



Foundations of Competence-Based Vocational Education and Training

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Abstract

Several competence theories have been developed, and much competence research has been conducted during the last decades. Various competence solutions emerged at conceptual, strategic and operational level in the fields of corporate strategy, human resource management, education, training, and the development of personal effectiveness. Furthermore, the competence-based education philosophy has deeply entered the vocational education and training sector

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worldwide. Despite much criticism in certain countries, the competence-based vocational education and training (CBVET) philosophy has been attractive to many stakeholders in this field. This attractiveness can be easily explained, since CBVET addresses some perennial challenges in VET: the alignment with requirements of the labor market and entrepreneurship (including self-employment), the inclusion of applying knowledge and skills in practice, the hybridization of work and learning, the attention for the attitudinal dimension in professional identity, the focus on increased self-regulated learning, and the shift from final exams to portfolio development and formative and authentic assessment. Without the pretention of being exhaustive, this chapter, on the foundations of competence-based vocational education and training, gives a review of eight theoretical views on competence, which emphasize performance, self-determination, alignment, professional knowledge, shaping, effective instruction, capability, and human development. The chapter then reviews the current states of affairs regarding competence practices, characteristics of mature CBE systems, and discussions about definitions. The chapter is concluded with an outlook on competence for the future. Amongst all future-oriented competencies, learning competence remains most important. The development of all other competencies is depending on that.

Keywords

Ability · Alignment · Argumentation competence · Capabilities · Capabilities theory · Capability · Capability theory · Competence · Competence acquisition · Competence assessment · Competence dictionaries · Competence frameworks · Competence management · Competence measurement · Competence recognition · Competence research · Competence taxonomies · Competence theory · Competence-Based Vocational Education and Training · Competences · Competencies · Competency · Competency model · Competency-Based Vocational Education and Training · Core competence · Disciplinary competence · Employment · Entrepreneurial competence · European Qualifications Framework · Future competence · Human development · Incompetence · Innovation competence · Instructional theory · Integrative learning competence · Interdisciplinary competence · Learning competence · Levels of competence · Motivation · Occupational competence · Oral presentation competence · Personal-professional competence · Practical competence · Professional capability framework · Professional education · Purchasing competence · Qualifications framework · Self-management and career competence · Shaping competence · Skills-based education · Social responsibility competence · Social-professional competence · Teaching competence

Introduction

In the 2017 movie “The Wizard of Lies,” directed by Barry Levinson (who also directed Rain Man), the story of the fraud made by Bernie Madoff, known as the largest Ponzi scheme ever, is told. Remember that the volume of the scam mounted to a dazzling sum of 65 billion US dollars, hitting thousands of people, including family and friends. The crime committed lasted for about 16 years, from the beginning of the 1990s until December 2008, when Madoff wanted to turn himself in, which however was actually done by his sons, after he had revealed his criminal acts to them. The movie shows Independent Financial Fraud Investigator and Analyst Harry Markopolos who said he had been warning the US Securities and Exchange Commission (SEC) already in May 2000, handing in evidence for the case. However, the SEC did not follow this up, so Madoff could continue his malpractices another 8 years. In the movie, Madoff (Robert De Niro) watches the television statement of Markopolos and alerts his wife Ruth (Michelle Pfeiffer) to it, who asks what this is about. Then Madoff explains the SEC was warned, but did not act against him, causing Ruth to conclude that the government agency was *incompetent*, which was confirmed by Madoff, claiming he was saying that for years already. Had the SEC followed up on the investigations of Markopolos, a lot of misery could have been ended significantly earlier.

However, was incompetence the real reason why the SEC did not intervene? There is some doubt about that; some state that corruption was the cause why Madoff could go on this long.

Whatever the truth, which will never be revealed, the point in case is that incompetence is often used as the major reason to blame people or institutions, justified or not, for why things are going, or will go, wrong. Look at other movies. Striking examples can be found in Philadelphia (1993) and Skyfall (2012). Government agencies, politicians, and administrators are a frequently accused of being incompetent. But sadly, incompetence of people and institutions is not only featuring in motion pictures but also in real life. When “incompetence” is Googled (yielding over 35 million results in July 2018), lots of examples of bad performance are discussed of, for instance, medical doctors (“incompetent doctors” yielded over 6 million results), police officers (nearly 6 million results), and teachers (over 5 million results).

What is it that competence and incompetence are so frequently used to underline the importance of being good in ones’ job and to perform well? The answer seems to be obvious: otherwise, too many people suffer from behavior of incompetent people and organizations. Think of the errors within the medical profession, the below-standard pedagogical and didactical performance of a number of teachers, and disputed behavior of certain law enforcers. Of course, this goes hand in hand with personal and professional integrity and attitude, work pressure, regulations, and assessment conditions. But incompetent behavior is generally regarded as being undesired.

Incompetence, however, is not only an issue of individual shortcomings. Competence can be constrained by cultural, organizational, and structural labor

conditions. For instance, in non-meritocratic societies, in which education is not being regarded as a vehicle for individual vertical mobility, the intention to make sure that all graduates will be competent in their field may be regarded as useless. The reason for their employment and career success may be dependent on quite different personal factors such as belonging to a certain tribe or societal class. But also in societies which value professional competence, there should be opportunities to use this. A pressing problem in this respect is that in many countries not all graduates can find a job or create a livelihood by self-employment. This makes it hard for labor market-oriented education to be regarded as being successful. This problem is most prominent in societies with high youth unemployment rates. So what is important here is that inequity frames in the labor market can impede the use of acquired professional competence. When there are insufficient opportunities to find jobs, competent job performance of the unemployed, obviously, is not going to happen. See, for instance, the work of López Fogués (2014), who analyzed the state of youth unemployment in Spain and who contends that there is a lack of “guaranteed work” for students who graduate. Apart from the fact that it will be hard to “guarantee” employment for graduates, she is right in this analysis. She also states that vocational education and training, which is closely related to the labor market compared to other parts of the educational system, and especially competence- and skills-based education are not being effective. She argues that it is important to introduce “capabilities,” as possibilities for employment, which is seen as a matter of labor market policy. Actors in the labor market should enable graduates to get jobs; they should be given these capabilities as opportunities, in a sense as a basic right. This, however, is not an issue that can be solved by vocational education; the education system cannot create jobs. The critique that is often brought forward that competence of skills-based education is not effective, since it does not help graduates to find jobs, is therefore not just. Competence- or skills-based education, nor any education, can be solely blamed for labor market failure. It may be so that this type of education is not implemented well in Spain, or the region of Valencia, about which the story of López Fogués goes, but it seems that labor market imperfections are projected on certain vocational education and training practices. This chapter argues that the very purpose of the competence–approach in education is to adequately prepare students for being able to cope with the challenges of their future working, societal, and personal life. As a disclaimer, however, not all educational policies and practices which are being implemented under the label “competence-based” are really competence-based. A lot depends on how competence, competence-based education, and quality of competence-based education is conceptualized and implemented in practice.

This blurry use of competence theories and diversity in competence practices is the reason as to why there is so much confusion, dissatisfaction, and controversy about competence-based education. This is particularly disturbing because there are many countries across the globe which are implementing some form of competence-based education, not only within vocational education and training but also in elementary, secondary, and higher education. For the latter, see, for instance, the way in which Western Governors University implements competence-based

education (they call it competency-based education). In the July 31st (2017) issue of *Business*, Alana Semuels describes this innovation, although she also shares concerns and poses critical questions. Western Governors University, as she describes, is a not-for-profit school which was created by governors from 11 states in the USA in the mid-1990s. The goal of this institution was and is to better prepare students for the world of work, by using technology to enhance learning. However, it seems that assessment of student competencies is getting more attention than the support of learning, and the question is whether that complies with good competence-based education. Assessment is necessary, but it should be balanced with competence frameworks which are the foundation of the curriculum, the curricula themselves, and learning, as the core of the education process. It is because of the overrating of the importance of assessment of competencies in the UK, which resulted in the negative critiques of its competence movement and current embracement of a skills movement, if that would be any different. The objective of competence-based education after all is also to teach skills, of which many are cognitive and require in-depth knowledge, and to develop a professional identity, for which teaching educational objectives in the affective domain is essential.

This chapter, on the foundations of competence-based vocational education and training, tries to review theories on competence-based vocational education and competence practices which have emerged. It will first point at competence practices conducted by various associations and organizations, including institutions for vocational education and training. The chapter will then give an overview of characteristics of mature systems of competence-based education, which can be used to differentiate between more and less competence-based education systems. The chapter then gives a series of examples of competence frameworks for different professions. This will show the weight of the competence movement in defining the content and levels of professional performance. The chapter will then address the definition issues regarding the concept of competence. This part of the chapter is kept short, since much has been written already about the heterogeneity of definitions of the concept of competence. The chapter then finalizes with a call for attention to the importance of a reflection on future-oriented competence. This is particularly important in vocational education and training, which in many countries has the image of not being able to keep up with the developments in the world of work. An important pitfall of vocational education and training is that it is geared toward narrowly defined competencies which reflect the needs in present well-known jobs, whereas the nature of work is radically changing and profound transformations of societal, economic, industrial, and labor processes are taking place.

This chapter is largely based on a review of the literature collected in the edited volume *Competence-based Vocational and Professional Education. Bridging the Worlds of Work and Education* (Mulder 2017a). In this volume over 80 authors shared their insights in competence, competence theory, competence research and policy, practices, and educational systems issues regarding competence-based vocational education. The chapter also builds on the review of the literature on competence and view on the importance of future-oriented competence frameworks (Mulder 2016). Finally, recent sources were used to complement this chapter.

Competence Theories

In this section various theoretical approaches of competence will be presented. The section will point at the importance of the work of White and the research on achievement motivation which followed from that (Elliot et al. 2017). Next, the section will go into the relationship between competence and performance. Finally, it will give a brief overview of how competence entered the debated about the improvement of quality of teaching and education. But first an account will be given of the theoretical views on competence. Eight theoretical approaches will be reviewed, which ends with short reflection about the relationship between the competence and human development and capabilities approach. The approaches are (1) performance theory, (2) self-determination theory, (3) alignment theory, (4) occupational domains theory, (5) shaping competence theory, (6) instructional theory, (7) capability theory, and (8) the human development and capabilities theory.

Performance Theory: The AMO Model (Appelbaum et al.)

In line of the work of López Fogués (op. cit.), the first theoretical view on competence that will be summarized here is the one of Appelbaum et al. (2000). This theory, often referred to as the AMO model, defines competence, or ability in the terminology of that model, as a factor which predicts performance. The known formula of the model is $P = A \times M \times O$ (P, performance; A, ability; M, motivation; O, opportunity). Therefore, if people who are in fact competent do not have the opportunity to show their competence because they are denied opportunity to perform the duties which require that competence (as described above), they may unjustly be assessed as being incompetent.

In the context of competence theory, the AMO formula may be adapted (Mulder 2017b) to

$$P(\text{erformance}) = C(\text{ompetence})_{ksa} \times O(\text{ppportunity})_{rpt} \times M(\text{otivation})_{ieo}$$

Competence in this formula consists of knowledge, skills, and attitudes, which need to be integrated in professional performance. Not only knowledge (k) and skills (s) are important, professional attitude (a) or identity is also important which manifests itself clearly in sales, care, hospitality, and services sectors, but also holds for other professions. Opportunity includes available resources (r), positions (p) in which professionals are placed, and their task assignments (t). These can be rich in terms of opportunities or affordance, but also limited or even deprived. Motivation includes intrinsic (i) and extrinsic motivation (e), which are triggered by short- and long-term incentives, personal expectations and those of others, and personal and business objectives (o).

Self-Determination Theory (Deci and Ryan)

The theory of self-determination, developed by Deci and Ryan (1985), is about the basic psychological needs of people, which are (1) competence, (2) relatedness, and (3) autonomy. Following the work of White (1959), who saw competence as a motive of human behavior, Deci and Ryan saw competence as the motive to master a sufficient level of performance. Relatedness is a need which is about interaction with others and a sense of belonging to a community. Autonomy is about the integrity of the self, being in control, and the feeling that one can make decisions and act according to one's own views.

Ryan and Deci (2000, p. 58) explicitly state (in their *Cognitive Evaluation Theory*) "... that interpersonal events and structures (e.g., rewards, communications, feedback) that conduce toward *feelings of competence* during action can enhance intrinsic motivation for that action because they allow satisfaction of the basic psychological need for competence." So, feelings of competence can increase intrinsic motivation, which is an important trigger for performance, as is explained in the description of the theory of Appelbaum et al. (op. cit.). But, Ryan and Deci (op. cit.) also emphasize "... that feelings of competence will *not* enhance intrinsic motivation unless they are accompanied by *a sense of autonomy*... Thus, people must not only experience perceived competence (or self-efficacy), they must also experience their behaviour to be self-determined if intrinsic motivation is to be maintained or enhanced." So, intrinsic motivation is enhanced by perceived competence of one self, also referred to self-efficacy, only if one's behavior is experienced as being self-determined.

Alignment Theory (Mulder)

Mulder (2017c) presents the alignment theory which is in his view the core idea behind competence-based and similar education approaches, such as outcomes-based education. The discontentment with the lack of alignment of education and the world of work was the starting point of many competence-based education practices. Notions about the alignment of education and work can be dated back to the middle of the nineteenth century, if not earlier, if the guilds which were created in the Middle Ages are included. During the last decades, the theory of strategic alignment (Biggs 1999) became quite popular in higher education. The essence of that theory is that intended learning outcomes, learning processes, and assessment of learning are balanced in such a way that they are well related. It is obvious that if learning outcomes are being modified, learning processes and assessment need to follow. But in education that did not always take place. New educational objectives were introduced, whereas often instruction, learning, and assessment stayed the same. According to Mulder (op. cit.), in vocational education and training, the strategic alignment theory of Biggs needs to be expanded. Intended learning outcomes need to be generated, and that happens within a certain context. This can be based on competence frameworks in which stakeholders express their view on what

students need to learn. These frameworks are much more general than sets of intended learning outcomes, which are specified for curricula, courses, and lessons. Educational institutes however should not blindly adopt these frameworks and try to implement them in their programs. Schools and colleges have their own views on education and training, and these philosophies should be used to filter these frameworks to establish education and training programs which are consistent with these views. Mulder positions the (extended) alignment theory in the so-called integrated occupationalistic approach of competence development. This means that competence frameworks express knowledge, skills, and attitudes which are conceived of as being essential for certain occupations (or occupational groups) and which are translated in learning programs. These learning programs are not necessarily behaviorist or reductionist, as some critics contend. For, goals, objectives, and outcomes of education and learning can be defined as open as one likes. Their nature depends to a large extent on the learning theory which is being used in the educational design process. In that sense competence frameworks are not deterministic. On the contrary, competence-based education can be holistic, flexible, and responsive. The competence frameworks merely serve as reference models for what the stakeholders of certain occupations and professions hold as being important. Mulder (op. cit.) points at various contexts and studies in which competence frameworks have been developed and used.

Domains of Occupational Competence (Billett)

Billett points at the fact that expertise has been studied from the perspective of cognitive psychology but can also be seen from the socioculturalist perspective. From the latter, perspective work is seen as a cultural practice. Billett states that the socioculturalist perspective is helpful in understanding "...what comprises competent performance at work" (op. cit., p. 48). Billett consequently distinguishes three domains of knowledge which are conceived of as the foundations of competence or professional expertise: (1) canonical knowledge of the occupation, (2) particular situational knowledge, and (3) the personal domain of knowledge. The canonical domain of knowledge "...is the collection of concepts, procedures and dispositions that capture what societies want from that occupation and what are demanded and expected from those practising occupation" (op. cit., p. 48). Billett sees situated competence as "...that what is required for the practice of that occupation in a specific work of community setting" (op. cit., p. 48), referring to the importance to the situational meaning and assessment of competence. He also points at the relative importance of qualifications, which are of course important for labor market or job access, but which in his view cannot "...compensate for the inability to perform competently in specific situations and in tasks manifested in that situation (op. cit., p. 49). Obviously, many contextual factors make a competent graduate not necessarily a competence job performer. The domain of the personal domain of knowledge, according to Billett, is constructed by people, and '...used within and across specific instances of their professional practice as they encounter and respond to it' (op. cit., p. 49).

Shaping Competence Theory (Rauner)

As Howe and Gessler ([forthcoming](#)) describe that Rauner introduced the idea that shaping competence (Gestaltungskompetenz) needed to be an important element of the theory of vocational education and training. This idea goes back to the work of Rauner et al. (1988), in which the concept of “social shaping” is introduced. This concept is used to “...describe the essential dynamic between the social purposes and technological possibilities which shape the development of technology in general” (op. cit., p. 47) and was applied to human-centered computer-integrated manufacturing (CIM). Within the discussion on professional competence as the goal of vocational education and training, Rauner thought that competent professional performance goes beyond a process-wise listing of occupational activities. Professional competence needs to go together with social and personal competence and the competence to shape work and society. This combination of competence domains needs to be understood against the background of the German version of the European Qualifications Framework (EQF), the DQR. Competence in the DQR does not stand next to the categories knowledge and skills, such as in the EQF, but it is an overarching category: it covers all intended learning outcomes, knowledge, skills, and attitudes. Essentially, the DQR is composed of two competence domains, (1) professional competence and (2) personal competence, which are both divided in two subdomains: 1.1 knowledge and 1.2 skills and 2.1 social competence and 2.2 autonomy. It is the autonomy category which represents the competence category in the EQF. The new vision of Rauner was to stress shaping as an essential element of professional competence. It is a competence domain that can be understood as comakership and co-construction. While self-responsibility and self-regulation for work became important values in the organization of work (as opposed to the Tayloristic organization of work, in which people are expected to perform part-tasks which were assigned to them), and employees were regarded more and more as co-workers, shaping one’s own work flow within the work environment that is provided, and even the innovation of work and its organization itself, became a key competence domain, referred to as shaping competence.

Instructional Theory (De Corte et al.)

When it comes to educational design, competence is often conceptualized as related to curriculum development and less often to instructional design. However, Wesselink et al. (2017) have made an attempt to combine principles for competence-based vocational education with the design or competence-based instruction. But in most cases, competencies are seen as curricular inputs for the instructional design process or even as inputs for the curriculum development process itself, such as in the alignment theory mentioned above. An example of treating competencies as inputs for instructional design is from De Corte et al. and presented in their “CLIA model” (De Corte et al. 2004). The components of the model are competence, learning, intervention, and assessment. In the competence

component, De Corte et al. have defined five competence domains: (1) domain-specific knowledge, (2) heuristic methods, (3) metaknowledge, (4) self-regulatory skills, and (5) positive belief in the self. All these competence domains have been heavily studied by learning psychologists. The competencies defined are then related to learning, interventions, and assessment strategies, which is basically an example of alignment theory.

Capability Theory (Cairns and Malloch)

In their review of the competence literature, Cairns and Malloch (2017) describe the critiques on the competency-based education and training philosophy. They state that that philosophy was strongly based on a behaviorist education philosophy. This competency-based education approach was recently reviewed by Barrick (2017). As this instrumental view on education has been criticized heavily already in the 1970s in the teacher education literature, alternative approaches of teaching and learning became more prominent, such as the humanistic-based teacher education (HBTE) approach and constructivist views on learning. While these developments were well underway, Cairns (1992) suggested to use the concept of “capability” to emphasize the holistic nature of education while retaining its purpose to prepare children and young adults for their role in society. Cairns based his view on literature which appeared in the UK (Stephenson 1992) and presented this as an “...alternative or complementary set of ideas and models to the competency-based education and training approach” (Cairns and Malloch 2017, p. 104). According to Cairns and Malloch, the capability movement started with a project on education for capability, which was described by Cairns and Stephenson (2009). It gained popularity in education, further education, vocational education and training, and higher education in the UK and Australia. Cairns and Malloch point at an elaborate list of applications on the capability approach in education (op. cit., pp 108–109).

Many of the publications on the integrative or holistic view on competence follow the broad view on capability. For instance, Stephenson sees it as important that (higher) education prepares capable people, who “...have confidence in their ability to take effective and appropriate action, explain what they are about, live and work effectively with others and continue to learn from their experiences as individuals and in association with others, in a diverse and changing society” (op cit., p. 1). Capability is “...a necessary part of specialist expertise, not separate from it. Capable people not only know about their specialisms; they also have the confidence to apply their knowledge and skills within varied and changing situations and to continue to develop their specialist knowledge and skills long after they have left formal education” (op cit., p. 2). Furthermore, capability is “...not just about skills and knowledge. Taking effective and appropriate action within unfamiliar and changing circumstances involves judgments, values, the self-confidence to take risks and a commitment to learn from the experience. Involving students in the decisions which directly affect what they learn and how they learn it develops a sense of ownership and a high level of motivation” (op cit., p. 2). This view on capability collides to a large extent with the views held by Biemans et al.

(2004, 2009) and relates to various principles of comprehensive competence-based vocational education (Wesselink 2010; Wesselink et al. 2015, 2017), which is also based on a broad view of occupational competence (Mulder 2014). Many of the competencies of the future are addressed near the end of this chapter (and elaborated in Mulder 2016). In the definition of competence in relatively recent publication, competence was even defined in terms of capabilities (Mulder 2014; Mulder and Winterton 2017).

Human Development and Capabilities Theory (Nussbaum)

With discussing the human development and capabilities theory, this section goes back to the introduction, in which the work of López Fogués (2014) was mentioned, which is clearly the situation in this tradition. The competence and capability literature in education is quite different from the capabilities theory which is the foundation of the human development and capabilities approach. In their chapter Cairns and Malloch point of the work of Sen (1985, 2009) and Nussbaum (2011), who are using the plural “capabilities” in their work, but the theoretical foundations seem to be quite different. Nussbaum (2011) developed her human capabilities approach, which originates from a global politics perspective, with a strong emphasis on human rights, social justice, and opportunities to develop capabilities. There is a Human Development and Capability Association, with the subtitle “agency, well-being, and justice,” in which education is obviously included. But the capabilities distinguished by Nussbaum (op cit) are similar to basic human rights. These capabilities are (1) life; (2) bodily health; (3) bodily integrity; (4) senses, imagination, and thought; (5) emotions; (6) practical reason; (7) affiliation; (8) other species; (9) play; and (10) control over one’s environment. The capabilities approach is “... about the opportunities available to each person” (Nussbaum 2011, p. 18) and is related to social justice. Nussbaum describes these opportunities as “...created by a combination of personal abilities and the political, social, and economic environment” (op. cit., p. 18). Examples of the capabilities Nussbaum defined are the following:

1. *Life*. Being able to live to the end of a human life of normal length; not dying prematurely, or before one’s life is so reduced as to be not worth living.
2. *Bodily Health*. Being able to have good health, including reproductive health; being adequately nourished; having adequate shelter.
3. *Bodily Integrity*. Being able to move freely from place to place; having one’s bodily boundaries treated as sovereign, i.e. being able to be secure against assault, including sexual assault, child sexual abuse, and domestic violence; having opportunities for sexual satisfaction and for choice in matters of reproduction (op. cit., p. 33).

It will be clear that these capabilities transcend education and can be clearly seen as human rights. See, for example, Article 3 of the United Nations’ Universal Declaration of Human Rights (<http://www.un.org/en/universal-declaration-human-rights/>; accessed 24 July 2018). Article 3 states: “Everyone has the right to life, liberty and security of person.” Article 13 is: “(1) Everyone has the right to freedom of movement and residence within the borders of each state. (2) Everyone has the

right to leave any country, including his own, and to return to his country.” Article 25 (1) states: “Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control.” And, finally, Article 5 is: “No one shall be subjected to torture or to cruel, inhuman or degrading treatment or punishment.” These are very close to the capabilities described by Nussbaum. While this is not to criticize the capabilities Nussbaum has defined, it is to show that these are fundamental to humanity, and education, including vocational education and training, has to contribute to these capabilities. But education has its limits in this respect, as was mentioned above regarding the issue of unemployment. For generic global vocational and professional education, more focus is needed on professional competence (see Mulder 2016). Clearly, education can contribute to certain capabilities such as capabilities 4 on senses, imagination, and thought, which can be “...informed and cultivated by an adequate education, including, but by no means limited to, literacy and basic mathematical and scientific training” (op. cit., p. 33). Important questions here are how internal personal capabilities and external societal capabilities (as opportunities to exert human rights in a society with high standards of social justice) are related, and what education (as an external capability) can contribute to the personal capabilities of its students, and what (broad, holistic, and integral) competencies can be developed by – within the framework of this handbook – vocational education and training.

For a further detailed discussion of the analysis of the relationships and differences between these concepts, including the difference between internal and combined capabilities, see the review of the work of Nussbaum by Magni (2014). See for a further discussion of the capabilities approach in the context of European vocational education and training the work of Alessandrini (2017).

There is another view on capability, which features prominently in the literature; it is the capability of business and industry to realize technological innovation. This theme addresses knowledge transfer, business venturing, investment, etc. Technological capabilities are thus strongly related to product, business, and industry development, hence the many references to top publications in the field such as of Lall (1992), Tripsas and Gavetti (2000), Lee et al. (2001), Stuart and Podolny (1996), and Dosi et al. (2000). Since the views on technological capabilities do not focus on the design of vocational education, although the theme of technological capabilities is relevant for many vocational education programs, this chapter will not elaborate on this any further.

Competence: The State of Affairs

After having reviewed a number of competence theories, without having had the pretention that this would be an exhaustive review, the state of affairs regarding competence practice will be discussed. There are three themes that will be elaborated

here: competence in practice, characteristics of mature competence-based education practices, and a number of competence frameworks.

Competence in Practice

So first of all, the state of affairs regarding competence in practice will be addressed. There is no worldwide survey about competence practices. Nevertheless, the edited volume mentioned before (Mulder 2017a) serves as a global inventory of national and regional approaches of competence-based education. But competence practices exist in various communities:

- Professional associations have developed competence frameworks to define their expectations of professional practice. Sometimes these frameworks come as standards for the profession or certification schemes. In many cases the frameworks serve as the foundation of vocational and professional education, professional licensure, and training for re-licensing.
- Governmental organizations have developed various competence frameworks as well. These are in most cases dedicated to public functions, such as tax inspectors or teachers' competencies of teachers. In some cases, these frameworks are established by law.
- Testing companies have developed a wide variety of competence measurement tools to test workers or students in all kinds of fields and at various levels. These tests can be purchased and used under licenses. The testing companies offer a wide range of services for testing individuals and groups, process test data, and report test results. They also provide comparative analyses and benchmarks at institutional, national, or international levels.
- Consultancy firms (some testing firms operate on a consultancy basis) have produced competence dictionaries, advisory services for competence assessment, and systems for competence development. The largest consultancy companies have their standard dictionary which can be adapted to individual corporations and implemented for employee, management, or executive assessment and development. These dictionaries typically consist of key competencies, underlying competencies, and sub-competencies, all defined, explained, and further detailed. Some of these dictionaries can be over 100 pages. In other cases, the consultancy companies create competence frameworks for a diverse group of clients, including companies that prefer not to work with standard dictionaries.
- Organizations, companies, and institutions have implemented competence management systems. In many cases these systems are based on the dictionaries mentioned above. In regular employee assessments (each half year or year), managers and employees, and sometimes co-workers and employees that report to the person who is being assessed (the assessee), review and rate the competence levels of the assessee, sometimes in a 360° assessment. The assessments can lay the foundation for further training and development, promotion, or other human

resource management decisions. Some companies have experimented with competence-based remuneration, but that appeared not to be extremely successful.

- Educational institutions have graded their education programs according to national qualifications frameworks or have developed and implemented competence-oriented and competence-based curricula. The grading of studies in publicly financed education within the European Union is obligatory. The levels of studies are defined by the European Qualifications Framework. Educational institutions are expected to mention the respective program level on the diploma. Education and training programs offered by privately funded institutions can also request for having their levels determined, although this is (still) voluntary. The grading of education programs is meant to make national and international levels of education more transparent. The degree in which principles of competence-based education are implemented in the educational institutions is also voluntary. This depends on the educational philosophy and expertise schools and colleges have in terms of realizing competence-based practices. The form of using competence practice in curriculum design that occurs most is that program teams use competence frameworks to defined learning outcomes. Others go an extra mile and are using competencies as foundations for learning tasks and authentic competence assessments as examinations.

Examples of national approaches and evaluations of experiences regarding competence-based vocational and professional education practices are given by Barrick on the USA (Barrick 2017), Cairns and Malloch (2017) and Hager (2017) on Australia, Stokes (2017) and Evans and Kersh (2017) on the UK, Weber and Achtenhagen (2017) and Gessler (2017) on Germany, Le Deist (2017) on France, Tütlys and Aarna (2017) on two Baltic States, Ronchetti (2017) on Italy, Fan (2017) on China, Panth and Caoli-Rodriguez (2017) on South Asia, Viet (2017) on Vietnam, and Van Halsema (2017) on Rwanda. Many of these national reviews show the diversity, complexity, and struggle to get competence models, education practices, and measurement schemes in place and some point at the dissatisfaction with using competence-based education as practiced, mentioning that there is the danger that assessment gets too much attention at the cost of learning time, or that competencies are trained and ticket off individually at the cost of the integration of the parts of professional competence, or that competence-based education frameworks are too rigid, whereas they should serve dynamic processes of agile adaptation to changing circumstances.

Characteristics of Mature Competence-Based Education Systems

Many educational institutions have introduced so-called competence-based education programs on the waves of the competence movement, whereas at closer inspection, this often appeared to be lip service, marketing, or a way to reduce contact hours. This is why gradually the notion of immature and mature competence-

based education systems developed. Mature competence-based education systems have various characteristics.

- *Competence frameworks.* These have been discussed already and often consist of key and basic of foundational competencies. Examples of these will be presented below.
- *Competence taxonomies.* These define skills, knowledge, and attitude levels and typically employ taxonomies of educational objectives. A specific issue of competence practices in vocational education concerns the various levels within the vocational education systems, sometimes referred to as the vocational education column. Suppose a competence domain like communication of entrepreneurship is part of the curriculum of junior secondary vocational education (for students of 12–16 years of age), but also of senior secondary vocational education (for students of 16–19 years of age) or of higher vocational (college) education (for students of 17–21 years of age). What does this competence domain at these different levels mean? Surely something different. The competence domains get more complex at higher levels because of the complexity of the vocational or professional practice. But how can achievement of mastery levels of communication or entrepreneurship competencies be compared? One way to do that is to link competence specifications to reference frameworks such as the European Qualifications Framework. Another possibility is to use laddering schemes such as the one developed by De Jong et al. (2017), which is the 4Cyourway framework for the measurement of competence growth, which can also be applied for curriculum development.
- *Competence recognition.* This is a system of recognition or the validation of prior learning. An important idea behind the competence-based education philosophy is, like in mastery learning, that once competencies are acquired no further education or training is needed. This especially holds for students or adults who are entering education programs and who already possess certain competencies which are being taught in the program. One would think that those who enroll in the program would get exemptions for these competencies and that the program time would be shortened. Due to the inflexibility of many educational institutions and programs, this however does not happen, unless students have a higher qualification than is strictly needed, so that they can perhaps skip the 1st year of the program they are starting. The inflexible structure of vocational education is particularly frustrating for workers who have many years of challenging work experience and who followed a number of in-company training programs and external courses, who take an assessment to accredit their prior learning, and who are then being noticed that they need to follow a complete education program to get the qualification of the level on which they already function for years. Bohlinger (2017) has given an international overview of systems of recognition of prior learning.
- *Competence acquisition.* This is the teaching and learning practice, in which the learners acquire the professional competence specified by the educational program. This learning in competence-based vocational and professional education

should be as authentic as possible, and should not only include the acquisition of knowledge and skills, but should also contain an applied learning part. In many vocational and professional education programs, this authentic and applied learning takes place in field attachments, internships, or apprenticeships. They can vary by intensity, duration, and contractual agreement. In some apprenticeship schemes, students are being paid a student-worker salary, in others they get compensated for costs, and in still other schemes they get no financial compensation whatsoever.

- *Competence assessment.* This is about the measurement of competence gain, but it can be used in different ways. Well-known is the difference between summative and formative assessment, for making pass-fail decisions at the end of the learning process and to provide support to the learner during the learning process, respectively. However, assessment can also be conceived of as an integrated part of the learning process. By continuous assessment of learning achievements during the learning process, students get direct feedback on their performance. This feedback can give them clear cues as to where they are in terms of their progress, which can help motivate them to proceed. This assessment as learning practice can also be used in adaptive learning systems and personalized instruction. Van der Vleuten et al. (2017) and Blömeke (2017) have given overviews of different competence assessment methods which provide support of learners.
- *Competence-based school-HRM.* If schools and colleges for vocational and professional education embark on a competence-based education journey, one of the things that should be considered is to transform the educational institution into a learning organization. It is surprising that institutions, whose primary objective is to make their target groups to learn, do not act as learning organizations. Team learning in vocational education institutions is getting more and more popular (Bouwman et al. 2017a, b, c, 2018), but still, team-oriented human resource management and the implementation of practices of the learning organization are scant.

Competence Frameworks

As said in the previous section, competence frameworks are a systemic element of mature competence-based vocational education practices. Many competence frameworks have been developed, by consultancy agencies, professional associations, and researchers. Various examples will be given below.

The Great Eight Competency Framework. This framework, developed by Bartram (2005) of Hay Group at that time, is the result of empirical research among thousands of managers and attempts to capture all human competence in eight broad competence clusters, just like the Big Five Personality Dimensions of Barrick and Mount (1991). Both the core competencies of Bartram and the personality dimension of Barrick and Mount are related to job performance, as it was the intention of these authors to be able to predict job performance by competence or personality tests, as these are essential methods in personnel selection. The eight core

competencies identified by Bartram are (1) leading and deciding, (2) supporting and cooperating, (3) interacting and presenting, (4) analyzing and interpreting, (5) creating and conceptualizing, (6) organizing and executing, (7) adapting and coping, and (8) enterprising and performing. These are all further specified in a total set of hundreds of more detailed competencies. The research of Bartram showed that a relationship between the competencies and job performance can be established if job success as the criterion is sufficiently differentiated. Mere managerial assessments of poor, average, good, and excellent job performance do not suffice. Job performance needs to be operationalized in detailed terms, and valid assessments of these are needed, as well as valid assessment of competence.

The CanMEDS 2015 Physician Competency Framework (Canada). This competence framework is developed by the Royal College of Physicians and Surgeons of Canada and is endorsed by 12 medical associations (Frank et al. 2015). It comprises roles, key concepts, key competencies, and enabling competencies for each role. The roles are medical expert, communicator, collaborator, leader, health advocate, scholar, and professional. Compared with the previous (Great Eight) competence framework, this framework is much more oriented toward the content of the tasks of the medical professional. Therefore, this framework can be referred to as a domain-specific, content-oriented framework, whereas the Great Eight competence framework can be seen as a generic, behavior-oriented framework. Both frameworks are appropriate and useful in their respective contexts.

The Engineering Competency Model (USA). This also is a recent competence framework, developed by the American Association of Engineering Societies (AAES) and the Department of Labor of the United States (USDOL). This model is created as a foundation for the development of the workers in the engineering sector. It comprises core competencies which enable the advancement of and success of individual workers in the engineering profession. This competence framework consists of tier 1–5 competence statements and on top of that management competencies and occupation-specific requirements. Tier 1 comprises personal effectiveness competencies, including interpersonal skills, integrity, professionalism, initiative, adaptability and flexibility, dependability and reliability, and lifelong learning. Tier 2 comprises academic competencies, including reading, writing, mathematics, science and technology, communication, critical and analytical thinking, and computer skills. Tier 3 comprises workplace competencies, which are teamwork, client/stakeholder focus, planning and organization, creative thinking, problem-solving, prevention and decision-making, working with tools and technology, scheduling and coordinating, checking, examining and recording, and business fundamentals. Tier 4 comprises industry-wide technical competencies, which are foundations of engineering, design, manufacturing and construction, operations and maintenance, professional ethics, business, legal and public policy, sustainability and social and environmental impact, engineering economics, quality control and quality assurance, and safety, health, security, and environment. Tier 5 comprises industry-sector functional areas which should be specified by industry-sector representatives. As said, on top of that management- and occupation-specific requirements are positioned. These are specific for management positions and occupations

and not further operationalized in the framework. All competency components seem to direct to specific jobs and contexts. Further information about this framework can be found at <http://www.aaes.org/model>.

The Professional Capability Framework of Social Work (UK). This framework is developed by the British Association of Social Workers and actually is part of various levels of professional practice along the career of the social worker, being the entry level, readiness for direct practice, end of first placement, end of last placement, the ASYE (which is the assessed and supported year in employment, which takes 12 months and is a program which is led by employers; candidates are being supported and assessed based on the knowledge and skills statement for social workers in adult services – see for further information <http://www.skillsforcare.org.uk/Learning-development/The-ASYE-adults/The-Assessed-and-Supported-Year-in-Employment-Adults.aspx>), social worker, experienced social worker, advanced level, and strategic level. All capabilities (or competencies) at all career levels are specified within the following categories: (1) professionalism; (2) values and ethics; (3) diversity; (4) rights, justice, and economic well-being; (5) knowledge; (6) critical reflection and analysis; (7) intervention and skills; (8) contexts and organizations; and (9) professional leadership. All capabilities are defined and further specified. For further information about this framework, see <https://www.basw.co.uk/pcf/capabilities/>.

More Research-Based Examples. Many more examples can be given from research. See, for instance, the following studies, which all address competence frameworks which are based on empirical research or related competence issues. The frameworks are quite different in nature. Some are more generic, others more specific. Some compartmentalized knowledge, skills, and attitudes, others integrated these. Some are more behaviorally oriented, others more content-oriented.

- Agricultural extension competence (see Karbasioun et al. 2007)
- Argumentation competence (see Noroozi et al. 2017)
- Entrepreneurial education and learning (see Lans 2009; Karimi et al. 2016; Baggen et al. 2017)
- Innovation competence (see Du Chatenier et al. 2010)
- Oral presentation competence (see Van Ginkel et al. 2015)
- Purchasing (see Mulder et al. 2005)
- Training for practical competence (see Khaled et al. 2015)
- Regional learning (see Wesselink et al. 2015)
- Rural development services (Brinkman et al. 2007)
- Social responsibility competence (see Osagie et al. 2014)
- Teaching competence (see Kasule et al. 2015; Alake-Tuenter et al. 2012)

Competence Definitions

In this chapter, an extensive section on the definition of competence was deliberately excluded. Much has been written about this already, and the conclusion very often is that there is little consensus about the concept and very wide diversity in the

definitions. This is no surprise, given the wide diversity of competence theories and practices presented in this chapter. Also in research, there is much diversity in which the concept of competence is defined, operationalized, and measured.

The definition of the concept of competence is discussed in detail in Mulder (2017a) and defined following earlier publications (e.g., Mulder 2014). “Professional competence is seen as the generic, integrated and internalized capability to deliver sustainable effective (worthy) performance (including problem solving, realizing innovation, and creating transformation) in a certain professional domain, job, role, organizational context, and task situation” (Mulder 2014, p. 111). Competency is seen as “...an element and characteristic of competence” (op. cit., 2017, p. 14) or as “...a coherent cluster of knowledge, skills and attitudes which can be utilized in real performance contexts” (Mulder 2014, p. 111).

This chapter uses an inclusive view on competence and denies very narrow conceptualizations of competence by which students of vocational education must learn a long series of detailed tasks. But this stance is not uncontroversial. As stated above, the AMO model of Appelbaum et al. (2000) includes ability, which in the adapted formula was equated with competence. Some purists detest such elastic use of the concept of competence and make spasmodic attempts to stay away from the competence concept and narrowly stick to other – but related – concepts such as occupational knowledge, professional knowledge, capability, capacity, expertise, talent, and other concepts. However, these concepts have many commonalities. To show the elasticity of the concept of competence, the dimensions on which they differ can be mentioned (Mulder 2017b): centrality, contextuality, definability, developability, dynamic nature, knowledge inclusion, measurability, mastery level, performativity, and transferability. All definitions include variations on these dimensions and still claim they define the concept of competence.

Not much has been said about the stages of development of (professional) competence, although the work of De Jong et al. (2017) and the framework of professional capabilities of social workers are related to that issue. Nevertheless, it is an important issue, which also related to the taxonomies and mastery levels of competence. This chapter uses a broad view regarding competence. It is thought that competence can be acquired at various levels, from beginning to advanced or even world-class performance levels. Very often different words are being used for the competence levels. This is different from the theory of Dreyfus and Dreyfus (1986) who see competence as a phase on the continuum of being a novice, being competent, being proficient, being an expert, and possessing full mastery. This chapter contends that all positions of the continuum represent certain levels of competence or mastery and therefore sees competence as the overarching concept. Levels of competence can be categorized as (1) insufficient, (2) sufficient, (3) adequate, (4) good, (5) very good, (6) excellent, and (7) brilliant. Many corporate competence management systems have abbreviations of these levels of competence, whereby the tendency is to not include the category insufficient, as it would be perceived as being offensive. Typical categories are sufficient, good, very good, and excellent.

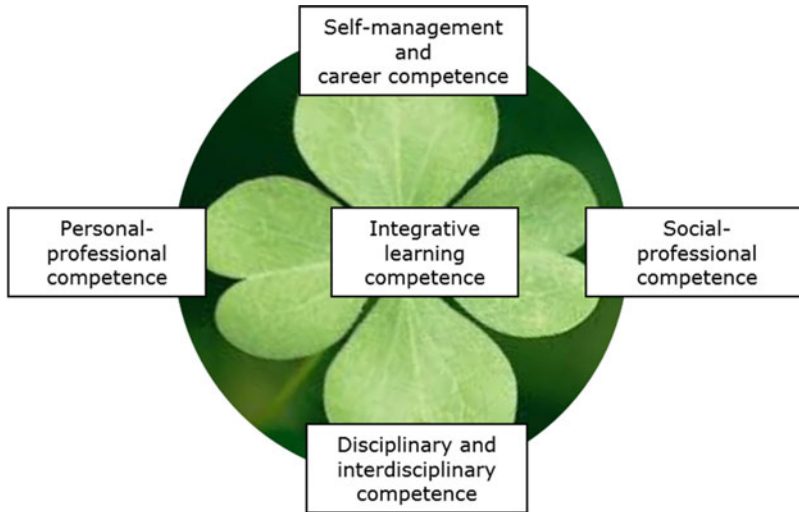


Fig. 1 Model of future-oriented competence. (Source: Mulder 2016)

Competence for the Future

More important than staying on the trodden path of competence definition discussions is the reflection on what would constitute competence which is needed for the future, not only for being able to function in tomorrow's society and to cope with the challenges ahead but also for shaping that society: competence that is needed to bring about change, create innovation, and realize transformation. To facilitate the discussion on this issue, a model was developed during 2016 in which various proposals for future-oriented competencies were made. These include the DeSeCo Model of Key Competencies (Rychen and Salganik 2003), the EU Recommendation on key competences (European Union 2006), the work on twenty-first century skills of the NCREL/Metiri Group (2003), the Essential Learning Outcomes as defined by the Association of American Universities and Colleges (AAUC 2015), the Seven Survival Skills for today's students (Wagner 2008), further work on the twenty-first century skills (P21 2015), and the critical competencies for future leadership (Vora 2015). Elements of the competence statements in these documents were semantically analyzed and grouped together in five categories which form the model of future-oriented competence (see Fig. 1).

There are five components in this model: (1) integrative learning competence, (2) disciplinary and interdisciplinary competence, (3) self-management and career competence, (4) personal-professional competence, and (5) social-professional competence.

Integrative learning competence is the heart of the model. This symbolized the key role learning competence that plays in human existence. Without the learning

competence humans would not be able to solve the current complex questions and future challenges.

Disciplinary and interdisciplinary competence are the foundation, as the idea is that for effective performance and further learning disciplinary and interdisciplinary competence is a *conditio sine qua non*. In professional contexts *self-management and career competence* are needed to establish a livelihood and start a career, which can be based on getting and keeping a job or based on self-employment or entrepreneurship. In many vocational education and training programs, the score of programs and teachers is to prepare for the labor market, which translates to finding a job, and too often the scope of self-employment and entrepreneurship is neglected, although via various stimulation schemes and policy attention this is gradually changing.

The horizontal dimension is the dimension of professionalism and consists of the *personal and social competence* side of that.

The competence components are further described as follows. The specifications are a modification of those in Mulder (2016). Repositioned competence domains are printed italic.

1. *Integrative learning competence*. This is essential for all competence domains in the model. Next to other competencies, it consists of competence regarding *critical thinking*, development, knowledge creation, *higher order thinking*, *sound reasoning*, *inquiry and analysis*, synthesis, evaluation, and *lifelong learning*.
2. *Disciplinary and interdisciplinary competence*. This includes the whole array of competence domains which are related to certain professional fields and interdisciplinary working contexts, such as competence in finance, economics, business literacy, mathematics literacy, social sciences literacy, humanities literacy, languages literacy, arts literacy, digital (ICT) literacy, media and information literacy, reading, writing, numeracy, computational competence, science, technology, design and inquiry literacy, environmental literacy, and interdisciplinary problem-solving competence.
3. *Self-management and career competence*. This includes competence in autonomous action, self-regulation, life planning, personal project planning, responsibility, managing for results, prioritizing, productivity, accountability, argumentative reasoning, resilience and stamina, sense of initiative, innovation and entrepreneurialism, and calculated risk taking.
4. *Personal-professional competence*. This includes competencies such as *ambiguity and uncertainty handling*, adaptability, flexibility, agility, reflection and self-awareness, emotions handling, curiosity, imagination, creativity, intuition, mindfulness and integrity, big picture visioning, global competence, cultural awareness and expression, civic competence (balancing, defending/asserting rights, interest, limits, needs), anticipate and create change, complex problem-solving, managing complexity, health and physical competence, *sustainability*, and ethical reasoning and action competence.
5. *Social-professional competence*. This includes competence regarding civic knowledge and engagement, relating well to others, interpersonal contact,

interactive communication, clarification of information to others, negotiating on meaning, multicultural literacy, *leadership*, *transformation*, productive teamwork, collaboration in networks, creating ecosystems for engagement, and managing and resolving conflicts.

As stated in Mulder (2016), the listing of competencies in the overview does not suggest an order of priority, nor does it serve as an exhaustive overview of future-oriented competencies. Furthermore, more discussion and reflection are needed on future-oriented competence such as in the context of Industry 4.0, but more in general also in the context of transformation.

Conclusions

This chapter has reviewed various foundations of competence-based vocational education, addressing theories regarding performance, self-determination, alignment, knowledge domains of occupational competence, shaping competence, instruction, capability, and human development and capabilities. It then reviewed the state of affairs regarding competence practice and pointed at the way in which professional associations, governmental organizations, testing companies, consultancy firms, companies, and educational institutions are dealing with the competence movement. It listed the structural components of mature competence-based education systems, which included competence frameworks, competence taxonomies, competence recognition, competence acquisition, competence assessment, and competence-based human resource management. Next it gave examples of large and comprehensive competence frameworks for the management profession, medical profession, engineering profession, and social work profession. It then listed various examples of research-based competence frameworks. The chapter then shortly went into the issue of defining competence and was completed with drawing attention to the necessity of reflecting on and discussing the competence which is needed for the future. This is no easy exercise, but there have been various studies already which address this. These studies can be used to define future-oriented competencies for secondary and post-secondary levels of vocational and professional education and training. The changes in industry and transformations in society regarding smart technologies, big data, virtual mobility, and carbon-neutral production and consumption on the one hand, and geopolitical, climate change, food production, and water management challenges on the other hand, ask for immediate attention for this reflection, not only for the sake of setting the right course in vocational education and training, and thus focusing on the right things, but also for aligning learning and assessment practices in that direction. And although critics of the competence movement contend that competence-based education draws attention away from learning, it should not. In all education approaches, student learning and development should be at the core (World Bank 2018).

Returning to the introduction of this chapter, the public interest in incompetence is understandable. Incompetence goes with a lot of societal costs. Therefore,

vocational education needs to prepare for professional competence (and where possible: professional excellence). It is up to educational designers, teaching professionals, and all those who are involved in quality education, to prepare students for a meaningful position in society in which the public can have trust.

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