leading positions (up to the levels of vice chancellor or minister of education), they may have mixed these ideas with their policy development agendas. International institutions, international donor agencies, development organisations and several large NGOs have been active in the dissemination and implementation of CBE practices as well. Examples of this from Asia have been described by Fan, Panth and Viet and from Africa by Van Halsema. Development approaches of these institutions are typically based on models applied in the home countries of the institutions or the consultants, which can result in competition between these approaches in support-receiving countries.

8. Research regarding competence-based vocational, professional and higher education

Looking back at questions formulated at the beginning of the composition of this volume, it can be said that there is some overlap between this question and question 4 as far as impact, added value and effectiveness of CBE are concerned. As has been shown, there is little added value to report, although CBE has been and still is a massive international innovation.

Other research is reviewed by the various Chapters in this volume. The description of this research follows the design of this volume.

In Part I the research has a conceptual and theoretical nature. The Chapters proposed different views on competence, and the tendency is to conclude that the integrated view on competence reconciles the differences of opinion, although some say that reconciliation is out of the question.

In Part II the research is about national approaches, which show the many international differences mentioned above. Intranational practices however are not coherent in many cases as well, which resulted in different visions on what has happened and should be done within the respective nations. Major issues which are reported are related to the implementation of qualification frameworks and standardisation, assessments, quality assurance, insufficient resources, curriculum revision and teacher education, professional development and institutional management.

In Part III the research is aimed at specific aspects of educational systems. This is partly also about the implementation of frameworks for competence-based education, but also about recognition and assessment, and teaching and learning. Models have been developed with the aim to support the aspects of competence-based education mentioned. These models are related to a number of unique features of competence-based vocational and professional education. The research aimed at quality and outcomes shows that competence-based vocational and professional education needs a dedicated quality management and competence assessment system.

In Part IV the research reviewed is about competence domains. There is a strong emphasis on competence modelling and measurement in given competence domains such as the technical (Ștefănică et al.), engineering (Spöttl et al.), teaching (Wuttke et al.) and medical professions (Ten Cate) and on emerging transversal domains such as sustainability competence (Pavlova), complex problem solving (Neubert et al.), intuition (Harteis), entrepreneurship (Toutain et al.), global competence (Popov et al.), social competence (Seeber et al.) and computational thinking (Yadav et al.). These Chapters show the power of the competence construct in defining and describing new or changing domains of competence.

50.4 Common Misunderstandings About Competence-based Education

As said, there are many theories, definitions, perceptions and opinions about competence-based vocational and professional education, and there is also a lot of confusion about this. Westera (2001) even wrote an article on this confusion, although that did not add much to solving that. During the course of the last 15 years, various issues are discussed in sometimes heated debates about the blessing or the curse of competence-based education (Mulder et al. 2009). Many of these issues however can be deconstructed as perennial misunderstandings about competence-based education in theory. Practical applications of competence-based vocational and professional education of course vary, and in some cases practices are not consistent with the principles or the espoused theory, but compromised by austerity measures and measures of economy of scale. Advocates and opponents of competence-based education will agree at least on the view that the purpose of education is certainly not to develop incompetence.

1. Is competence-based education related to vocational and professional education only?

There is a tendency to look at CBE this way, but this is not exclusively the case. There are various examples of the use of competence domains, like social, mathematical or linguistic competence, in elementary and general secondary education, and of competence-based studies in academic education, like psychology, business administration and engineering. Furthermore, generic competence covers social competence, citizenship competence, lifelong learning competence, self-regulation competence, etc. So generic competence is much broader than just about preparing students for the labour market.

2. Is motivation an element of competence?

Whereas White (1959) saw competence as performance motivation, motivation itself is a prerequisite for performance, like competence, self-efficacy and the opportunity to perform. If competence is the capability to perform, motivation is the will to perform; self-efficacy is the trust in oneself to be able to perform (at least) adequately. As described earlier in this Chapter, these two dimensions should be added to the opportunity to perform according to the widely accepted tripod of Appelbaum et al. (2000). The absence of opportunity holds for persons who are unemployed although they are competent, or who are employed but forbidden to perform certain tasks, which in certain cultures definitely occurs, often as a consequence of gender, social status, power or tribal issues.

3. Is behaviour a component of competence?

Competence is seen here as a necessary though not sufficient requirement for successful performance. The remark often is that competence cannot be directly observed, and inferences have to be made from performance. That is exactly the case and is concurred by Shavelson (2010), who sees competence assessment as the measurement of a sample of behaviours of a person on a sample of tasks and responses, on a sample of moments in time, as determined by multiple methods and as scored by a sample of assessors. As Vonken is saying in his Chapter (based on Hager 2004), 'judging competence always involves inference'. So competence assessment is conducted via performance tests for which the mastery of the specified competence is necessarily conditional. Although there are developments to measure the possession of competencies with questionnaires, correct inference of competence therefore hinges upon valid and reliable performance assessments until now.

4. Is intelligence needed for competent performance?

Like multiple intelligences (Gardner 1983), there are several competence domains. Intelligence is certainly essential for competent performance. Smartness in various domains helps with learning certain knowledge, skills and attitudes faster, but that does not imply that people who are less smart cannot achieve competence in any field, unless they have certain impairments. The pace of learning however varies to such extent that organisations tend to select on essential competencies, as the development of those competencies may be too costly. Here we are touching the work of Gilbert, who was speaking about the cost of worthy performance (Gilbert 1978).

5. Do competence frameworks dictate the way in which learning is organised?

Maybe this was the case in the 1970s, when the behaviouristic view on competence prevailed, and education was organised in such a way that many competencies were trained and checked

independently. In more generic and holistic views of competence, this is not the case. There are principles to take into account at micro-design level when a competence-based educational approach is taken, although there are many detailed considerations which pertain to subject matter, pedagogical content knowledge, target group and contextual issues. Competence frameworks are predominantly linked to the 'what' of education and are related to qualifications, educational objectives, attainment targets and intended learning outcomes. As already noted, they have implications for further educational development and planning activities, but the implications are neither exhaustive nor exclusive.

6. Does competence-based vocational and professional education stress skills only?

That is not correct. Vocational and professional (as in fact all) education finally has three broad objectives. It should enhance the capacity to learn, start a career and act as a responsible and participative citizen. In various stages of education, the emphasis can be on the acquisition of subject matter knowledge, skills development, attitudinal growth and integrity. But in competence-based education, as in fact in all education, there should be careful and coherent attention to the three broad objectives mentioned.

7. Does competence-based vocational and professional education lead to minimising educational achievement?

This is a gross misconception. The first competence frameworks which faced the problem of over-detailing were setting minimum standards and therefore acted like focusing on realising minimum standards in education. Although current competence frameworks specify the content of what has to be achieved in education at a minimum level, they cannot be accused of achieving this minimum as a maximum level. This Procrustean view would imply that there would be no variation at all in the (ideal) achievement of students. This view is totally different from reality in which student achievement is dispersed, as is also reflected in grading practice. The minimum standards are exactly what they are: a minimum in required performance, a minimum that has to be guaranteed by the educational institution when they declare that a student has completed a study programme. Beyond that minimum, student achievement can be excellent or even brilliant, which is often awarded with honours, (summa) cum laudes or other distinctions.

8. Is competence-based education an identifiable education innovation?

In his article on competence in competence-based education and training (CBET), Lum (1999, 2011) formulated various concerns regarding this education innovation. Below these concerns are summarised (in italics), and reactions based on the state of play regarding competence-based vocational and professional education as presented in this volume are given:

- *Competence as goal is not the same a CBET methodology.* That is correct. Before 1999 there were hardly any theoretically grounded principles of CBV&PE. These were formulated as there was a great need for that since various countries formulated lifelong learning and competence development policies.
- *Can-do statements cannot precisely be formulated as intended learning outcomes.* However, education, including CBV&PE, is always outcome oriented. Curriculum profiles define those outcomes. Not being able to specify education or learning outcomes would be like not being able to build chairs and bridges. It is by definition because of the common understanding of the specifics that technology exists.
- *Liberal education would change people and vocational education would not;* however, vocational and professional education is much more than just learning a specific job; it also leads to the development of a personal professional identity. It is like educating teachers and professors in teacher education, graduate education programmes and continuing professional development. During that process the identities of teachers, researchers and professors are being shaped. Competence-based vocational and professional education changes the outlook on the world of adolescents and young adults as well as liberal education.
- *Instead of proceeding with the concept of competence, the alternative capability is suggested.* However, the critical comments on competence are as valid as for capability, and the reactions on that would be identical. The reason for this is that in essence there is no difference between competence and capability. These are words for the same thing, referring to what people can do, or the ability to perform.
- *Liberal education should be aimed at serving the interests of young people, vocational education of those of employers.* This is the historic view on vocational education in the USA, which can be understood by the narrowly defined job-oriented programmes for (in many cases) the oppressed, and may hold for parts of vocational and liberal education in the UK, but it is hard to maintain the position that competence-based vocational and professional education, which provides students access to employment, entrepreneurship, societal participation and lifelong learning and development, is only in the interest of employers. It is as important for social inclusion, livelihoods and identity formation of young people. Of course, education should be liberal, in that it liberates young people and unleashes potential. However, the extreme vision of liberal education in many countries has also resulted in delivering graduates who know a lot but can apply little, leaving them behind in the search for survival in society. Poignant examples of that can be found in various African education systems, but also in Western societies, where many ‘professional’ graduates were officially qualified, but in practice actually not competent. See the many complaints there have been about the quality of teachers.

The intricate relationship between views on liberal education and the importance of competence is very well shown by the LEAP initiative of the Association of American Colleges and Universities (AACU 2015). LEAP stands for Liberal Education and America's Promise, which is an ongoing initiative. Related to that initiative, the AACU agreed upon the LEAP Challenge, which is a call for colleges and university to stimulate students to do 'signature work' which is about applying what they are learning in a project which is meaningful for the students and society (<https://www.aacu.org/leap-challenge>). It is the application nature of the projects, which is interesting here. It resembles the work of the education counter, the academic consultancy training and the academic master cluster in Wageningen University (one of the globally leading universities in the agricultural and environmental sciences) very much. Commissioners in society, from public or private organisations, can submit project ideas to the university which then links them to courses throughout the bachelor and master programme and to integrating projects of student groups in the master programme. In all cases students are expected to develop solutions for the given (mostly open) problems, which significantly contributes to authentic learning and the feeling of contribution to solving real problems, which makes the learning experiences much more relevant. The Leap Challenge tries to overcome the gap between the traditional practice of elitist liberal education for some and narrow training practices delivered to others. It uses seven principles, which are all in line with the competence-based vocational and professional education philosophy described in many Chapters in this volume. These principles are (1) aim high – and make excellence inclusive; (2) give students a compass; (3) teach the arts of inquiry and innovation; (4) engage the big questions; (5) connect knowledge with choices and action; (6) foster civic, intercultural and ethical learning; and (7) assess students' ability to apply learning to complex problems (op cit, p. 8). By the descriptions of these principles, it gets even more clear that this view on liberal education is strongly reflecting core ideas behind competence-based education. The principles, for instance, stress the importance of using essential learning outcomes which should establish a framework for their education; connecting education work and life; using a student-centred view on studying and monitoring study progress, including problems of the real world for learning to prepare students for citizenship and work; integrating personal and social responsibility in all study components; and using assessment for continuous improvement (see for full details about these descriptions op cit, p. 8).

This analysis of misunderstandings in competence theory and practice may not be convincing for opponents of the competence-based education philosophy, but advocates and opponents of this philosophy alike will agree (as said earlier in this Chapter) on the view that at least the purpose of education is *not* to develop *incompetence*.

50.5 Further Research for Competence-based Vocational and Professional Education

Future developments in competence-based vocational and professional education research are aimed at regular characteristics of competence-based education, but also at more fundamental theoretical and empirical questions. Developments which are currently taking place in

competence research and which will most likely get more attention during the coming years are the following:

1. Regular updating of competence frameworks. As society and work will keep changing, the competence frameworks which are being developed during the last couple of years will need to be updated. Revisions will be needed on a 3-year basis in many cases. This at least was expected by various professional associations mentioned in this Chapter. Revisions may not always be fundamental, but throughout the years, they can be.
2. Zainun et al. (2015) and Kasule et al. (2015) showed that there is too little attention for teachers in competence-based education. More emphasis needs to be given to conditions under which teachers' competencies can be developed. Professional development can be characterised as has been done by Day in this volume and made more productive by better national labour regulations for teachers and human resource management policies and practices in educational institutions such as promoted by Runhaar in her Chapter in this volume. Other work of Runhaar that can be used in this respect showed the importance of the relationships between team learning and shared understanding amongst team members in educational innovation contexts (Runhaar et al. 2014). Since policy-making regarding implementation of competence-based education is a team effort, team learning in competence-based vocational and professional education is therefore a crucial topic of research.
3. A stronger link needs to be established between research regarding the competence-based curriculum on the one hand and teaching and learning on the other hand. As said, many of the principles of competence-based education refer to curriculum issues (the what of education), whereas a more limited set of principles is aimed at the micro-design at the level of teaching and learning activities. However, if competence frameworks are defined for the curricula, and authentic competence assessment is implemented to promote learning, competence-based teaching and learning should follow.
4. An essential competence domain which will need more attention is argumentation competence. Reviewed by Rapanta et al. (2013), and empirically investigated in studies conducted by Noroozi (2013a, b), this field needs more attention as independent judgement and justification of professionals for their decisions and actions become increasingly important.
5. Research on competence development in organisations needs to be better linked to research on competence-based vocational and professional education. For instance, the work of Baggen et al. in European companies on entrepreneurial workplace learning and opportunity identification competence tried to establish a relationship between presage, process, product variables, learner, work environment and process factors which were studied to assess their influence on opportunity identification competence (Baggen et al. 2016). The study showed that employees of small- and medium-sized companies were able to participate in the early phases of innovation and that the role of owner-managers was essential in stimulating entrepreneurial behaviour. The research of Birru et al. (2016) tries to explain variance in export performance by the

variation in international business competencies. Key variables in the study are international, export market and international entrepreneurial orientation competence. The study shows positive relationships between the three competence domains and export performance. The interactions between the international business competencies have mixed effects on financial export performance. Finally, the study of Osagie et al. (2014) on individual competencies in the field of corporate social responsibility (CSR) that support the implementation of CSR policies in organisations showed eight competencies which are relevant. These are (1) anticipating CSR challenges, (2) understanding CSR-relevant systems and subsystems, (3) understanding CSR-relevant standards, (4) CSR management competencies, (5) realising CSR-supportive interpersonal processes, (6) employing CSR-supportive personal characteristics and attitudes, (7) personal value-driven competencies and (8) reflecting on personal CSR views and experiences. The findings of these studies have direct consequences for innovation, entrepreneurship and CSR competence development in vocational and professional education.

To conclude this section, the overview of developments in research given above is obviously far from complete. There are many more developments, inside and outside educational research, which are to a greater or lesser extent relevant for competence-based vocational and professional education. A next volume would be needed to expand the scope of this volume to review the whole field of competence. For instance, a recent search in the Web of Knowledge on the keyword competence showed a wide variation of interesting studies of which most are highly relevant for competence-based vocational and professional education in the respected fields. The top ten of the most recent publications from this search will be described shortly here, just to taste the flavour of the diversity and relevance of the studies on which they report. The majority of these publications are on professional competence.

- Liou et al. (2016) developed and tested an instrument with which perceptions of nurses of clinical reasoning competence can be assessed, and Desbouys et al. (2016) surveyed nurses' influenza vaccination competence in France.
- Sessler et al. (2016) showed differences in blood pressure management by anaesthesia residents as measured by competence committees and in-training exams.
- Curran et al. (2016) published a study on inherited competence and spin-off performance. Mason et al. (2016) studied the effects of placements of junior doctors in emergency departments on their perceived well-being, confidence and competence.
- In the field of medical research, Weller (2016) reported on a study on residents, which are medical graduates who are working under supervision. Monitored electronic anaesthesia records provided objective performance data, based on which resident competence can be inferred. This can play an interesting role in their assessment and further professional development.

- There are also interesting studies in other fields, for example, in child studies, Hands et al. (2016) reported research on the relationship between gender and motor competencies and perceived physical activity outcomes of children of 14 years of age.
- Zeedyk et al. (2016) studied perceived social competence and loneliness amongst young children with ASD.
- Finally, there are studies which go into the competence of bacteria, which is a known field in biology research (as mentioned in Chapter 1). In the field of biology, Bach et al. (2016) published research on a specific competence of bacteria which promote plant growth. Lin et al. (2015) studied competence for genetic transformation and virulence in a certain bacteria.

Obviously, the studies on professional competence are most directly relevant for competence-based vocational and professional education. The studies on child studies seem to have a possible indirect relevance for this education sector, although they are directly important for special needs education. The studies on bacteria are least relevant, although at conceptual level, they are related to the debate on nature or nurture regarding competencies of children, students and professionals.

Research in cell biology and nanotechnology, including research on the functioning of the human brain, may however appear to be extremely relevant on competence acquisition in the future. The Internet and social media have opened up whole new grounds for time- and space-independent distributed learning. But science and technology develop ever faster, and bionic brains, virtual telepresence of experts, learning robots, drones and teleportation of energy are no fantasy anymore. They exist in reality. Vocational and professional education has to prepare itself for these radical innovations, as they may fundamentally change the way in which competence will be developed.

50.6 Further Observations and Comments

This section of this Chapter presents a number of further observations and comments.

1. *Much more evaluation studies needed on the value added of competence-based vocational and professional education*

It is staggering to see how little research has been done on the measurement of effects of competence-based vocational and professional education. Above various reasons for this have been given for this. Lassnigg pointed at the unwillingness of policymakers to critically examine approaches which they have advocated. Also, given the fact that competence-based vocational and professional education is a generic educational philosophy with heterogeneous operationalisations, it is difficult to craft a meaningful evaluation approach. The complexity and diversity of vocational and professional education also plays a role. Furthermore, as said,

CBE is a systemic innovation, which lasts years before it is fully implemented. This means that longitudinal research designs are needed to enable measurement of change. Finally, research funding for vocational and professional education is hard to find. Nevertheless, there is a great need to show effects of CBE, and therefore it is strongly recommended to conduct studies which critically evaluate competence-based vocational and professional education practices.

2. *Competence and socio-constructivism*

Bagnall states that educational practices in which various epistemologies are combined risk incoherence, since the epistemologies make incompatible claims. That, however, remains to be seen. At micro-level, education is enormously complex, and elements of various epistemologies can exist *in action*. Bagnall also contends that from a disciplinary epistemological perspective, the ends of CBE neglect the knowledge dimensions of occupations. However, this is not necessarily true; it depends on how knowledge development is treated in the curriculum or practice. See, for instance, the work of Wenger (as cited in the Chapter of Seeber and Wittmann) who states that ‘... knowing is an act of participation in complex ‘social learning systems’ (Wenger 2003, 76)’ and who defines social competence as ‘... what it takes to act and be recognized as a competent member’ of a community of practice (op cit, 78). In education it is possible to treat knowledge as a separate domain within a macro-framework of competence-based education. As said earlier, having a competence-based curriculum does not necessarily mean that disciplinary knowledge should not play a crucial role. Without sound knowledge there is no application possible. Furthermore, Bagnall points at the importance of a constructivist epistemology, which does not neglect growth, development, responsibility and awareness. This critique however is based on notions of CBE1.0, which were in place in the 1970s and 1980s, during the beginning years of pure instrumentalism. However, in the 2010s, these notions are obsolete, and CBE practice much more advanced. Current CBE practices are not anymore rooted in instrumental epistemologies, which Bagnall believes. The alternative for the development of vocational and professional education he suggests should be progressive and based on a constructivist epistemology. This is correct, although, as said, CBE practice has progressed significantly, and many current perspectives and practices of competence-based education are already based on socio-constructivist notions, in the sense that educational designers realised that learners construct their knowledge themselves, in cooperation or dialogue with others. This is the foundation of practically all attempts to implement activation-based pedagogies and collaborative learning. So, many CBV&PE practices are not as instrumental as suggested. Furthermore, implementing a competence-based education philosophy implies a competence development imperative. That means it is hard to maintain that current competence-based education approaches could neglect development. Gradual increasing responsibility is the precise intention of competence development; see the various levels of the European Qualifications Framework. Awareness goes along with personal growth in a competence-based education environment. It is the continuous attention for learning, assessment, feedback and reflection that makes self-consciousness and self-efficacy grow. The critique from an emancipatory epistemological perspective that CBE exerts control by powerful interests may

be correct in some places, but when a competence framework is developed by all stakeholders involved and competence-based education is designed and implemented by teaching teams, it is not correct that one powerful force, like the industry, is pushing certain competencies into the curriculum. It is the balanced influence of all stakeholders involved, including the students or their representatives, which make the curriculum. Obviously objectives/outcomes are pre-stated in competence-based vocational and professional education, but is that not the case in all vocational education and training? After all, masons, cabinet workers, car mechanics, nurses, secretaries, controllers, engineers, architects and medical specialists need to be able to perform in work situations according to the expectations which exist, expectations not only of the employer but also of the professions, institutions and the public.

So the view of Bagnall that there will be a paradigm shift in education which will be informed by one of the alternative epistemologies may be realised already, in that, as said, vocational and professional education practices are already based on various epistemologies, at different levels, by different stakeholders. Personal professional epistemologies of teachers vary; educational innovations are interpreted by them, and educational practice is based on their personal goal structures. The same holds for competence management. According to Quinn et al. (1996), management should be based on different – even conflicting – values, roles and competencies. This diversity makes better teams. But also in competence-based vocational and professional education, many of the alternative epistemologies are simultaneously in use. This is visible in concurrent practices of cooperative knowledge construction, cognitivistic instruction and professional activism of teachers which is based on emancipatory epistemologies. Current competence-based education philosophy tries to point at the societal relevance of the curriculum, the need for whole-person development, stimulating engagement in continuous lifelong learning activities, focusing on future-oriented competencies (problem solving, creativity, innovation, transformation, shaping) which are needed in a volatile, uncertain, complex world. Preparation for work (which can be self-employment or entrepreneurship) is but one, although important, dimension of that, apart from social participation and learning to learn.

In response to a final issue raised by Bagnall, regarding the, in his words, futile attempts to develop hybrid versions of competence-based vocational and professional education, it can be said that boundary crossing in and hybridisation of vocational and professional education are just key trends, which involve competence development, practical intelligence, critical consciousness, self-directed learning, entrepreneurship, risk taking and learning to cope with wicked problems (Cremers et al.). Several stakeholders are joining forces in hybrid learning configurations, such as educational institutions, governmental organisations, NGOs, businesses and researchers. CBE is in fact already a hybrid practice in which many different approaches are integrated. The idea of integration of visions and approaches was also the foundation of the matrix of CBE, a method to empower teaching team to develop their own version of competence-based vocational and professional education (see the Chapter of Wesselink et al. in this volume).

3. Not all competence is expressed in performance

Competence in itself cannot be observed from outside. It can only be observed via performance. For example, a great talent for playing piano will never be turned into competent or excellent piano playing if a person does not actually practice piano playing. It is by the playing, which is the actual performance, that competence can be inferred.

However, not all competence is expressed in performance. Vonken, in his Chapter in this volume, uses the crude example of drinking beer and mentions that the capability of drinking a number of beers does not imply that people actually drink that number of beers. The example can be made more crude even: the competence of killing people does not mean all people do this all the time. Other competencies, in the affective domain, prevent persons from not performing hazardous or illegal activities. Apart from these crude examples, there are also more subtle variations of competence which are not being materialised in action. For instance, in certain cultures social competence prevents people from giving their personal opinion about certain events, as this goes against the code of conduct or protocol, although they could, if they were allowed to.

4. Competence as graduate attribute

In this volume graduate attributes are seen as an alternative for competencies of graduates (see, for instance, the Chapter of Cairns and Malloch). If competence is gained by experience and exercise and expressed in performance, this competence in itself can be attributed to a person and is indeed a graduate attribute. Speaking of competencies as graduate attributes is therefore completely legitimate; however, if graduate attributes are seen as generic characteristics of graduates, graduate attributes are a set of characteristics of persons which is wider than competence or a range of competencies. So, all competencies are graduate attributes, but not all graduate attributes are competencies.

5. Creativity is part of competence

In this volume, competence is defined as a prerequisite for effective performance, thus for behaviour. Competence should enable reproducible performance, but competence is more than the capability to reproduce behaviour. As Vonken in his Chapter pointed out, Noam Chomsky (1965) understood speech as performance and the ability to speak as competence. Vonken stressed that speaking was seen as a creative and generative process, as Wilhelm von Humboldt (1836) said earlier. With certain competencies persons can indeed be creative. It is the very nature of art, science, design and innovation, by which persons arrive at new observations, interpretations and explanations and create new views, approaches and solutions.

6. *Competence and self-responsibility*

As White (1959) has stated, competence is a motivation factor; it is the will to master and starts as an innate driver of development. However, not all persons pursue the highest level of mastery. Along the development process, some give up, and others go on and want to further develop, get better or be even excellent. This is the choice of people, although facilitated or constrained by personal circumstances, school and work history and life events. Nevertheless, people themselves stay responsible for their own competence development.

7. *The attribution of competent behaviour in dependency relationships*

In many current work processes, coworkers are depending on one another for information, inputs, resources, tools, feedback, etc. As an example, this is very clear in teaching physics. For certain physics theories, it is necessary to have sufficient mathematical knowledge and skills. If the teaching in mathematics lags behind, teaching and learning in physics may be hampered. Can suboptimal learning results of classes who take physics then be attributed to the quality of the physics teacher? The answer is obvious. It is the performance in mathematics teaching which causes problems in physics teaching. Many other examples can be given of course, such as in language teaching, where the learning of foreign languages hinges upon the teaching of grammar in the mother language, or in work processes of high-performance teams, where performance is very much related to resources provided by management. The understanding of this has resulted in much more attention for team work and the notion of collective competence.

8. *Competence, savoir, savoir-faire, savoir-être*

The concepts of *savoir*, *savoir-faire* and *savoir-être* in France seem to be equivalent to the definition of competence in Chapter 1: competence as integrated knowledge, skills and attitudes (knowing, knowing how to do and knowing how to behave). However, the issue is that in the French language all three components of competence are phrased as *savoir*, so knowing or knowledge. But, as said, a fundamental characteristic of competence is that it goes beyond knowing and knowledge, since knowledge alone is not enough for productive or effective performance. Competence implies the ability to perform to certain standards in given situations which can vary in complexity and novelty. It implies that existing knowledge can be transferred to other, sometimes new, problem situations.

9. *Competence and labour relations*

There has been considerable resistance against the implementation of competence management and development practices because of the protection of employment rights by employee organisations. Employment rights are based on national personnel laws, labour

agreements and organisational regulations. Typically, employees are being protected by the labour contract they have with their employer, including job titles and job descriptions. These job titles and descriptions are often part of job buildings, which are related to payment schemes and annual results and development meetings. Many organisations have found these job buildings conservative in that they prevented flexibility in task divisions and thereby inhibited innovation, as tasks divisions were used as an excuse for not having to change. The implementation of competence management practices was quite often hampered by the influence of labour unions which were advocating job structures and task descriptions as established rights.

10. Competence 1.0, 2.0 and 3.0

As a follow-up on the division of the development of competence theory in three stages (see Chapter 1), competence itself, and the underlying competencies, can be divided in three categories, which are labelled here as competence 1.0, competence 2.0 and competence 3.0. These competence domains and underlying competencies are related to the three groups of competence theories:

Competence 1.0 refers to behaviouristic skills (see the Chapter of Barrick) and, used in systems of mastery education, tends to consist of detailed lists of tasks and skills. Examples of this can be found in competency profiles for teacher education in the 1970s in the USA. For instance, teachers were taught to stand in the corner of the classroom to have an overview of what all pupils were doing or to walk up and down in front of the classroom to retain attention of the pupils. Performing all these small skills and checking the mastery of them did not make good teachers though who were basing their teaching philosophy and practice on scientific insights and empirical evidence. It also did not result in inquiry-based teaching practice and reflection in action (Schön 1983). Competence 1.0 can be characterised as an attempt to map competencies which are relevant for detailed task performance or closed activities.

Competence 2.0 is a reaction to the behaviouristic mastery education philosophy and practice and evolved in the 1980s when competence was more seen as an integrated set of capabilities acquired by professionals which enabled them to effectively carry out tasks, solve problems, shape innovations, etc. These integrated competencies are by some seen in terms of responsibility levels (such as in the European Qualifications Framework), but also as the common domains of professional knowledge (Eraut 1994) or professional expertise (Ericsson 2009). Sometimes termed holistic competence, competence 2.0 is related to core tasks and work process knowledge (Boreham et al. 2002; Scheib 2004). Competencies like (further specifications of) the great eight, leading and deciding, supporting and co-operating, interacting and presenting, etc. (Bartram 2005), are connected to work process charts and make units of education. Although clear in design, this application of competence mapping against work processes has again resulted in extensive and detailed documents which were hard to implement in vocational and professional education, questioned by employers' associations and problematic in test development. However, good practices exist, such as

described in the Chapter of Wesselink et al. Competence 2.0 can be characterised as an attempt to formulate integrated competency statements which are relevant for larger responsibilities within known occupations and professions.

Competence 3.0 is a reaction to both competence 1.0 and competence 2.0 statements for closed tasks and known occupations and professions, in the awareness that although the future is unknown, current problems need to be addressed to create a sustainable future. Competence 3.0 is thus aimed at identifying capabilities or capacities which are relevant for an unknown future and close to what has been defined as shaping competence in the context of education for sustainable development. These competencies are being able to develop knowledge which integrates global openness and new perspectives; analyse and assess future-oriented developments; develop interdisciplinary knowledge and act in an interdisciplinary way; recognise and assess risks, dangers and uncertainties; plan and act cooperatively; handle goal conflicts during reflections about acting strategies; participate in collective decision-making processes; motivate self and others to get in action; reflect own views and those of others; use notions of justice as foundation for decisions and actions; plan and act independently; and show empathy for others (see for an extension of this <http://www.transfer-21.de/index.php?p=222> and Wals 2015). Based on an overview of the field of human competence and various Chapters in this volume, the following set of future-oriented competencies can be formulated: ambiguity handling, argumentative reasoning, balancing interests, complex problem solving, computational thinking, creativity–creation, entrepreneurship, global competence, intuition, mindfulness, negotiating meaning, professional identity, resilience, sustainability, transformation and uncertainty handling. Current vocational and professional education institutes should include these in their programmes to prepare the next generations of professionals for the future world, which will not be less vulnerable, uncertain, complex and ambiguous. Competence 3.0 addresses competencies which are meaningful in professional situations in which standard solutions for known problems do not apply, but in which creative solutions are needed to solve unknown problems and transformation is shaped of current practices towards a more optimal state for those who are involved, be it clients, commissioners, citizens, coworkers, children or students.

11. Does competence-based education have a pronation to closed professional domains?

It seems that Lassnigg in his Chapter tries to explain the ease by which a competence-based education approach can be implemented by the nature of the professional domain. For example, some professions, like in health care, the nuclear industry or the aviation industry, are quite closed (or ‘well established’ ‘with a relatively clear structure and marked borders’ as he described it), in the sense that doctors, operators and pilots are bound by fixed protocols for their performance, whereas other professions or professional fields are more open, like in the creative industries, innovation and transformation, in the sense that there are no standard operating procedures. However, these professionals require different competencies. Occupations and professions with more closed performance procedures may need more competence 1.0 and competence 2.0 ingredients, whereas those which are more open, and

which predominantly rely on heuristics, may need more from the competence 3.0 domain. This would mean that the competence-based education philosophy equally applies to the different occupations and professions, but that it should not be a one-size-fits-all practice.

12. Knowledge alone is not enough; skills neither

In their Chapter, Spöttl and Musekamp go into the modelling and measurement of mechanical engineering competence. They limit this to the cognitive aspects of the field of science. They argue that this is defensible as domain-specific knowledge is important to teach in higher engineering education, which obviously is correct. They furthermore state that current higher education teaching practice in Germany is textbook based and that these books follow the structure of disciplines.

Although it is utterly important to acquire sufficient subject matter knowledge in vocational and professional education, there is the risk of treating the cognitive domain separately; it is at least not in line with the integrated view on competence as presented in Chapter 1 and in other Chapters in this volume. Reality presents itself as a *Gestalt* and is complex, opaque and interdisciplinary in nature. Teaching and learning should address this and keep in mind that professional performance is taking place in this holistic reality. In that reality professionals need knowledge, skills and attitudes which enable them to effectively carry out all kinds of activities, solve problems and invent new solutions and contribute to change, innovation and transformation, in known and expected task situations and in unknown and unexpected ones.

Education should prepare students for that, and if the introduction into science means that students have to learn domain-specific content from structured textbooks alone, they may be induced into science in a way which is too narrow and concentrated. It may result into professionals who are nearsighted and who do not have a sufficiently broad view on their field, adjacent disciplines and occupations, and those which are totally out of their domain. It would hamper interdisciplinary work and cooperation, which is much needed in coping with current challenges. It may be assumed that Spöttl and Musekamp would not want this, and that they themselves have a broader view on all competence-based higher engineering education, but this is to make a precautionary remark: selective attention to the cognitive domain can hamper the broader intentions of the competence-based education approach.

The Chapter of Nägele and Stalder can be discussed in a similar way, as they exclusively treat the skills domain of competence. Like knowledge, skills are a *conditio sine qua non* for effective performance. However, focusing on the skills domain alone can lead to the underestimation of the importance of knowledge included in skills application. In the 1980s the saying was popular that it is possible to teach monkeys tricks, but harder to teach them insight. The theoretical background of this metaphor was that in fields like office automation and production technology, students should not only learn skills but also the conceptual principles behind those skills, first of all to warrant that they understand what they are doing and secondly to make them more agile in accommodating change. The assumption

was that competence based on the understanding of the theoretical or systematic principles behind practices would be more transferable to other task situations than the skills base itself. In his Chapter Billett points at the phenomenon of mimicry, the practice by which behaviour of others is copied. This copying takes place, but it does not guarantee that copied behaviour is based on professional argumentation and justification. Since liability is becoming an ever more serious element of many occupations and professions, education should definitely include the knowledge background of skills.

The integrated view on competence has also implications for the assessment of student achievement. This has been treated already in the Chapters of Van der Vleuten et al. and of Blömeke. In competence-based education, the tendency is to work with systems of holistic assessment. Although this is good practice, there should be sufficient attention to the measurement of the acquired knowledge. Competence-based education, which pays balanced attention to integrated knowledge, skills and attitudes, should have assessment strategies and instruments in place by which the required knowledge, skills and attitudes are validly tested, preferably in continuous formative and authentic assessment, which is in fact assessment for learning, but also in valid summative assessment. Separate tests of knowledge, demonstrations of skills and showing professional attitudes can be necessary, as long as the integrated competence of graduates is the end result.

50.7 Final Conclusions

In the first Chapter of this volume, the purpose of this volume was stated. The intentions were to clarify the manifold meanings and approaches of competence-based vocational and professional education, to show the diversity which exists not only in theory but also in practice, to explain backgrounds of this diversity, to get more transparency of views, to bridge opposing positions, to inform about debates, to at the end contribute to the improvement of competence-based vocational and professional education policies and practices and the further development of competence theory and to give a perspective for further research. It is of course up to the judgement of the reader whether these intentions are realised, but the following can be said about this. In Part I different meanings of competence from the perspective of social learning theory, educational philosophy, professional expertise research, graduate attributes theory, social constructivism, cognitivism, epistemology, Eastern philosophy, professional identity theory, critical socioeconomic theory and educational alignment theory were presented and discussed. This was complemented with an integrated view on competence which states that various paradigms can be reconciled to one, although other authors are opposing that view. Some are even contesting the value of the theoretical notions outlined in Chapter 1 of this volume. A strong argument for the position that reconciliation is possible, and hence a synthesis is feasible, is that in daily practice in education, all sorts of conflicting inter- and even intrapersonal working theories about good vocational and professional education exist. For example, there are differences about the extent to which this type of education should be theoretical or practical, liberal or functional, cooperative or competitive, reflecting different world views, political preferences and

education ideals such as the social or liberal state, collectivism or individualism, inclusion or exclusivity and all kinds of mixes between them. In practice, good education works well if teams conduct healthy and constructive dialogues about their collective intentions. In that daily dialogue or deliberation, all views and preferences come together in collective action for the best education teacher teams can provide.

In the various parts of this volume, the different backgrounds are explained by different authors. These explanations may help to appreciate the differences in opinions regarding the introduction and implementation of competence-based vocational and professional education. It may be clear that the context in which competence-based vocational and professional education is being implemented matters a great deal. In the UK the debate about the value of competencies in education is heavily dominated by the critiques on the way in which the National Vocational Qualifications were introduced. In France the debate on competence is mostly about competence management in organisations and competence assessments of individuals and the difficulty to establish the reference with the European Qualifications Framework (EQF), as in France the existing qualification structure does not exactly match with the structure of the EQF. Actually, in Germany the same situation exists, as in German competence-based vocational and professional education competence is seen as the overarching capability of people to perform, whereas the EQF juxtaposes knowledge, skills and competences. German competence-based vocational and professional education experts themselves however fundamentally differ in opinion about the cognitivist and socio-constructivist view on competence-based vocational and professional education, which is sharply visible in the debate about the way in which professional competence should be assessed: by cognitive tests or by integrated assessments which are based on work process knowledge. Examples from other countries such as the USA, the Baltic States, Italy, the Netherlands and other countries from Asia and Africa show varieties of the approaches which are extensively described by the authors of the Chapters. So it is hoped that this volume indeed contributed to a higher level of transparency of views by making the differences visible.

This Chapter listed the features which make competence-based education a unique innovation. It pointed at the recently developed key competencies in the EU, the EU guidelines for assessment, and the 2015 Riga Conclusions on key competencies. It furthermore gave examples of recent EU ICT and Logistics competence frameworks. The Chapter also referred to competence initiatives of the OECD, UNDP, ILO and UNEVOC. These examples show that competence-based education is a truly world-wide innovation.

The Chapter answered the eight questions raised in Chapter 1. such as on key drivers behind and dimensions of competence in practice and theory. The Chapter proceeded with the discussion of common misunderstandings about competence-based education, and articulated questions for further research. Next, final observations were made and comments were given. As said, more attention needs to be given to competence for the unknown future. In this Chapter this was called competence 3.0.

The main conclusion of this volume is that much has been achieved by the competence movement in vocational and professional education, but that there remains a lot to be done to realise its full potential and show its added value. Critical analyses have to be taken into account as much as possible, to overcome the challenges this education innovation faces. The reflections and discussions presented in this volume can be used for that.

In sum, although diverse, the collective intention of the competence movement is to align vocational and professional education with the developments and needs in the world of work, science and society, and thereby, to raise the quality of labour market oriented vocational and higher education, in the best interest of all stakeholders involved.

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