
**Information technology for learning,
education and training — Information
model for competency —**

**Part 2:
Proficiency level information model**

iTeh STANDARD PREVIEW
*Technologies de l'information pour l'apprentissage, l'éducation et la
formation — Modèle d'information pour les compétences —
Partie 2: Modèle d'information des niveaux de compétence*
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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: [Foreword – Supplementary information](#).

The committee responsible for this document is ISO/IEC JTC 1, *Information technology*, Subcommittee SC 36, *Information technology for learning, education and training*.

ISO/IEC 20006 consists of the following parts, under the general title *Information technology for learning, education and training — Information model for competency*:

- *Part 1: Competency general framework and information model*
- *Part 2: Proficiency level information model*

The following parts are under preparation:

- *Part 3: Guidelines for the aggregation of competency information and data*

Introduction

From the late 1990s, some industrial and academic organizations have developed information technology standards in the skills and competency domain, such as human resources, on a global level to address the interoperability requirements and environment complexities of management and sharing of competency information amongst different organizations. Some examples include work spearheaded by the following organizations: the IMS Global Learning Consortium Inc., HR-XML Consortium, IEEE-LTSC, OMG, CEN TC353, HRMLs, and also ISO/IEC JTC 1/SC36 itself. Some typical problems encountered by stakeholders as well as ITLET systems dedicated to the management and exchange of competency information and where these issues may be encountered are provided in examples below.^[1]

Example 1: Technical — Competency and associated information cannot always be selected and shared between different ITLET systems (e.g. learning management, HR, and other related platforms).

Example 2: Organizational — Competency and associated information is not easily used in human development activities, because skills and competency information may be detailed or expressed differently in various ITLET systems (e.g. learning management, HR, national occupational classification, and other related systems).

Example 3: Information exchange — Skills and competency proficiency information, such as individual status or degrees acquired, cannot be shared easily amongst different ITLET systems (e.g. HR, learning management, national occupational classification, and other related systems).

Example 4: Individual learner — Individual developmental learning, education, and training paths cannot easily migrate or be exchanged amongst ITLET systems.

Example 5: Systems perspective (where systems include individuals, organizations, and the technologies that support them) — Individuals and organizations cannot easily design and integrate informal and formal learning, education, and training opportunities to support life goals, career strategies, and career paths using existing common dimensions within ITLET systems.

Example 6: Practical analytics — The ability to access, extract, and analyse competency and associated information can provide evidence as to whether learning, education, and training information needs are being met in order to analyse lifelong learning, thus where competency information must be drawn from different systems and where non-interoperable format and definitions are used.

Example 7: Assessment and evaluation — ITLET systems (e.g. acknowledgement and consideration are needed regarding evaluation biases in human assessment, the use of varying methods and metrics to evaluate human performance, and the need to conduct accurate skill gap analysis), where ITLET systems that use different competency digital schema are involved.

Example 8: Overarching goals and outcomes — Human assessment and support for the development of human potential requires ITLET systems that provide a more flexible, holistic integration, and exchange of competency and associated information beyond individual learning opportunities, everyday operation, and work performance.

Currently, organizations, such as schools, universities, institutes, and companies, use different ITLET systems to support the use of learning content, to enable and enhance various learning activities, and to provide other services. To meet their missions and goals, such organizations can rely on in-house developers, others such as ITLET vendors or suppliers, or a combination of both to provide and operate IT systems to support LET. This means ITLET operations and other organizational systems that deal with skills and competency information, such as interrelated human resources (HR) information systems, need to be interoperable to allow for communication between organizations, their employees, and outsourcing ITLET providers or suppliers.

The purpose of this International Standard is to provide a framework, models, system architecture used for competency and proficiency information, and a way to aggregate competency information. ISO/IEC 20006-1 International Standard will provide a general framework and information model to manage and exchange information about knowledge, skills, ability, attitude, and educational objectives. Especially, this part ISO/IEC 20006 will focus on extending the concepts contained within

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ISO/IEC TR 24763 by providing more detailed information regarding competency information and its information aggregation. This International Standard can be used by software developers and implementers, instructional designers and test designers, and others to ensure that learning, education, and training environments satisfy learners' and organizations' competency needs. ISO/IEC 20006-3 will provide definitions of several types of competency information aggregation, which will provide guidance for all stakeholders to better understand and support the development of interoperable systems that will enable competency information exchange.

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Information technology for learning, education and training — Information model for competency —

Part 2: Proficiency level information model

1 Scope

1.1 General

This part of ISO/IEC 20006 provides an information model for competency proficiency and its level. Moreover, it presents several use cases that can be used by software developers, implementers, and architects of human resources systems and learning systems. These use cases will support management and exchange of competency information within information technology systems used for learning, education, and training.

NOTE This International Standard is based on work completed in ISO/IEC TR 24763.

This International Standard includes the following parts:

- ISO/IEC 20006-1, *Information technology for learning, education and training — Information model for competency — Part 1: Competency general framework and information model*
- ISO/IEC 20006-2, *Information technology for learning, education and training — Information model for competency — Part 2: Proficiency level information model*
- ISO/IEC 20006-3, *Information technology for learning, education and training — Information model for competency — Part 3: Guidelines for aggregations of competency information and data*

This part of ISO/IEC 20006 provides an information model used to express the semantics of competency proficiency and its level and can be used to support the management and exchange of competency information amongst information technology systems for learning, education, and training. This part of ISO/IEC 20006 provides

- information model for expressing semantics of competency proficiency and its levels, and
- use cases used to support the development of the competency proficiency level information model.

ISO/IEC 20006-1 provides a framework, information model and use cases to support the management and exchange of competency information. ISO/IEC 20006-3 provides guidelines regarding the aggregation of competency information and data.

1.2 Exclusions

The scope of this part of ISO/IEC 20006 does not include an in-depth technical review of issues related to:

- adaptability to culture, language, and human functions;
- although intended to support, this part of ISO/IEC 20006 does not replace the requirement for regional, transnational, and international agreements relating to the equivalencies of representations of competency proficiency and its associated levels;
- security;
- authentication;

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- privacy;
- accessibility.

1.3 Areas not addressed

This part of ISO/IEC 20006 currently does not address the following items:

- e-Profiles, which are a set of records that pertain to an individual (e.g. personnel records, student information system records);
- evidence information;
- assessment methods and metrics information.

2 Conformance

The objective of this part of ISO/IEC 20006 is to support the management and exchange of competency information in a way that will promote and improve interoperability and integration. The proficiency level information model is based on the Conceptual Reference Model for Competency Information and Related Objects (CRM) (defined by ISO/IEC TR 24763). The CRM provides a toolkit that can be used to abstract and identify concepts used within IT systems to support the management and exchange of competency information across different HR, learning, education, and training contexts. This part of ISO/IEC 20006 builds upon the conceptual and abstract focus of ISO/IEC TR 24763 to provide an information model for proficiency or its associated levels and use cases.

To support competency management and development, competency information needs to be structured and described consistently to promote understanding, mutual communication, and agreement. Competency related information should be detailed in a way that is semantically robust and extensible. For the purposes of this part of ISO/IEC 20006, proficiency and level information are conformant if it uses the corresponding information model and the appropriate item notation as provided in [Clause 7](#).

A conforming notation may contain information items that are based on ISO/IEC TR 24763. In other words, it is intended to be extensible and can contain additional information elements of ISO/IEC TR 24763. For information about conformance to ISO/IEC TR 24763, classes associated with a proficiency level in CRM competency are indicated with the following notation [En] where n = a number that refers to a class defined in ISO/IEC TR 24763 to assist with understanding the linkages and relationships between the CRM and this part of ISO/IEC 20001. For example, as noted in ISO/IEC 24763:2011, E1 = Action, E2 = Actor, E3 = Competency, and so on.

3 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 19796-3, *Information technology — Learning, education and training. Quality management, assurance and metrics. Part 3: Method and metrics*

ISO/IEC 20006-1, *Information technology — Learning, education and training. Information model for competency. Part 1: General framework and information model*

ISO/IEC TR 24763, *Information technology — Learning, education and training. Conceptual reference model for competency information and related objects*

4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1**formal**

expressed in a restricted syntax language with defined semantics based on well-established mathematical concepts or standardized formats

[SOURCE: ISO/IEC 15408-1:2009, 3.1.35]

4.2**informal**

expressed in natural language

[SOURCE: ISO/IEC 15408-1:2009, 3.1.35]

4.3**level**

<ITLET competency> position as assessed using criteria and method to determine amount, intensity, extent, or the like

4.4**level sequence**

<ITLET competency> ordinal value set of proficiency or levels in a competency

Note 1 to entry: The sequence can be of several types, such as: nominally expressed steps as ordinal degree, numbered steps as ordinal degree (increasing or decreasing), continuance as interval scale or ratio scale by number, structured data type (SDT) (e.g. pass or not). All of these different ways can be used to express concept of competency proficiency or a set of competency levels.

4.5**proficiency**

<ITLET competency> competency related concepts that are used to identify amount, level or degree of a competency by judgment or measurement

Note 1 to entry: OED defines proficiency as a skill, a talent; (now freq.) a certain standard of skill acquired after a period of education or training.

Note 2 to entry: Proficiency can be used to ascertain or to identify progress, advancement or improvement in a competency, such as skill, knowledge, and other competency-related concepts.

5 Symbols (and abbreviated terms)

CRM	Conceptual Reference Model
EQF	European Qualifications Framework
HRIS	Human Resources Information System
HRM	Human Resources Management
HR-XML	The HR-XML Consortium
HRMLs	The Society for Human Resources Markup Language
IMS RDCEO	IMS GLC Inc. Reusable Definition of Competency or Educational Objective Specification
info.	Information
ITLET	Information Technology for Learning, Education and Training
ITSS	Skill Standards for IT professionals; The Japanese National Skills Standard
LMS	Learning Management System

Mgt	Management
PM	Project Management
RDF	Resource Description Framework
SDT	Structured Data Type
SIS	Student Information System
TOEIC	Test of English for International Communication

6 Relationship between proficiency and competency

ISO/IEC 20006-2 provides proficiency and level information models and use cases to demonstrate how proficiency and its levels may be described in an IT system that is being used to manage and exchange information regarding this aspect of human competency. Through use cases, examples of semantic expressions that are used to describe proficiency and level sequences and structures were extracted. Then commonalities regarding the various structures were identified. The resulting proficiency and level information models provided below in [Clause 7](#) indicate how proficiency and level information regarding individuals' competencies may be expressed within an IT system.

Proficiency level information has several direct relationships with entities in the competency information architecture that is detailed in ISO/IEC 20006-1:2014, 6.2. Proficiency and level information may reside in different types of systems, such as Learning Management Systems (LMS), Human Resources Information Systems (HRIS), Student Information Systems (SIS), etc. Also, it may be expressed in various ways within these different systems, making it challenging to exchange and share these types of information ([Figure 1](#)). For this reason, it is crucial to consider separately how competency information and proficiency or level information are expressed in IT systems. For instance, the value set or proficiency and levels sequence of the competencies “statistical skill” and “communication skill” that is at the 4th level or degree within an IT system could be expressed as “needs help”, “independent”, “automatically demonstrates”, and “can teach others”, depending on how it has been defined. On the other hand, a definition of “communication skill” could be assessed by an examination and human assessment completed by a boss, and could have only two proficiency values as possible value options for the examination (e.g. “pass” or “fail”) and five proficiency values as possible value options for the performance review completed by the assessor for the human assessment. These examples highlight the importance of ensuring that competency information and proficiency and level information should be considered separately.

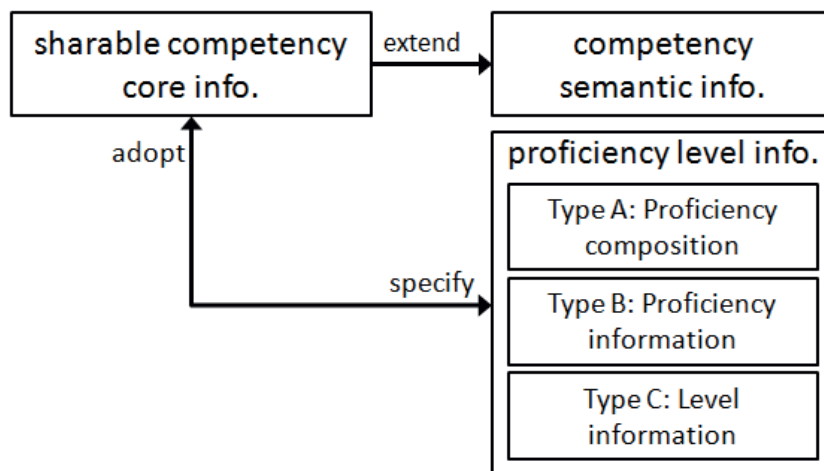


Figure 1 — Relationship between competency and proficiency

Competency information may be structured or organized as a hierarchy. Mapping with the CRM for competency, proficiency level information would be considered as part of the class “[E3] competency” as described in ISO/IEC TR 24763. Competency information may consist of child competencies and each child competency may have its own proficiency level sequence (e.g. be divided into different levels). For example, competency (X) might be defined and comprise of competency (X) 1st, 2nd, and 3rd levels. For example, in the case of a “social skill”, the child competency “communication skill” could be a requirement for someone who is at the 1st level and the child competency “negotiation skill” might be required for someone at the 2nd level. The child competencies may each be described using different levels. For example the child competency “communication skill” could be described using 2 levels (“pass” or “fail”). The child competency “negotiation skill” could be described using 5 levels (“exceptional”, “exceeds expectations”, “meets expectations”, “improvement needed”, “unsatisfactory”). The competency and child competencies in this example could be labelled differently in various IT systems. Also, the proficiency levels could be structured in a variety of ways across different IT systems. This is one of the reasons why it is helpful to define proficiency level distinctly from competency information.

There may be other aspects that impact on how proficiency level is expressed within an IT system. It is possible that other classes of information as defined in the competency CRM (in ISO/IEC TR 24763) could be used to indicate proficiency and level. For example, an individual who has no difficulty communicating with other individuals in an organization might be considered to have a higher proficiency and level with regard to “communication skill” compared to an individual who has difficulty communicating with other individuals in an organization but can communicate with no issue with their good friends. In this case, the proficiency level of “communication skill” may be defined using the classes “[E1] action” or “[E8] outcome”. Also, in this example the difference could be specified according to different competency information associated with the class “[E4] criteria and method” and “[E2] actor”.

Thus it is helpful to ensure that the variety of ways that proficiency and level information is expressed in IT systems is made explicit to support management and exchange of this aspect of competency information. The next clause provides a competency proficiency and level information model that can assist with communicating about this type of information.

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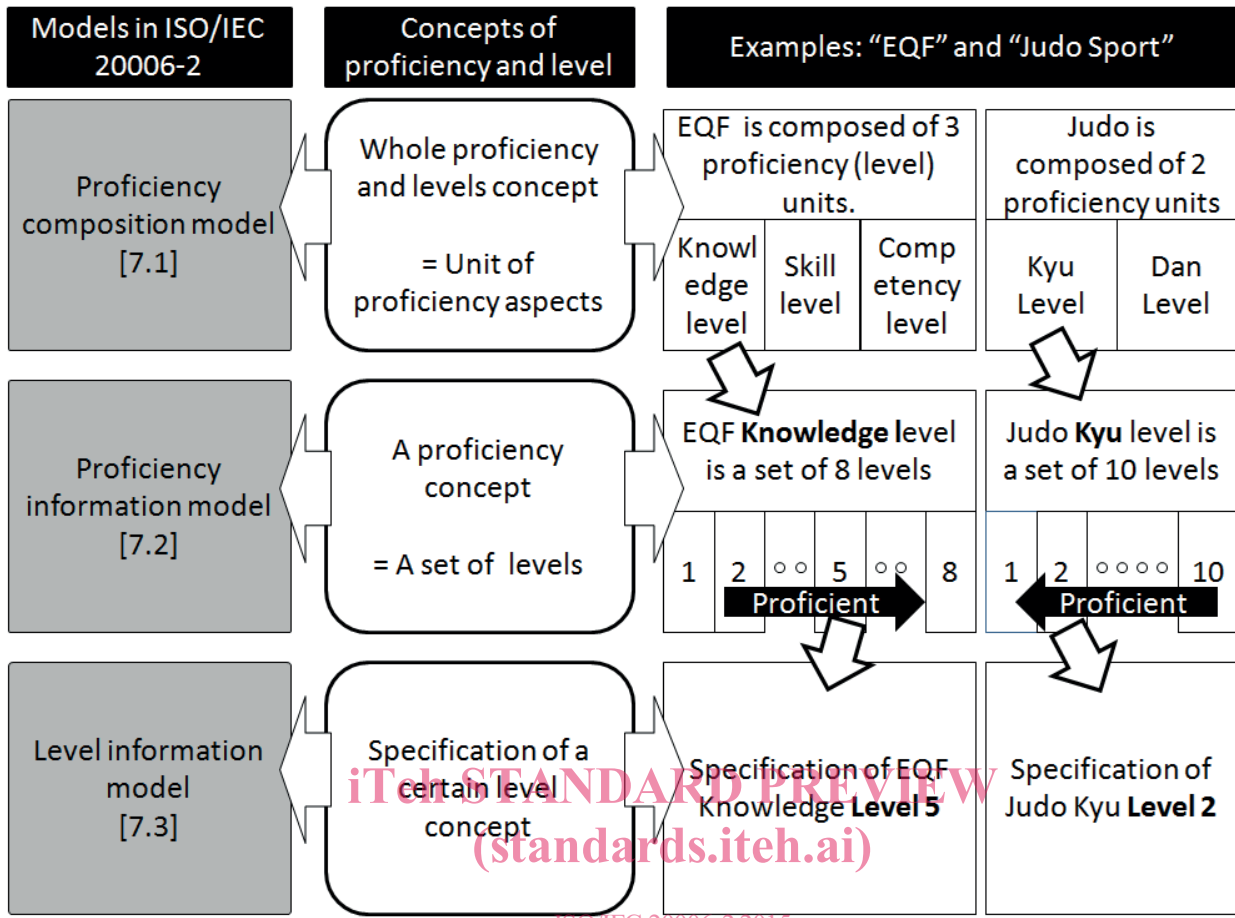
7 Proficiency level information model

The proficiency level information model comprises 3 components as noted below and in [Figure 2](#),

Type A, proficiency composition model ([7.1](#)), which is used to define the whole concept for a proficiency or a unit of levels as a highest or abstract conception. It is used, only if a proficiency or a unit of levels is composed of more than two different aspects or stages.

Type B, proficiency information model ([7.2](#)), which is used to express and implement one unit of levels.

Type C, level information model ([7.3](#)), which is used to express and implement one level in a set of ordinal levels.



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Figure 2 — Relationship among the proficiency composition model, the proficiency information model and the level information model

7.1 Proficiency composition model

The proficiency composition model is used to describe the structure of the proficiency. It includes the attributes that are used as labels within an IT system (e.g. id, name, description). It also includes two items, the proficiencySequence and the proficiencyList. The proficiencySequence is used to describe aspects of the proficiency that is being represented. These aspects are at a high level of abstraction. So, for example, for the European Qualifications Framework (EQF), the proficiencySequence would include three main items (i.e., knowledge levels, skill levels, and competency levels). Additional information regarding the proficiencyList item would be included as attributes (e.g. id, name, description). The structure of the proficiency composition model is provided below in [Figure 3](#).

There are many different types of competency information and rating structures. Some examples are provided below.

- a) Single rating scale (e.g. ascending or descending): where an individual would be assigned a specific value on a scale that is either ascending (e.g. 1 – 10) or descending (10 – 1).
- b) License or certificate: where a person takes a license or certificate exam and possibly participates in LET activities. In such cases, it is possible that the coursework and/or exam would be either “pass” or “fail”. This type of rating structure may be used for professionals, tradespeople, and others.
- c) Educational attainment/credential/state: where proficiency and levels are given names, for instance, bachelor, master, and Ph.D., or junior class and senior class.