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Guest Editorial Preface

On the Status of Learning Technology Specifications and Standards

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Standards in the Technology-Enhanced Learning (TEL) domain, also denoted as Learning Technology Standards, have over the past decade been the subject of increased attention. As the education and training sector gains importance and technologies are ubiquitous within educational processes, it is natural that these standards are located within the conversation However, the adoption and deployment of standards in education is not meeting the expectations of the learning technology standards community, this is in marked contrast to other vertical industries.

What is the current status of development in Learning Technology standardization? What are the main developments and how are these developments adopted, or not, by the TEL community and what is the future potential of this field?

These questions are the primary focus of this special issue of this journal.

TYPES OF STANDARDS

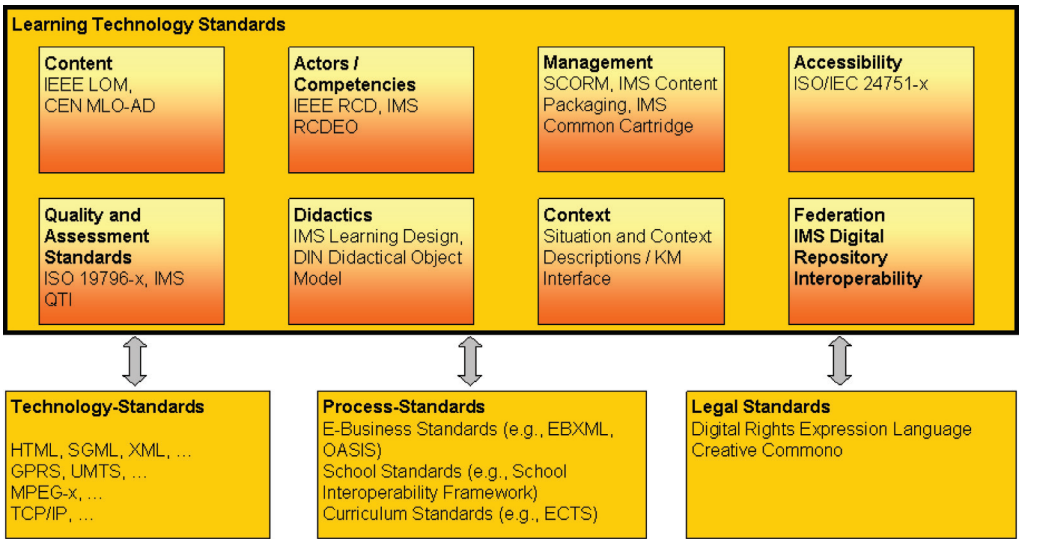
Generally, we can distinguish two types of standards applied in the TEL domain (see Ehlers & Pawlowski, 2006):

- Learning Technology Standards focus on enabling the seamless interoperability of components of learning environments, such as authoring systems, learning management systems (LMS), social networks and learning resources and services. These standards include standards for content, management, actors/users, didactics, activities and quality aspects. Recently, new areas of LT specific standardization have emerged including context description and accessibility.
- Related standards are more generic technology standards used within the quality or TEL domain, these standards relate to such things as technology, process, or legal issues. They are developed within other domains.

The following figure describes the main types of standards and specifications for the TEL domain and lists examples for each field (Figure 1).

In the TEL domain, surprisingly few related / basic standards are used. Even though basic technology standards are applied (such as HTML, XML), other developments and related standards seem to have historically been largely ignored. Examples include Dublin Core

Figure 1. Types and examples of Learning Technology Standards



(ISO, 2009), HR-XML in the Human Resources Development domain (HR-XML, 2009) or generic Enterprise Architecture frameworks. Currently however new specifications seem to be based on related or embedded in more widely accepted frameworks, standards and specifications not specific to the TEL domain.

Furthermore, most of the standards arguably seem to be anticipatory. This may explain why the majority of specifications have not been adopted widely and, thus, not preceded to consensus in the formal standardization process.

Stakeholders and Lifecycle

The direction and scope of standardization activities is highly dependent on the participating stakeholders within the standardization process. In Technology-Enhanced Learning (TEL), stakeholders represent a diverse group of interests including technology providers / vendors, content providers / vendors (including Open source communities and Open Educational Resource (OER) producers and consumers, domain experts, researchers, policy makers and, in some cases, users. Generally, we distinguish the following phases (cf., Olivier, 2005):

- Research and Development (R&D) denotes the stage of Research in the domain and in parallel the development of (mostly) proprietary systems. At this stage of the lifecycle most results are purely experimental.
- Pre-standardization: In this phase, results from the R&D phase are adopted, by the pre-standardization organizations 1 such as the CEN Workshop Learning Technologies "Information Technology for Learning, Education and Training" (CEN, 2010a) or the IMS Global Learning Consortium (IMS, 2010). A variety of specifications are developed and validated in practice.
- Community-driven or pragmatic specifications are often grounded in projects or stakeholder needs in addressing interoperability problems with solutions for existing and new services. Sometimes the outputs of these kinds of activities are brought into the formal standardization process as a sustainability strategy. This can be viewed as an alternative to the pre-standardization instruments within the formal standardization or specification organizations.

- Standardization: Successful specifications are taken up by the formal standardization bodies, such as CEN TC 353 (CEN, 2010b) or ISO/IEC JTC1 SC36 "Information Technology for Learning, Education and Training" (ISO/IEC, 2010).

Overall, industry participation is, arguably, relatively low in formal standardization bodies such as the international ISO/IEC JTC1 SC36 and European CEN TC 353. Within pre-standardization activity (see below), the relationship between industry and academics, as key stakeholder groups, is more balanced.

Current Status

The uptake is still relatively low for most specifications and standards. However, with the current rapid increase of available standards (in contrast to specifications), this situation may change over the next years. The following table shows selected specifications and standards as samples to illustrate the current status in the domain.

In conclusion, we argue that Learning Technology Standardization has made significant progress over the past decade and contributed to addressing interoperability issues. However, the current number and variety of specifications and standards does appear to cause some confusion within the community and arguably restrict uptake and adoption. Despite this problem, successful examples/exemplars can be found as presented in this special issue.

Contents of this Special Issue

The special issue includes the following articles which cover a broad range of topics. The paper by Pawlowski and Kozlov addresses how standards, specifications and, more general, reference models can be evaluated and assessed. As there is currently no widely accepted assessment framework, this paper provides an insight into potential categories and criteria for assessment. It should be noted that there will be no one-fits-all framework. The outlined framework provides a basis, to be adapted for the purpose of evaluations and assessments in different contexts.

Is the learning technology domain unique in going through standardization or does it differ This is a crucial question posed by Cooper in his paper on the Key Challenges in the Design of Learning Technology Standards – Observations and Proposals. His observations are compared to a business enterprise; he argues that the workings of the education system as a whole are rather more complicated than other domains. Consequently, you require more than the engineering heritage to deal with the complex challenges presented .Further he argues of the need to account for the inherent complexity of the domain. Therefore, LT standards should be developed to accommodate diversity and change and to be part-of the systemic processes from which learning technology emerges. Both the organizational aspects of standardization and the technical aspect of how standards are written need to be addressed.

One approach to this challenge is pragmatic Community-driven specifications, described in Wilson's paper. He analyses three UK projects developing specifications independent of the traditional governance processes of either industry consortia or formal standards organizations. From a technical perspective, these specifications there are inspired by open web standards and semantic technologies, rather than repository vertical standardization. From an organizational point of view, even though they are anchored in specific user communities and nursed by project funding from the educational sector, they are fed into formal standardization as part of a broader sustainability strategy.

Two of the specifications Wilson explored are related to a new field of interest for ITLET standardization, areas related to skill and competence. This is the starting point for Grant and Young, who offer a common conceptual

Table 1. Maturity of Learning Technology Specifications and Standards

Standard	Category	Maturity / Adoption	Explanation
IEEE Learning Object Metadata (IEEE, 2002)	Content standard	High	Wide use in repositories. Competing / conflicting standards available such as Dublin Core (ISO, 2003) or Metadata for Learning Resources (ISO, 2010)
ADL SCORM (ADL, 2009)	Management specification	High	Limited field of usage
IMS Common Cartridge (IMS, 2009)	Management specification	Low	Combined specification for packaging and selected services
IEEE RCD (IEEE, 2007)	Actor standard	Low	Basic description scheme for competencies with low contextualization for the domain
IMS Learning Design (IMS, 2003)	Didactics specification	Medium	Wide usage in Europe and in European R&D projects
ISO/IEC 19796-1 (ISO, 2005)	Quality standard	Medium	Basic framework for quality management as extension to ISO 900x
CEN MLO (CEN, 2008)	Content specification	Medium	Emerging specification for content providers for advertising information, currently progressing to a standard in CEN TC 353
IMS Content Packaging (IMS, 2004)	Management specification	High	Packaging of learning contents, currently in discussion in ISO/IEC for further standardization
IMS QTI (IMS, 2006)	Assessment specification	Low	Specification for assessment re-use; use of different inconsistent versions in the community
ISO/IEC Accessibility for All Series (cf., ISO/IEC, 2008a, 2008b, 2008c)	Accessibility standards	Low	Specifications for accessibility in the TEL domain

model to guide the discussion towards the kind of useful specifications and standards that can enable the many real services that may well be demanded in this area. The aim is through collaborative modeling involving educators, trainers, employers, learners, assessors / evaluators, professional bodies, awarders of licenses or certificates, customers / clients, careers advisors, and any other stakeholders to come up with agreed concepts. The advocated approach consistent with the increased diversity in this field is to recognize 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. Grand and Young point to semantic web technology, in particular W3C's Simple Knowledge Organization System, SKOS, as an enabler for this kind of standardization work.

While Grant and Young start where concepts need to be negotiated to gain a clear meaning, Dahn and Zimmermann's point of departure is where we already have precisely defined and testable concepts, i.e., in mature specifications and standards. They discuss the potential of application profiles and domain profiles as means to adapt technical specifications of data structures to particular needs. Dahn and Zimmerman argue that application

profiling may be better suited to increase the take-up of formal specifications than the creation of new specifications. They support their claim by referring to successful examples of conformance test systems for machine-readable application profiles.

Profiling, if not conformance testing, plays an important role in the paper of Najjar et al., proposing a Data Model for Describing and Exchanging Personal Achieved Learning Outcomes (PALO). This specification is a step towards a common model supporting the exchange of date about knowledge, skills and competencies, to enhance interoperability of personal learning outcome information between, for example, learning management systems, e-portfolios, social applications and recruitment systems. The model builds on the result of a European project that builds on the premises of the European Qualification Framework (EQF), extending and profiling existing standards and specifications as IEEE LOM, IEEE RCD, etc.

The paper by Livingstone and Hollins expands our themes to explore the new boundaries of learning technologies represented by Virtual Worlds, no longer the sole reserve of the entertainment industry. In order to support specific business or education applications the authors find that additional standards are required to address the needs of different virtual world user communities – such as the need for new or adapted educational standards to facilitate the development and reuse of educational content in virtual worlds. In these technologies technical interoperability might be achievable, but argue it is more likely to be in the hands of virtual world developers and their commercial business models than the traditional stakeholders of learning technologies.

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