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# Concepts and Standardization in Areas Relating to Competence

## **A white paper**

By Simon Grant and Rowin Young

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# Concepts and Standardization in Areas Relating to Competence

By Simon Grant<sup>1</sup> and Rowin Young<sup>2</sup>

1. JISC CETIS, IEC, University of Bolton, Deane Road, Bolton BL3 5AB, UK.

email: asimong@gmail.com

2. JISC CETIS, CAPLE, University of Strathclyde, 50 George Street, Glasgow G1 1QE, UK

email: rowin.young@strath.ac.uk

## Abstract

This paper reviews terminology, motivation, history and current work in areas relating to skill or competence. Many useful services, clarifying pathways within and from education to employment, self-assessment, and selection would be facilitated by better standardization of the format in which related definitions are represented, and also by a standard approach to representing the structured sets often called frameworks. To be effective, information models underlying interoperability specifications must be based on common conceptual models; the authors propose one such model as a work in progress. The authors see the way forward as reaching greater consensus about the components of competence, including intended learning outcomes, agreement on a model for frameworks allowing reuse of and comparison between components in and between frameworks, and investigation of how requirements and claims for skill and competence can be coordinated in the light of common practice in recruitment.

**Keywords:** Competence, Competency, Conceptual Modelling, Frameworks, Modelling, Standards

## 1. Introduction

This paper is prompted by the sharp rise in interest in electronic representations of skills, competencies, learning outcomes and related definitions. In response to this interest, the paper asks several fundamental questions about this whole area. The key question is, how can we progress through concepts and models towards the kind of useful specifications and standards that can enable the many real services that may well be demanded? The paper's approach is primarily to review and synthesize existing work, but additionally the opportunity is taken to present a new proposal, for the representation of the many related kinds of "framework" structures of skills, competencies, etc., which are widespread across very many domains in education and employment. This is offered for further discussion and critique.

### 1.1 COMPETENCE: CONCEPTS AND TERMINOLOGY

This first main section addresses the different terms used, and offers first suggestions for drawing them together.

The term competence is subject to a range of subtly different interpretations across different standards and projects. In natural language, it refers to “the condition of being capable; ability” (HarperCollins, 1994), encompassing notions of possessing sufficient skill and knowledge in order to fulfil some role or perform some task. Interpretations used by standards in the competence domain (discussed below) share this general sense, but are complicated and diverge from each other in the detailed breakdown of its meaning. This can raise difficulties in sharing competence information as apparently synonymous terms may actually refer to somewhat different qualities. This poses a particular problem for competence information that is intended to be processed by machines rather than humans, whether because of mismatching terms or, potentially more seriously, different meanings assigned to the same term in different systems.

The HR-XML Consortium uses the term “competency” rather than “competence”, specifying that competencies are “measurable characteristics” (HR-XML Consortium, 2007), and recognising that “some competencies can be objectively measured, whereas others may only be subjectively recognized.” Although, as the name implies, the specification is particularly orientated towards business recruitment and recognition, it is easily adaptable towards educational and training contexts.

One issue that regularly arises is the question of whether competence is a binary quality or not. In natural language, and in other domains such as law and biology, competence is seen as binary, someone is either competent or not. In the educational domain, however, some uses such as that of RDCEO (IMS, 2002) and IMS Learning Design (IMS, 2003) Level C suggest that competence or competency can be graded on a scale, and that it can have degrees or “dimensions” (RDCEO).

A competence may be made up of a number of sub-competences, for example, competence in a foreign language requires the separate skills of understanding written or spoken text and constructing written or spoken responses; these can be represented through the use of multiple linked elements. Whereas lower level competences may be seen as binary, these higher level ones might be seen as able to be partially fulfilled.

The TENCompetence project’s definition of competence (TENCompetence, 2009) makes explicit the significance of context or community of practice, describing a competence as being a disposition or latent attribute of an individual, team or organisation that is situational and identified and defined in a community of practice. Similarly, the MedBiquitous definition of competence, “possession of sufficient and necessary knowledge, skill and attitude by an individual to allow her to safely and effectively perform a specific job” (MedBiquitous, 2009) is tightly focused on professional context.

HR-XML sees a statement of competency as very similar to a statement of Knowledge, Abilities, Skills and Other Characteristics (“KASOC”) which formed the basis for their concept. The KASOC acronym is specifically excluded by HR-XML in part because the term competency is a far more familiar concept and was felt to be more meaningful (although this familiarity can be seen to lead to confusion and multiple meanings).

The Chartered Institute for Personnel and Development makes a distinction between competency, “the behaviours that employees must have, or must acquire, to input into a situation in order to achieve high levels of performance” and competence, “a system of minimum standards ... demonstrated by performance and outputs” (CIPD, 2009). This suggests that an individual can demonstrate competence without necessarily acquiring the expected competencies, or achieve competencies in a field without necessarily demonstrating competence.

The concepts of competence and competency are clearly closely related to, although not the same as, the concept of an intended learning outcome (ILO) from a course of study or vocational training. An ILO is a statement of the standard of knowledge, skill, etc. A learner is expected to acquire and to be able to demonstrate by the end of a course of study or training; it is equivalent to the objectives of a learning opportunity as defined by the Metadata for Learning Opportunities (CEN, 2008) specification and the European Learner Mobility work (EuroLM, 2009).

The relationship between the concepts is subtle. The European Qualifications Framework (Education and Culture DG, 2008) includes the acquisition of competence as a component of an ILO, along with knowledge and skills, defining competence in the context of the EQF in terms of responsibility and autonomy. This seems to be very similar to the more common definition of competence as encompassing knowledge and skill, but the distinction drawn within the EQF is that competence utilises skill and knowledge rather than being part of its construction. In this conception, competence transcends knowledge and skill because it utilises them selectively: competence is not “merely” the possession of knowledge or skill but the ability to take action according to the most appropriate information or perform the most appropriate action. Competence suggests the internalising of knowledge and skill to the point at which they, and the instinctive selection of the most appropriate knowledge and skills, become an innate part of a person’s responses.

In this paper, we see these views discussed above as being partially true, but needing to be drawn together. We understand both competence and competency as being related to the knowledge, skill and attitude or behaviour required for the effective performance of a task or role, as being measurable and certifiable, and composed of a number of individual components. From this perspective of drawing concepts together, it seems most straightforward to regard competence as a binary quality.

For technical implementation, a competence record may at minimum be represented as a single entry containing a unique identifier pointing to a description of the competence.

Later in this paper, we also discuss the relationships between competence or competency elements. The terms “competency framework” and “skills framework” have been used to describe a set of these elements related in a structure, where some are components of others, and we reuse the term framework. However, it should be noted that “framework” is also often used to denote an overarching structure, whereas here we may mean a relatively simple and small structure maintained by a single authority.

## 2. Motivation of Standardization in the Area of Competence

### 2.1 THE NEED FOR COMMON LANGUAGES

There are many reasons why people want to know about other people’s, or their own, abilities. People hold positions, and perform roles, in industry, commerce, government, education, family life, wider social life – all walks of life in fact – and successful performance in these positions requires their holders to be able to do certain things to meet the needs, and conform to the expectations, of others playing related roles in related positions. In older societies much more static than our modern one, children may have learned to fulfill the roles of their parents by observation, imitation, and correction. Also frequent in the past were periods – possibly long periods – of training or apprenticeship, whereby less experienced people could learn about occupations or trades from more experienced people that were not necessarily their parents. This form of society may have worked adequately where just about anyone could in principle fill any role, and it was just a matter of accident of birth who actually got to fill the roles – as persists in the institution of monarchy today. However, it is not difficult to see that, particularly when societies compete with each other, it makes more sense to place into positions those most suited to fill them. Moreover, in a changing society, new positions arise. To operate most effectively, society as a whole needs some means of matching available people with available positions, and this needs knowledge about the abilities of all concerned.

It seems that the mechanisms in our society have not kept up with this need, if indeed they ever did work effectively. There are several different views about the nature of education, only one of which is that what is taught and learned as part of education should be what is required to fill roles in working life. And even where that is that view, what is required in working

life keeps changing, so that it is difficult for an educational system to keep up. At the same time, increasing mobility of jobs, and increasing change in employment, means that employers are less and less likely to take on those leaving school or university, keep them for a good part of their working lives, and therefore have the motivation to train them adequately on the job. There is increasing pressure for educational institutions to provide work-ready graduates.

Looking at this more generally, there is an increasing need overall for a common language about abilities, to be used for communication between educators, trainers, employers, learners, assessors / evaluators, professional bodies, awarders of licences or certificates, customers / clients, careers advisors, and any other stakeholders, when referring to what individuals want to or should learn, or what they have learned, in terms of ability, capability, competence, or whatever the most relevant term is in a particular context. This common language is needed for the expression of requirements for jobs, requirements for prospective students on higher courses, the outcomes of learning processes (whether connected to formal education, or to informal learning in the workplace or in wider society), and the claims made by (or about) individuals to have attained the outcomes, to have the abilities, to be competent, etc.

## 2.2 MATCHING CLAIMS AND REQUIREMENTS

It is not just the language which needs to be harmonised, to relate together claims for competency and requirements for it, because both requirements and claims have significant structure, and the corresponding elements of those structures need to be matched against each other. So it is vital to specify just what those elements are, even to start to enable automatic matching that is neither simply text-based, nor using arcane artificial intelligence.

The matching currently done in this area, as part of recruitment, tends to be either labour-intensive or of variable quality or both. One of the persistent problems is that requirements, particularly as specified by employers, tend to bear little relationship to what learning opportunities aim at giving, or what they actually give, learners who complete them. Learners who want to provide evidence for their abilities turn readily to what they see defined as the learning outcomes, and therefore risk missing connecting with employers' requirements.

## 2.3 THE NEED FOR AGREED FRAMEWORKS

Going along with the increasing diversity, change and potential fragmentation of occupations and their requirements, is the need to recognise quite small units of ability, and to be able to build these up in different ways to express the needs of different roles and positions. We see such frameworks being expressed, for example, as National Occupational Standards (NOSs) in the UK. Conventionally, these are all expressed in similar ways, with the requirements in a particular area being analysed in terms of what a person needs to be able to do, and what underlying knowledge is needed to support effective performance of what they are doing. But though these have similar form, they vary enough to greatly hinder putting them into a common format capable of distinguishing the parts that seem to be important to distinguish.

## 2.4 FROM COMMON LANGUAGE TO COMMON SPECIFICATIONS

The introduction of ICT tools into this area of life brings an extra set of requirements. If IT systems supporting the areas mentioned above are to work together, the common language necessary for human mutual understanding needs to be more tightly defined so that it is machine processable in some way. It needs to be clear when an ability referred to is the same, or different, or related, in a way that is not dependent on human background knowledge and ability to process language in an extremely sophisticated manner. If tools use frameworks, and if those frameworks are to be decoupled from the tools, they would ideally be expressed in a standard format which is readable or importable by any tool implementing that standard. E-portfolio tools are a good example of the kind of tool that would benefit from a standard format for frameworks.

This paper is not concerned with the processes of agreeing occupational standards themselves, such as NOSs, which are the province of bodies representative of industry and education. Rather, we are looking for the possible standardization of

- Formats for definitions related to competence, and their exposure
- Formats for frameworks related to competence, and their exposure
- Relationships across frameworks
- Claims and requirements related to competence

## 2.5 FACILITATED SERVICES

We could expect various services to be greatly facilitated by widespread adoption of common definitions of competence or competency, if they were expressed, singly and in frameworks, according to common formats. These could easily include:

- Establishing whether something is claimed to fulfil a requirement;
- Searching for and matching people and opportunities;
- Searching for pathways to get from a low state of achievement to fulfilling a higher requirement;
- Assessment / assignment / recruitment for employment positions, external or internal;
- Skills gap analysis, and management of corporate competency profiles;
- Self-assessment of abilities / knowledge / skills / competences in conjunction with preparing CVs etc.;
- Selection of students to participate in educational opportunities;
- Selection of learning materials to help towards learning objectives.

There are probably several more.

## 3. History and Background of standardization in the area

Any standardization effort should start by looking at related efforts that have been made in the past, and current initiatives that may have related objectives, to try to ensure that standards do not multiply and diverge. The following two sections address this.

### 3.1 IMS RDCEO AND IEEE RCD

The IMS Reusable Definition of Competency or Educational Objective (RDCEO) (IMS, 2002) specification “defines an information model for describing, referencing, and exchanging definitions of competencies.” It attempts to identify a set of core or key contextually neutral characteristics of competencies that can be shared across different learning systems. Released in 2002, this work was subsequently further developed as IEEE Reusable Competency Definitions with the most current version being released in 2008 (IEEE, 2008). Both IMS RDCEO and IEEE RCD avoid attempting to specify how a competency should be defined, but allow generic statements within a definition. It is not clear how this approach of including some detail in the definitions sits with trying to keep all definitions separate and able to be referred to separately, to avoid duplication and the errors liable to build up in potentially having several versions of the same wording.

### 3.2 IMS LEARNING DESIGN

IMS Learning Design (IMS LD) (IMS, 2003) is a specification for modelling and designing learning processes, consisting of three levels of which the third, most extensive (and least implemented) is Competency Based Learning. IMS LD does not itself define competency but instead refers to the IMS RDCEO definition, but it is noteworthy as it interprets competencies as being potentially gradable and therefore not necessarily binary.



### 3.3 XCRI

The eXchanging Course-Related Information (XCRI) project (XCRI, 2010) has developed an XML schema to enable learning providers and information services to easily share information on learning opportunities, increasing access to and potential participation in education and training. Competence statements are clearly a significant aspect of this, both for establishing entry requirements and in relation to the course's intended learning outcomes. However, XCRI does not define any particular structure to a statement of what the objective, or intended outcome, of a learning opportunity might be.

### 3.4 LEAP2A

The Leap2A (Grant, 2010) specification supports interoperability between e-portfolio tools and similar systems and the exchange of information between them. It is specifically intended for systems that allow users to manage their own portfolios, rather than for institutions to define institution-wide information. In line with its intentions, Leap2A allows the transport of portfolio information referring to skills or competencies, which are called "abilities" in Leap2A. In most cases, the definition of an ability is envisaged as given at a URL on the server of the body responsible for that definition. But in cases where the learner wishes to define their own skill, this is also allowed.

## 4. Projects in the area and their outcomes or objectives

There are several projects active in this area. The brief notes here give a sense of what the ones we know about are doing.

### 4.1 TENCOMPETENCE

The TENCompetence project (TENCompetence, 2010) has worked on the development and implementation of infrastructure to support individuals, groups and organisations in lifelong competence development. The project takes a competence-based approach to lifelong learning which is tightly tied to a specific work, educational or other context. The ability to effectively exchange competence-related information is therefore a significant factor in this work as it is crucial for supporting transition between learning or training providers.

### 4.2 ICOPER

The ICOPER (ICOPER, 2010b) project is developing best practice in the use of educational standards for the exchange and reuse of competence models, learning designs and educational content. Several of ICOPER's deliverables (ICOPER, 2010a) relate to building on existing competency specifications to develop more helpful models to support best practice in competency-driven higher education.

### 4.3 MEDBIQUITOUS

The MedBiquitous Competences working group (MedBiquitous, 2010) develops standards and good practice guidance for linking educational content to a competency framework within medical education. The working group wiki provides extensive information on the work of the group.

### 4.4 ECOTOOL

The eCOTOOL project aims to develop an information model of the Europass Certificate Supplement, within which skill or competence is a central feature. It will therefore be investigating how to structure definitions of competences effectively, taking the agriculture sector as a working example.

### 5. Conceptual models of competence for information models

Conceptual models provide a vital underpinning for information models, helping ensure that the concepts represented in different information models are compatible, and that specifications built on those information models will actually help with interoperability and portability.

There are some existing conceptual models that deal with competence in some way, but none of them go into any detail, for instance, about what the difference is between the different kinds of competency – whether one follows the EQF in distinguishing learning outcomes in terms of knowledge, skills and competence, or the other approaches mentioned in earlier sections.

Schmidt and Braun (2008), for example, beyond allowing tree structures of competencies, distinguish only levels and scales, and we have found levels tricky in similar contexts. Other authors identify various kinds of “qualifier” for competencies, but are not so clear about the conceptual model surrounding this. Representing things simply as “qualifiers” fits well into an information model approach, where they would be sub-elements of the competency element, but more important at the conceptual modelling level is to understand what the qualifier concepts really mean, and how they relate to each other and to other related concepts.

One possibility for qualifiers, similar to what is being proposed within the ICOPER project, is to abstract common elements that are frequently referred to across different definitions of skill or competence. Whether these are then called “context”, as in current ICOPER drafts, or use some other term, is less important than the idea itself.

Our own cognitive modelling work has detailed the relationships across a range of potentially formal processes surrounding the individual, including opportunities for learning or work, assessment, and recognition, which includes the award of credit and qualifications. The distinction between knowledge, skills and competence finally makes sense only in terms of an analysis of the processes within the individual – even if this analysis is relatively superficial by any standards of psychology.

Figure 1 is a selection from a more detailed conceptual model (see, for example, Grant, 2009). Here, a knowledge learning outcome is understood as being about a desired pattern of belief of the individual. A skill learning outcome is about individual behaviour patterns, but also needs to be supported by knowledge. Competence, on the other hand, is always described in terms of a real world situation, and seems to be about behaviour patterns and knowledge that together produce outcomes conforming to agreed quality criteria, in agreed real-world contexts.

An area where this model does not attempt to delve is whether frameworks can be conceptually distinguished from individual definitions. Two considerations argue rather for the idea that they are interchangeable. First, practically any competence-related definition could in principle be broken down to a set of related components. This is true as much of practical skills, where sewing skill could be analysed in terms of threading a needle, handling fabric, accuracy in locating the holes in a button, and many more; or cognitive skills, where to do long division you have to multiply, subtract, etc. But while some people might be interested in the finer details, many people would not be. Looking the other way, a framework that is normally used as a structure may be relevant to someone else only as a single, high-level definition.

These considerations point away from a rigid distinction between frameworks and individual definitions. In consequence, if a definition can be seen ambivalently as a single entity or as a framework, when it is included in another framework, it has to be clear which is meant. One can include just the top-level title and definition, or import the detailed structure as well. Importing the detailed structure will entail not only the subsidiary competence concepts and definitions, but also the parts of their competency map that relate them together.



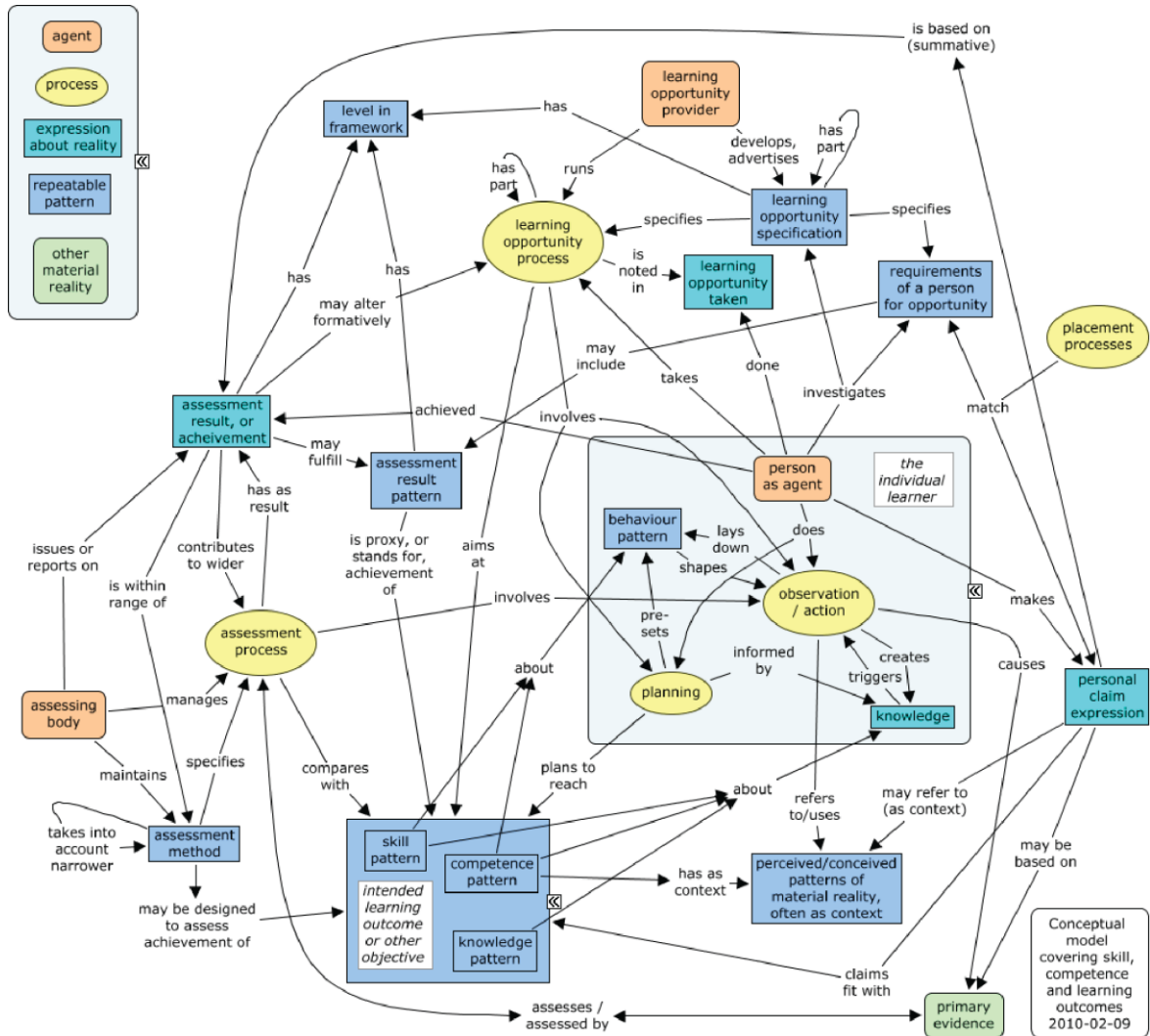


Figure 1. A concept map of several concepts related to competence, drawn from a wider model

This duality between individual definitions and frameworks may also in part account for the very wide variation in the degree to which definitions are detailed. Some programmes of education or development use only very broad headings for the skills and competencies that are proposed for learning, perhaps because there are many acceptable ways to develop them. It is up to the individual learner to decide the detail. This is in contrast to specific qualifications, licences, or tests, which may set out in considerable detail not only the precise skills that are to be learned, but also the means of assessment by which they are to be verified. Given these differences of application, it is not surprising that some high-level skill and competence terms are vague and not well specified.

One reason why people may use highlevel definitions that may seem vague is that competence in certain roles can be fulfilled in several different ways. People rarely discuss management competence without mentioning management style, and it is reasonable to suppose that different styles of managing require a different set of skills. Thus, assessment of management competence in practice cannot simply consist of assessing one particular set of sub-skills, which would be relevant only to one management style. Competence in any artistic endeavour is also likely to have a large style component, as may other creative competences, even extending to computer programming. All these examples warn us that a competence does not necessarily have a single decomposition.

A final point follows from the observation that people like creating their own maps, their own frameworks, and their own definitions. To get useful inferences across frameworks, in the style of the Semantic Web, there will need to be many other relationships specified, as well as the relationships necessary for individual maps, and the mapping of inclusion of externally defined competence concepts. For instance, it would be very useful to know, of two competence-related definitions, whether either one covers more than the other.

One way of representing both framework structure, and relationships between parts of different frameworks, would be by using the W3C's Simple Knowledge Organization System, SKOS (W3C, 2009). This is discussed further below.

### 6. The way forward for standardization in the area of competence

In this section we will bring together the issues introduced above in a general discussion, arguing that there are certain areas that could now be taken forward towards standardization. It is useful to distinguish between separate definitions related to competence, and frameworks related to competence. Jobs and roles require abilities that tend to be grouped together rather than isolated, and this is the motivation for representing frameworks. Recall that when we use the term "framework", we do not mean a large, overarching structure, but just a set of definitions and documentation related to a particular application area, role, industry, educational programme, etc.

In anticipation of the emergence of definitions and frameworks of competency, it also makes sense to explore a common format for what could perhaps turn out to be the most practically useful standardization effort, namely, the common ground linking claims by individuals to possess aspects of competence, and employer or institutional requirements for aspects of competence in those applying for relevant positions – jobs or courses.

#### 6.1 INDIVIDUAL DEFINITIONS IN THE AREA OF COMPETENCE

For laying down a detailed standard model for separate concept definitions in the area of competence, there is a great deal of practice already established, and as this practice does not follow a common model, a detailed standardization would require the restructuring or even rewriting of many, if not most, currently used definitions and frameworks related to competence.

Given the current diversity of practice, two approaches are plausible. First, it is possible to standardise on the common elements evident across current practice. This is a remarkably straightforward task, given the lack of common elements. In effect, the common ground is the same ground as is common to very many documents, and can be concisely expressed as a few elements from Dublin Core (DC): title, content or description, authorship, dates of publication, etc. What is generally missing, in order to turn these elements into a specification workable for learning (and other) technology is a universal identifier, and what is commonly accepted as the most useful form of identifier is the http URL or URI, as in the widespread semantic web related vision of "linked data". Given this basis, any atomic definition can be given a URI, and at the URL that is arrived at by dereferencing that URI, there can be the DC metadata, together with either the actual content of the definition, perhaps in HTML or XHTML format, or a link to a document designed for printing, in any common format.

The second approach would be to look at the extra features that often appear within definitions related to competence, and to construct a permissive schema to allow representation of these in a way in which information which is common is recognised as such. To be standardized effectively, such features have to be clearly distinct.

Looking at the features of models that are currently proposed, alongside existing specifications such as HR-XML and IEEE RCD (as IMS RDCEO), some features appear that could perhaps be seen as distinct. But substantial further work would

have to be done, and the consensus processes followed, to facilitate people moving towards agreement on them. Here is a list of potential features (or “facets”) of competence:

- Professional, occupational or educational context
- Level of responsibility, or role
- Constraints above those inherent in the context
- Knowledge of subject matter required
- Tools or equipment provided
- Other support provided.

Some of these might, in some frameworks, be bound up in the concept of “level”, but as there is no universal standard level scheme, the meaning inherent in levels would have to be broken down in terms of the level descriptors, so that it could be compared in terms of the features or facets above.

RDCEO does not specify particular facets. Instead, it provides a more general purpose structure. Not to be confused with the common identifier, title and description, RDCEO’s definition element allows a model to contain statement names and texts. However, this effectively ducks the challenge of providing agreed facets. RDCEO adds nothing towards defining what facets are actually useful and potentially agreed. Rather, it could be taken as a warning that it may in practice be impossible to agree any universal facets at all.

However, there is one aspect of competence-related information that comes up over and over again: some division along the lines of knowledge, skill, and something else (competence, attitude, other attributes...). This is loosely related to the method of assessment. Knowledge and cognitive skills can be assessed through ordinary paper and computer-based tests, or direct question and answer. Practical, transferable skills can be assessed through practical tests, given appropriate equipment.

The other aspects of competence are those that can only be fully assessed in the context of use, or something very like it. But competence as a whole involves the use of knowledge and skill, so other forms of assessment may still be relevant.

## 6.2 RELATIONSHIPS BETWEEN DEFINITIONS

Relationships between terms in the same framework seem to raise few issues of difficulty. People envisage greater and lesser, broader or narrower, definitions, and when frameworks related to competence are documented, this is clear in the structure of the documentation. Typically, a framework may consist of several areas, and each area may consist of a set of descriptors, which may cover either or both of what people are expected to do to fulfil that definition, and what people are expected to know, perhaps to support their effective actions. When definitions are used electronically, however, it can easily happen that parts of definitions are reused outside their original context. If the definition components are to be understood correctly outwith their original context, the relationships between the parts and their whole needs to be made explicit, and included when the part is taken away from its natural context.

As this is an example of a general knowledge representation structure, it would seem reasonable to use the most widespread general definitions for these relationships. SKOS, mentioned above, has relationships that seem to be good contenders for this role. The properties `skos:broader` and `skos:narrower` are generalised from general knowledge organisation systems, and applied to competence components, “A `skos:broader` B” would mean that B is a broader term than A, which could mean that A is a component of B. Conversely, “A `skos:narrower` B” could reasonably be taken to mean that B is a component of A. This would fit well with a view that definitions are just concepts, and concepts as such cannot contain other concepts.

However, while this may be an adequate start, simply having broader and narrower relationships does not capture the distinction between, on the one hand, a greater competency comprising a set of lesser competencies, and on the other hand, a competency having different “styles”, each involving a potentially different set of lesser competencies. This remains a further work.

### 6.3 AN INFORMATION MODEL FOR FRAMEWORKS RELATED TO COMPETENCE

There appears to be an obvious and immediate need here – the case of e-portfolio tools was introduced above. The question is what is a general purpose structure for a framework format, which will cover existing frameworks adequately so that they need only to be fitted in to the format, not radically restructured, and which will allow e-portfolio and other tools to use the framework?

The first requirement to consider is to specify the relationships between different parts of the same framework. If the parts of the framework are thought of as concepts, rather than expressions, SKOS relationships are well suited. If, rather, they are thought of as parts of a larger document, some whole-part relations may be preferred. Probably some work will have to be done to reach consensus on this, but it seems likely that the SKOS broader-narrower relationships might be initially acceptable, with the possible later addition of a mechanism to distinguish components of a competence from styles of a competence.

Different people, organisations or bodies may want to create different frameworks using, and reusing, some of the same definitions, or even whole frameworks. The relationships in each framework may differ. To allow for this, three considerations may be helpful.

1. Care needs to be given to whether given relationships are really inherent in a definition, that is, valid in all situations, or whether they might differ in different frameworks. The safer choice is the latter.
2. As a consequence, the preference will be to define the relationships as part of the framework, but not as part of the individual definitions. Conceptually, therefore, we should distinguish a relationship map, attached to the framework, but separate from the individual definitions.
3. A definition within a framework must be able to refer to an external one within its definition, and preferably without the need to duplicate all the information associated with the external definition.

In many ways it seems an obvious choice to use the SKOS mapping properties. As a relationship, `skos:exactMatch` can express your intention that your definition means just the same thing as, and is interchangeable with, someone else's definition. You could use `skos:closeMatch` to indicate that evidence for one is likely to be evidence for the other, albeit less reliably. The object of a `skos:broadMatch` relationship is a concept which satisfies more than your original concept, and therefore other people could provide evidence for the broader concept that automatically is taken to satisfy the narrower one. Conversely, you could suggest, using a `skos:narrowMatch` relationship, that your concept covered more than the external one, and attributing it implied attributing the narrower one. If two authorities agreed on reciprocal `broadMatch`-`narrowMatch` relationships between competence concepts in their respective areas, it would give added confidence to inferences across the two.

Thus, a likely specification for frameworks related to competence could include these features.

- A framework could conceptually include a set of concepts and a structure map, though these need not necessarily be represented in separate sections of XML.
- The map could use `skos:broader` and `skos:narrower` relationships between the concepts in the same framework, with the possibility of refining that later to distinguish components from styles.

- The map could use any of the SKOS mapping properties for documenting relationships between your competence concepts and those belonging to others.
- External concepts and frameworks could be reused and extended in a structure map created by you.
- Metadata could be given in each framework, referring particularly to the structure map: some metadata could also be carried in the competency concepts.
- When reusing external frameworks, there could be a way of specifying whether just to take the top concept and definition, or to import the whole framework as it is.

These points are illustrated in Figure 2.

This is perhaps not quite as simple as could be imagined, but anything simpler would risk losing some important feature. Another question is whether this is simple enough, or can be represented simply enough, to be processed by tools such as e-portfolio systems, where there is the desire to incorporate a framework into their tools and related practice. But in any case, this seems like a plausible suggestion for a conceptual model of how skill and competence concepts and structure could be related.

### 6.4 CLAIMS AND REQUIREMENTS RELATED TO COMPETENCE

We can now attempt to specify a common format at least for claims and requirements. The conceptual model in the previous section has been drawn to include “personal claim expressions” and the attributes of people wanted for opportunities. The model illustrates the view that there is significant correlation between these two.

Helpful ideas on claims come from PDP and e-portfolio practice. Often, an individual wants to claim an ability of some sort, usually related to some kind of competence, and the e-portfolio medium allows linking from that claim directly to some kinds of evidence to support the claim. There are a small number of obvious sources for supplying relevant evidence which might be accepted by those relying on it, and which are often used in evidence.

- Qualifications (and other professional grades, certificates, or other public recognition of status) are perhaps the most classic form of evidence. Vocational qualifications may even be based around definitions related to competence, though what academic qualifications are evidence of is more uncertain.
- It is possible that an assessment is designed directly to assess a competency, or it may be more or less related to that competency.
- Trusted witnesses have always played a part in evidence. This varies from expert judgement on whether a performance is itself expert, which can often only be judged by a human expert, to witness statements merely confirming that something actually took place.
- One of the things that witnesses can attest is to experience relevant to an ability, and particularly to a competency. It may be that it is not feasible to hold down a particular role without a certain competency, in which case simply holding the post is evidence. Or it may be that competency generally grows as a result of certain experiences.
- E-portfolio practice increasingly allows more primary evidence to be presented to interested parties. Clear examples of this could be videos of performances; links to discussion fora; links to informational artefacts produced; news or other web sites documenting the public results of a person’s actions or interventions.

But at the same time, it must be recognised that one particular person’s ability – in anything but the most mundane tasks – is never quite the same as another’s. Personal style differs, but often also the particular mix of abilities that people use, say in management, is personal. The contexts in which experience is gained vary widely. Thus, a true and full claim of competence will almost always need to bridge the gap between the competency definition itself and the actual competence or component of competence claimed, with an individual explanation and clarification of what the claim is for. This also takes into account the fact (discussed above) that competence concepts vary wildly in their specificity. One can have a “definition” that merely states “team work” as a topic heading, in which case a personal claim needs to bridge a long way to explaining exactly what

team working ability is actually claimed. In contrast, another definition of team work may go into great detail about the exact interpersonal skills used or required, and the context in which they are needed. In those cases, much less personal explanation is likely to be needed. In any case, an information model for a competency claim should include a free text field for this kind of explanatory detail.

Turning now to requirements, there seems to be some significant common ground with recruitment and interviewing practice. Reviewing sample person specifications reveals a grid, there are usually two columns, for “essential” and “desirable” characteristics (or a column stating whether a particular characteristic was essential or desirable), and each row represents a characteristic heading, with essential attributes and/or desirable attributes. Frequently, there is a third column, something like “method of assessment”. This might be chosen from “application form”, “interview”, “presentation” if there is one, “reference” or possibly “certificates”. Obviously, something like “assessment centre” could feature for applicable practice. The exact grouping of the rows varies, but a full model could easily include categories such as

- Qualifications
- Experience
- Knowledge
- Skills
- Attitudes and other qualities
- Other characteristics, attributes or criteria.

What is very promising for standardization about current practice is that, despite differences in detail, there seems to be a fundamental agreement about the nature of a person specification, in that anyone who has been involved in recruiting, or been recruited, with the help of a person specification would probably recognise all of them as reasonable examples. The underlying agreement gives the basis on which standardization is feasible, while the differences present the challenge to achieving consensus.

Perhaps the key to useful as well as viable standardization here is to allow the external form of the structures to remain recognisably the same, while trying to ensure that what could be matched automatically is represented in a format that allows sufficient machine processing to do the matching. Though the details remain to be investigated more thoroughly, it does appear that there is substantial overlap, which could be maximised in a number of ways.

- Qualifications would probably need a standardised representation of subject area, together with an internationally recognised or cross-referenced level.
- Assessment other than through recognised qualifications might benefit from categorisation of the general assessment method, and of the type of evidence taken into account, as well as a clear specification of the results that can come out of the assessment process. This can be combined with cohort performance information to get useful information about where applicants stand in relation to the norms of their peer groups.
- Experience would need a common model of occupational categories, plus an agreed scheme for level of responsibility.
- Knowledge, skills, attitudes and other qualities need to refer to commonly acknowledged definitions of the kind that have been discussed above.
- References might benefit from some common scheme for recognising status of the referee.
- Other primary evidence needs to be clearly connected with what it is presented as evidence for, though in any case it is difficult to see it being used in any automatic matching process, but rather in the conversion of a list of “possibles” to a short list for interview.

For many of these, it would only become viable to put them into practice given effective tools to help with the categorisation, labelling, classification, etc., based on the agreement of a good number of categories, balancing ease of understanding with sufficient discriminating power.



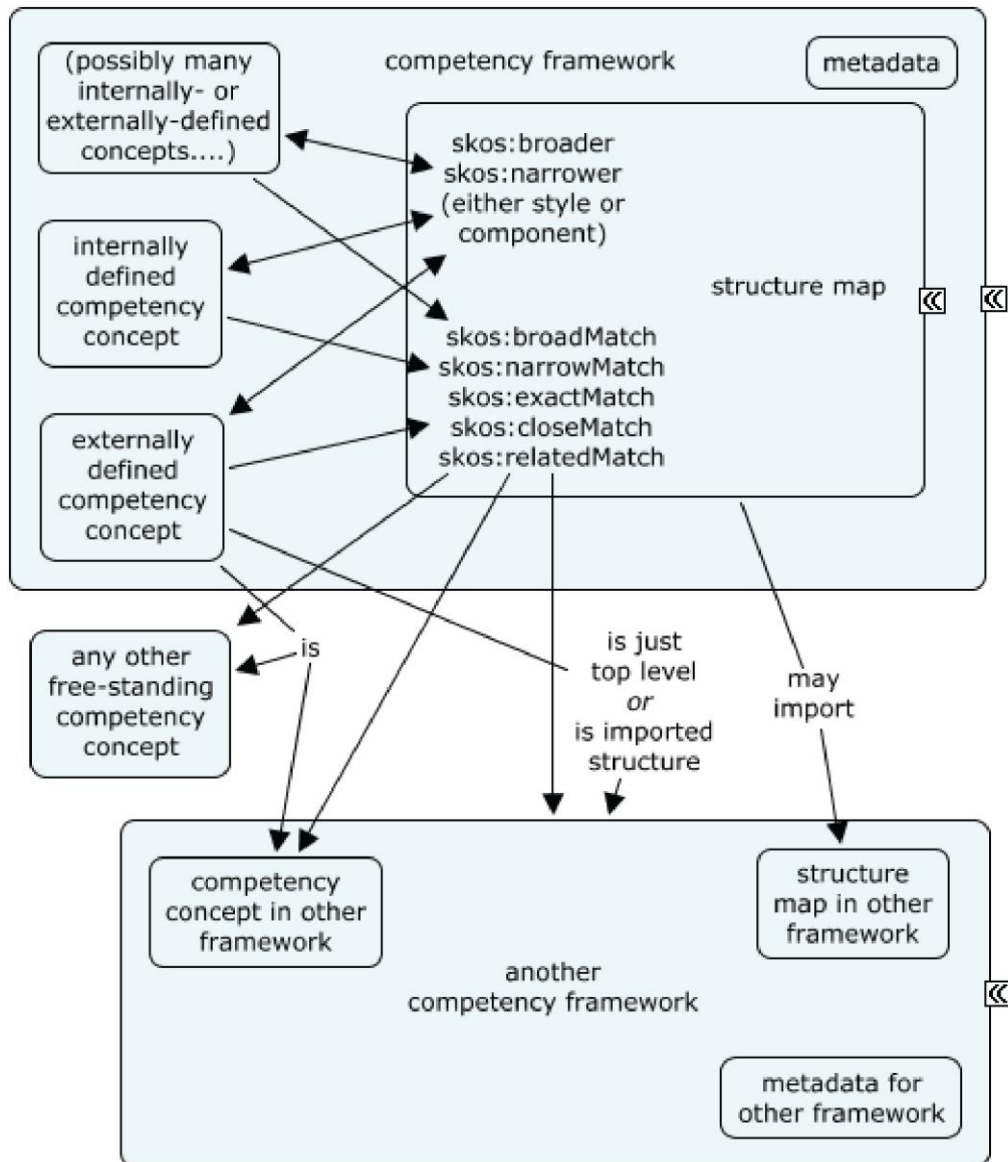


Figure 2. The structure of competency frameworks – a possible model

## 7. Conclusions

We have reviewed a range of issues relevant to potential standardization in the area of competence-related information. The way seems open now to integrate the work of several projects and initiatives, to feed in to proposed international standardization work. We conclude by briefly summarising the key points we believe should be taken into consideration.

### 7.1 COMPETENCE CONCEPT DEFINITIONS

There needs to be more exploration of what consensus is possible around the different features / qualifiers / facets proposed for competence concept definitions, including the knowledge / skill / context dependent distinctions. If genuinely common

features become clear, a consensus will need to be reached on an information model for their representation, which might be quite simple.

### 7.2 COMPETENCY FRAMEWORKS

First, a minimal set of relationships needs to be agreed to cover good practice in relating the components of competence concepts to each other. SKOS properties should be considered, and may initially be adequate. Second, a set of relationships needs to be agreed for relating competence concepts within a framework to those in a different framework. The SKOS mapping properties should be considered, and again may well be adequate. This may lead towards an agreed specification for competence frameworks, in the foreseeable future.

### 7.3 COMPETENCY CLAIMS AND REQUIREMENTS

The line of enquiry outlined above needs to be taken further, to reach a broad consensus on appropriate approaches to enhancing the automatic processing of the various elements potentially shared between a competency claim and a person specification, or similar document used in a selection process. It remains as further work to investigate the requirements for and uses of the distinction between framework relationships indicating components, and those indicating styles.

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**Authors:** Simon Grant and Rowin Young

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