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The benefits and Future of Standards: Metadata and beyond

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The Benefits and Future of Standards: Metadata and beyond

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Abstract. This article discusses the benefits and future of standards and presents the generic multi-dimensional Reference Model. First the importance and the tasks of interoperability as well as quality development and their relationship are analyzed. Especially in e-Learning their connection and interdependence is evident: Interoperability is one basic requirement for quality development. In this paper, it is shown how standards and specifications are supporting these crucial issues. The upcoming ISO metadata standard MLR (Metadata for Learning Resource) will be introduced and used as example for identifying the requirements and needs for future standardization. In conclusion a vision of the challenges and potentials for e-Learning standardization is outlined.

Keywords: e-Learning standards and specifications, interoperability, quality development, standardization committees and initiatives, Generic Reference Model for e-Learning standards, ISO/IEC JTC1 SC36, CEN TC 353, Metadata for Learning Resources (MLR)

1 Interoperability and Quality Development

Interoperability and quality development are the main challenges of e-Learning today. The acceptance, the realisation, and the success of e-Learning offers depend on their interoperability and quality. In this contribution we will show that interoperability and quality development cannot be prescribed in a specific manner, there is always the need for an adaptation and specification concerning the given situation.

Interoperability means more than technical conformance: It covers the whole range of requirements and characteristics from any systems and has to be addressed at all different levels and domains. The term 'system' is used here in its broadest sense including human beings, societies and any kind of technical and natural network: A system consists of internal communication and relationship between all its elements, entities and members and can be defined against its external environment. (cf. [1]; [2]). The epistemological problems regarding the recognition of a system by another system can be suppressed here especially if we are focussing on e-Learning: It is impossible for external systems (e. g. teachers or other persons or systems) to observe

and follow the internal learning processes of a learner. Learning progress, knowledge and competencies are always built by the learner itself and we cannot prove a causal connection between learning offers and learning processes, we can only assume some relationships and effects (cf. for the theory of cognition [3]).

Implying these preconditions we can therefore define interoperability as follows:

Interoperability means the ability of exchange and re-use of every kind of information and resources in any way within or between different systems.

Based on this definition four different scopes of interoperability can be differentiated in relation to given systems:

- Internal interoperability,
- Directional interoperability,
- Mutual interoperability, and
- General interoperability (cf. [4]).

The different interoperability scopes are applicable for the formal distinction of interoperability. But interoperability is a complex subject with many facets and dimensions: A detailed differentiation is needed for the application sectors regarding the specific domains and implementation scenarios. That is also true for the multi-dimensional term of quality development.

In a general way quality development can be defined as follows:

Quality development covers every kind of measurement, assurance, optimization, and continuous improvement of the quality within given systems.

According to interoperability quality development can also be described formally by the chosen scope. Quality is not a fixed characteristic belonging to subjects or systems but depends amongst others on the point of view and the scope. The following differentiation of the scope into three quality dimensions has become widely accepted (cf. [5]):

1. Potential dimension: What are the potentials for the quality development in the future?
2. Process dimension: How can the processes be described and optimized for the purpose of quality development?
3. Result dimension: How can the quality development be supported regarding given results and systems¹?

Interoperability is a request and a precondition for the quality development. Standards are offering a special support and have been accepted widely for the aims of interoperability as well of quality development.

¹ For the whole long-term debate on the quality issues, aspects and approaches cf. [6], [7].

2 Categories and benefits of standards

The main objectives of standards in general are to achieve benefits in the ratio of effects and efforts. One main benefit of a standard should be its economical benefit that could be reached e. g. by the establishment of the interoperability of different systems or by the re-use of learning objects (interoperability of resources). And also quality tasks could normally raise economical benefits in a long-term, e. g. by harmonization of the terminology or by introducing a quality reference model. Interoperability (in its broad sense) and quality development can be called the two main purposes of standardization to gain economical benefit especially in the fields of e-Learning.

Focussing on standardization we have to distinguish between the two general categories of (formal) standards and (other) specifications (cf. [4]):

- **Formal standards:** Formal standards also known as "de-jure standards" can only be developed in consensus processes by the official standardization organizations, i. e. the International Organization for Standardization (ISO) and the European Committee for Standardization (CEN) at the European level, and are always publicly available.
- **Community specifications:** Community specifications are developed by a communities or fora that are normally available in public as open specifications. Examples are: the Institute of Electrical and Electronics Engineers, Inc. (IEEE) and the World Wide Web Consortium (W3C).
- **Industrial specifications:** Industrial specifications are developed mostly domain-specific for branches by industrial consortia and could be open specifications, i. e. publicly available, or closed specifications, i. e. only available for the consortium members.
- **Organizational specifications:** Organizational specifications are developed internally as closed specifications.

That means that formal de-jure standards can be developed only by ISO and CEN, all other standardization initiatives are developing only specifications (but often also called "standards" for simplifications).

The main benefits of standardization can be summarized as (cf. [8]):

1. Competitiveness: Benchmarking of performance
2. Economics: Clear processes and reduction of failures
3. Motivation: Transparency and involvement of all stakeholders
4. Image: Marketing with international accepted standards
5. Planning reliability: Risk management by standardization
6. Customer orientation: Equal partnership
7. Continuous improvement cycle: Evaluation and optimization

3 Generic Reference Model for e-Learning Standards

This chapter provides an overview of the Generic Reference Model for e-Learning Standards based on differentiation of the mainly relevant dimensions and categories. Currently, its adaptation and usage for standardization in general is under research: First results are indicating that the Generic Reference Model is also applicable for any kind of standards in the field of learning, education and training.

Three categories of (e-Learning) standards can be regarded as the three main dimensions for standards according to it²:

1. **Types of (e-Learning) standards**
2. **Domains of (e-Learning) standards**
3. **Entities of (e-Learning) standards**

The following three *types of e-Learning standards* can be differentiated:

- Implementation standards: Implementation standards are developed to ensure the interoperability within all domains of e-Learning.
- Conceptual standards: Conceptual standards are offering generic and theoretical solutions to compare and harmonize the entities and objects corresponding to the standard.
- Level standards: Level standards define the quality level that should be reached by the application of the e-Learning offer and are often used for certification aims.

These three types of e-Learning standards can be attributed to the two main purposes and functions of e-Learning standardization that are interoperability and quality development (see above). Implementation standards are always focusing the interoperability within all domains and level standards are addressing the quality development but are out of scope for standardization as level standards have to be defined by the responsible legal authorities. Conceptual standards can support both the quality development (e. g. by providing generic frameworks or reference models) as well as the interoperability by implementing and adopting the concept.

The following figure 1 shows that relationship:

² For a complete description of the Generic Reference Model for e-Learning Standards cf. [4].

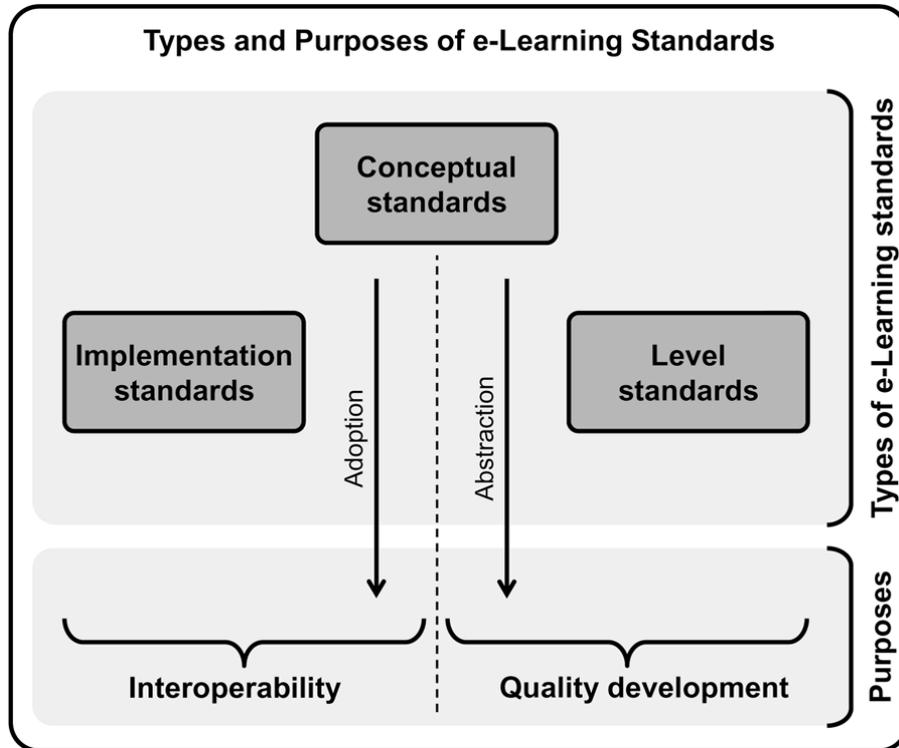


Fig. 1. Types and purposes of (e-Learning) standards

For the second dimension, six *domains of (e-Learning) standards* can be differentiated: Meaning, Quality, Didactics, Learning technology, Learning content, and Context. (e-Learning) standards can cover one domain or a combination of these six domains.

For the third dimension, six *entities and objects of (e-Learning) standards* can be differentiated: Learning environment, Roles, Methods, Learning systems, Learning resources, and Practice. (e-Learning) standards can also correspond to more than one entity in combination.

The Reference Model for e-Learning Standards consists of these three main dimensions: Types, domains and entities of e-Learning standards. It can be represented by drawing a cube with these dimensions. The following figure 2 shows the dimensions of the Reference Model for e-Learning Standards:

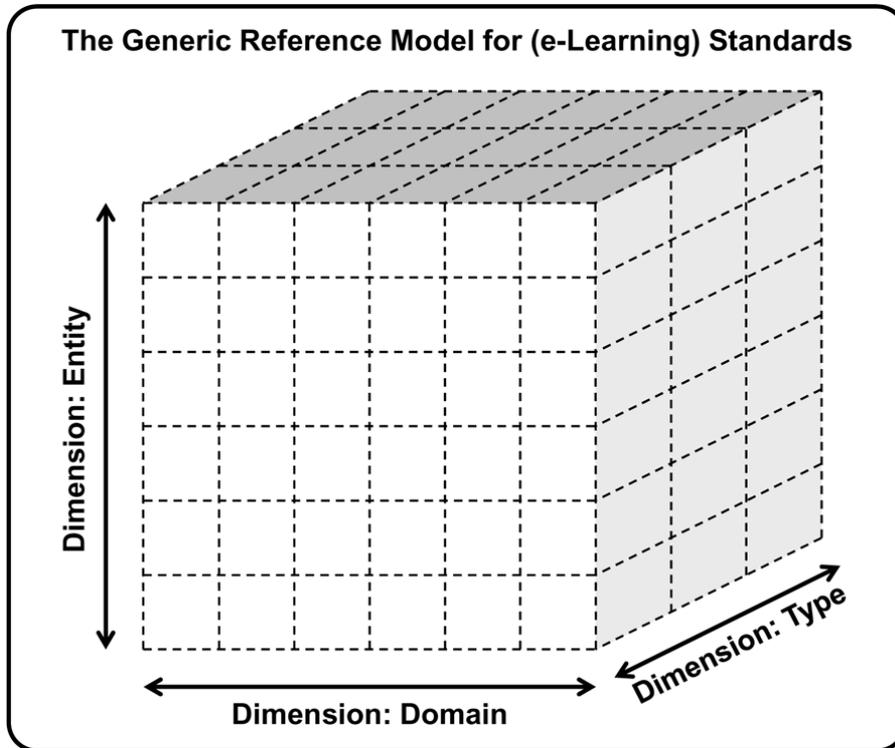


Fig. 2. Reference Model for (e-Learning) Standards

Every e-Learning standard or specification can be classified and specified according to the dimensions with possible combinations and overlapping. Thus the Reference Model for e-Learning Standards is a first instrument for the combination and harmonization of standards towards their easy integration.

4 The international standards RFDQ and MLR by SC36

ISO/IEC JTC1 SC36 is the unique official formal standardization body for e-Learning at the international level³. The scope of SC36 is defined as: "Standardization in the field of information technologies for learning, education, and training to support

³ The abbreviation stands for: "International Organization for Standardization (ISO)/ International Electrotechnical Commission (IEC) Joint Technical Committee 1 (JTC1) - Information Technology - Subcommittee 36 (SC36) - Information Technology for Learning, Education, and Training (ITLET)". Members of SC36 are National Bodies (NB), i. e. national delegations of appointed experts, and Liaisons Organizations (LO) without voting rights (cf. <http://www.iso.org/jtc1/sc36> and <http://www.sc36.org>).

individuals, groups, or organizations, and to enable interoperability and reusability of resources and tools" [9].

The first substantial standard that was developed, approved and published by SC36 in 2005 is the quality standard **RFDQ** (Reference Framework for the Description of Quality Approaches), ISO/IEC 19796-1 ("Information Technology — Learning, Education, and Training — Quality Management, Assurance and Metrics — Part 1: General Approach") [10]. It is providing a generic Reference Process Model and the first quality standard of the multi-part ISO/IEC 19796 series. The quality standard has been implemented worldwide⁴ and adopted as European Norm EN ISO/IEC 19796-1 by the European standardization Committee CEN TC 353⁵.

The standard **MLR** (Metadata for Learning Resources), ISO/IEC 19788, was the main SC36 standardization initiative during the last years and will support the international interoperability for metadata harmonization: It is a multi-part standard and its first part provides the General Framework for Metadata and Application Profiles that is completely interoperable and compatible with the Dublin Core (DC) metadata standard (ISO 15836:2009 Information and documentation – The Dublin Core metadata element set) [12].

Currently more than fourteen standards are approved and published by SC36. And in 2010, the next major standardization initiative has been approved and started: The multi-part ISO/IEC 20006 series on competency will provide a competency model as a General Framework based on Asian, American and European specifications [13].

This active progress and productive international consensus building is raising new challenges and questions

5 Vision

Finally we would like to broaden the view on interoperability and quality development in e-Learning and on standardization in the future. What are the main challenges today for future development of standards? Here are some answers:

- **Consensus:** Interdisciplinary development of consensus between the different subjects as well as the standardization initiatives
- **Vocabulary:** Common terminology describing the different meanings and applications of specific terms
- **Harmonization:** Harmonization of specifications on the same topic developed by different standardization initiatives
- **Framework:** Development of a harmonized and international accepted generic reference framework for any e-Learning systems, environments, architectures and services.

⁴ For a detailed description of the quality standard RFDQ and of the Adaptation Model IDEA for the Introduction of Quality Development cf. [11].

⁵ The abbreviation stands for: "European Committee for Standardization (CEN) Technical Committee (TC) 353: Information and Communication Technologies for learning education and training". Members of CEN TC 353 are National Bodies (NB), i. e. national delegations of appointed experts, and Liaisons Organizations (LO) without voting rights (cf. http://www.cen.eu/issc/TC_353).

In 2008, SC36 has started its initiative for the development of a **Conceptual Framework for Standards** that will be accompanied by several Technical Frameworks for different use cases and target groups. The presented Generic Reference Model for (e-Learning) Standards is a helpful and supporting contribution on the long way towards such a generic (e-Learning) framework.

Interoperability and quality development are crucial and indispensable for the long-term success of learning opportunities and in particular of e-Learning: To reach an economical benefit through re-use and harmonization e-Learning, standards are offering a sustainable support. Their adaptation, implementation and integration can be regarded as one of the main tasks for the future.

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