

Learning technology standards adoption – how to improve process and product legitimacy

Tore Hoel
Oslo University College
tore.hoel@hio.no

Paul Hollins
Centre for Educational Technology and Interoperability Standards
Institute for Educational Cybernetics/ University of Bolton
pahl@Bolton.ac.uk

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ABSTRACT

Standardisation of learning technologies as a co-ordinated design activity needs legitimacy to attract the necessary support from its stakeholders. This paper identifies the need for a theoretical model of such standardisation and offers an analysis of two pivotal concepts in such a theory, process legitimacy and product legitimacy. Comparing the development of two specifications from Norway and Britain the authors propose a reframing of an existing theory of input and output legitimacy, focusing more on the technical characteristics and the enactment status of the standard at hand.

1. Introduction

As a consensus-driven activity, specification and standards development – carried out by and for the interested parties themselves – is almost ‘*by definition*’ of great value to those participants in the process [1]. This high level perspective does, however, require qualification. In the Learning, Education and Training (LET) domain, the authors argue, those involved in the established process of standards development should recognise the inherent weaknesses of the process itself; if, that is, the LET community is to fully realise the potentially positive externalities afforded by specifications and standards.

There has been a marked shift in the emphasis in the work undertaken by a number of established active contributors to the European Learning Technology Standards community. Added to existing contributions to

the standards development within the formal standards bodies has been active participation in research and development and proof of concepts as major areas of activity. In their 2005 bid for service funding the Joint Information Systems Committee Centre for Educational Technology and Interoperability Standards (JISC CETIS) decreed recognition of “emergent pragmatic community standards” as warranting significant support and effort, complimenting their work with the formal standards bodies and consortia¹.

It could be argued that the learning technologies standards community works under the assumption that they create valuable *design references for products or processes*², which in due course will enhance technologies for the LET domain. When use of such design references fails to emerge, or the standards produced are perceived as seemingly irrelevant to current practices within schools and higher education, there is consequentially a lack of interest and enthusiasm in the standardisation process as a co-ordinated design activity. This can result in poor adoption and uptake of standards in the LET community and at worst can result in outright resistance to the activity.

However, in today’s networked society, it is difficult to ignore technology standards; be they established *de facto*

¹ The theme of the CETIS 2007 conference was “Beyond standards”, indicating an ambition to explore what could be done to further develop beyond the established existing process.

² This definition of a standard is taken from prof. Mogens Kühn Pedersen, Copenhagen Business School, www.cbs.dk/ostea. Other definitions of standardisation or standards do focus more on the consensus process and approval by a recognised body, e.g. this definition by ISO/IEC: “A standard is a document, established by consensus and approved by a recognised body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.”

informal standards or the more formal *de jure* standards emanating from formal standards bodies.

“If infrastructures are the “connecting tissue of modernity” (Edwards, 2003), then standards are the fibres of the infrastructures. It is aggregation of elements by the means of standards that results in the formation of large and complex systems bringing about entirely new properties at each level of complexity (Anderson, 1972, p.393).” [2]

That pivotal role of standards means that the perceived legitimacy of the standardisation process or its outcomes requires care and attention.

Embarking upon this analysis we suggest that the role of standards in the design of learning technologies is easily misunderstood. To explain the benefits of standards many proponents have found it all too easy to draw on the crude, although useful, analogies of different gauge railway lines or the electrical plug sockets. In order to foster a greater understanding of their role *we need to develop a more informed domain theory regarding the standardisation of these technologies*. Only if we have a good theoretical understanding of standardisation and the processes of standardisation within the domain will we be able to improve strategy and guidelines to raise the quality and outputs of the standardisation work; thereby providing leadership in the LET domain.

There are few independent studies of the impact of standardisation on the development of learning technology. The formal standards bodies themselves provide few exemplars to support the wider business case for standardisation [1,3]. In this paper we will analyse the role of standardisation of learning technologies in the wider context of standards activities, review some of the general theories on standardisation and see how they fit in the LET domain. Through the analysis of two case studies of approaches to Learning technology standardisation, one from the UK and one from Norway, the authors aim to identify issues that could be significant in the quest to deepen our understanding of the challenges faced in the design requirements for LET technologies.

2. Legitimacy of technical standardisation

Studies have concluded that the dynamics of the ICT industry and of a globalised societies are responsible for the profound changes in most aspects of technical standardisation [1,3,4]. Werle & Iversen [4] list changes in the formal settings in which the process takes place; changes in the rationale that initiated the process; changes in the stakeholders' involvement in the process; and changes in the outcome of the process. Each of these aspects can impact positively in respect of the democratic legitimacy, which both mandatory (i.e. regulative) and voluntary (i.e. coordinative) standards require achieving wide adoption. Werle & Iversen have noted that there

remains a tendency to think of the legitimacy-deficit in terms of *“input legitimacy” criteria*, while they at the same time observe a tendency for standardisation organisations to orient efforts towards achieving *“output legitimacy”*, by developing standards which are regarded by diverse groups of legitimising stakeholders as *“good standards”* [4]. The authors argue that the dichotomy of input vs. output legitimacy is useful to consider as the first organising principles towards a theory of learning technology standardisation.

The input legitimacy criteria focus on the *“production”* of a standard, i.e. the standardisation process; whilst the output legitimacy addresses the *“product”*, i.e. the standard itself.

Werle & Iversen discuss the concept of democratic legitimacy of a standard against the analytical distinction between two types of standards, i.e. Coordinative vs. Regulative standards (as an alternative to the distinction between market and committee standards), summarised in this diagram:

Diagram 1: Two types of standards: An analytical distinction

	Coordinative	Regulative
Aim	Interoperability, compatibility	Prevention of negative externalities of technology
Mode of generation	Negotiation of agreements among “interested” actors, emergence in markets	Hierarchical political governance
Normative character	Convention, voluntary	Legal rule, mandatory
Area of validity	Industries, markets (techno-economic units)	States (political units)
Economic effects	Reduction of transaction costs, positive externalities	Internalization of negative externalities

(Source: Werle 2002: 246)

In defining the two types of standards Werle & Iversen draw on the economic concept of externalities, the economic side effects on other parties so often found in network society which are not reflected in the cost of the services involved. Thus

“Regulative standards – often in the form of maximum or minimum requirements and limits – aim at preventing negative externalities through internalization, i.e. imposing the externalities on those who have induced them. (...) Coordinative standards, such as protocol and interface specifications, on the other hand, frequently aim at promoting interoperability and compatibility of technology in order to reduce transaction costs and to generate positive externalities.” [4]

According to this theory high input legitimacy is characterised by a *due process*, i.e. ensuring *stakeholder representations*, ideally maintained by a *well acknowledged Standards Setting Body*³ [4]. We may ask

³ Werle & Iversen summarised input legitimacy as modes of standardisation that focussed on openness and direct representation

then what the characteristics are of a standard with high output legitimacy, other than its perception as a “good standard” by the legitimising stakeholders? Werle & Iversen define output legitimacy by the following factors: “all ‘interests’ are considered (but not directly represented) in the standardization process; *external tracking and monitoring* of standardization by stakeholder and advocacy groups; and *decision-making in an open inclusive discourse* (arguing) to the benefit of all standards addressees”[4].

The authors claim, based on an analysis of recent learning technology standardisation practice, that there is more to consider than merely the procedural aspects that contribute to output legitimacy. We will identify other “product characteristics” of a more technical nature that we argue are essential for a standard to be valued as being “good” by the “standards addressees”. These characteristics are domain specific and should be identified through detailed analysis of the particular technology cultures. We would, for example, maintain that regulative standards serving e.g. the needs of eGovernment services such as tax declarations, building regulations etc. could be of a highly *technical complex* nature (once achieved legitimacy through a due process); while coordinative standards serving the LET, e.g in technology enhanced learning applications, could be of a less technical complex nature to be adopted by the community. It is, however, recognised that within the LET domain, specifically within regulatory and assessment regimes robust complex technical standards may still be required.

3. How to avoid complexity – from recent standardisation practice in Norway and UK

In December 2007 The CEN/ISSS Workshop on Learning Technologies commenced work on a European harmonisation of Core Elements for describing Learning Offerings or courses. The first country to present a model for Course Description Metadata (CDM) was Norway in 2004, followed closely by the UK in 2005, presenting the eXchange of Course Related Information (XCRI) specification.

After three years a profile of the CDM specification is being taken up by Norwegian institutions within higher education, populating central services with course descriptions. The specification was developed through a semi-formal process by a representative committee of course providers. However, the technical lead of the development was given to the service providers or vendors with the most established student registry system. Inevitably, the data model of this system became the

(participation) of all actors interested in or potentially affected by a standard; work in accordance to impartial and fair procedural rules; and decision-making based on consensus [4].

starting point of the CDM project. The role of the committee members extended to ensuring that *their requirements* were represented in the final specification. With a complex data model as the initial starting point, this only added to the final complexity of the specification (although it is recognised that multiple requirements can also lead to underspecification accommodating too many optional elements).

The UK XCRI reference model project commenced with a detailed analysis of the Norwegian work and CDM, and came up with a very different strategy, that of limiting the scope of their standard⁴. The XCRI project objective was to deliver a vocabulary and technology bindings for exchanging course-related information for course marketing and enrolment. This was achieved by reaching an informed compromise within the community and developing useful tools as proofs of concept for the UK LET community. The approach was harnessed by building on REST web services using a minimal vocabulary.

In comparing the two projects we note some striking differences in approach, summarised in the table below:

<i>Development aspect</i>	<i>CDM (.no)</i>	<i>XCRI (.uk)</i>
Complexity of the specification	High	Low
Extendibility of the specification?	No	Yes
Development process	By committee	By community project
Specification and service development in parallel?	No	Yes

Table 1 Development aspects of two specifications with the same remit

Measured by the regulative effects of CDM, it may be characterised as a success as it is, now being mandated in Norway and France (though with a not clarified formal status). The XCRI services on the other hand are seen by the UK learning technology community as a “highly effective application and easy to implement” the specification is widely hailed as an example of a successful development within the e-Framework for Education and Research⁵.

⁴The XCRI approach is described as having a strong foundation of “why”; progressing through survey of existing work, mapping of the territory, and focussing (“you cannot do it all”); with an agile and collaborative “informed compromise in action”. (Presentation by Adam Cooper, JISC-CETIS, January 2007, online at <http://www.slideshare.net/soameeting/presentation-by-adam-cooper-jisc>)

⁵See www.elframework.org/projects/xcri. “In developing the XCRI specification for exchange of programme, curriculum, and course data, the Integration Working Group (and the CETIS Enterprise SIG) have developed a process that is very effective in authoring specifications that can be rapidly adopted and will have a long useful life. This could be a model for other projects creating specifications for a JISC service.” Jim Farmer, Notes JISC/CETIS Conference, 15 November 2005

Comparing these two approaches, it could be that defining a carefully considered scope for the specification and focussing on the essential elements necessary to create new services, is the most challenging part of the process. We also recognise that the approach taken in the two countries is replicated in other projects. For example, the monolithic, all embracing characteristic of the CDM specification is repeated in the recent draft for a new Norwegian Standard on a Framework for Person Information in Schools (PIFU)⁶, whilst the British approach of for service-oriented development is allowed for alongside the more formal CDM type approach within the e-Framework for Education and Research⁷.

The importance of development guidelines is apparent in the design requirements applied to the upcoming European standard of Metadata for Learning Opportunities, which is anticipated will supersede the CDM and XCRI specifications as a European norm. When this new standard was discussed in the CEN/ISSS WS-LT (October 2007) a declaration was passed stating that *“harmonization should balance the benefits of common standardization with the necessity for meeting local contextual needs and infrastructure, and harmonization efforts should focus on small, simple models based upon existing commonalities that can be expanded upon at national or regional level, rather than all-inclusive monolithic standards”*.

In the business cases developed for the standard it was strongly argued that the standard should “be lightweight and simple to implement with a very low technical threshold (i.e. not create a technology tax); either fit existing business processes or enable business process improvement (i.e. not create a process tax); support extensibility in a modular fashion to support specialized requirements; (...) support extremely simple architectures, e.g. RSS-style simple aggregation” [5].

4. Standards in action – examining stakeholder agency

If a standard is difficult to implement, there is a risk that ultimately it will lose legitimacy. High implementation costs (“high technology tax”) are associated with the complexity of the specification or standard in such cases. This is why the authors assert that the aspects of a standard’s technical characteristics, e.g. complexity, should be included in the theory of output legitimacy.

However, it is not as easy as to say that we should just keep standards simple and lightweight. If a standard is too simple (and too general), the domain stakeholders will be unable to “model their world”. There is a negotiation between “*express-ability*” and “*specific-ability*” of a

technology, exemplified more than once in the short history of learning technologies⁸.

The question of the right balance between simplicity and complexity, and other technical or material aspects of the specification as an *objective technology*, should only be answered after examining the technology, in which the specification is used, as *enactment in action*.

An enacted technology is according to Millerand and Bowker [6] “technology on the ground as it is perceived, conceived and used in practice, in a particular context”.

“In this view, the way in which actors enact technical configurations such as standards depends directly on their imbrication in cognitive, social, cultural and institutional structures. Organizational arrangements (characterized by routines, standards, norms, and politics) mediate the enactment of technologies, which in return contribute to the refashioning of these arrangements.” [6]

Without being scrutinised as an enacted technology, a standard such as the Norwegian CDM could be viewed as a success, due to its high input legitimacy. According to feedback resulting from consultations with implementers of the CDM specification it is not easy to implement, and does not seem to encourage the development of independent institutional or community services. In contrast, the integration with existing services, e.g. the Google Maps API, of the XCRI specification facilitates immediate demonstrations of its benefits. In the case of the CDM, technology demonstrators were part of the project requirements, but never realised.

This suggests that a standard can be successful as an invention, but not as an innovation. It also raises the question whether it is possible to plan for a successful innovation, or whether innovation needs to be ad hoc. The authors concur with the conclusions of Millerand and Bowker that it does not make sense to see standards simply as things out there in the world which have a predetermined set of attributes.

“In information systems, standards are in constant flux – they have to migrate between communities and across platforms. Closure is a narrative which serves a purpose, not a fact which describes an event. (...) Both standards and ontologies (the one apparently technical and the realm of machines, the other apparently philosophical and the realm of ideas) need to be socially, organizationally bundled – not as a perpetual afterthought but as an integral necessity.” [6].

If we are not able to develop standards as part of an innovation process involving the developers (and R&D community) as well as the implementers (and end-user

⁶www.standard.no/pifu

⁷www.e-framework.org

⁸ The IEEE LOM is one example with its more than 70 elements structured in nine categories. The 15 core elements of the Dublin Core were too general for the educational community, who inscribed in LOM a number of educational elements that never have been used only sparingly and in incompatible ways by implementers after the release of the standard, according to studies. (International LOM survey by ISO/IEC JTC1 SC36, 2003 & 2004)

communities), then wide scale adoption is unlikely and we are bound to fail. Technology is rapidly changing and as a result there is little time to wait for the resistance to a standard to wear out, even if the standard was developed in a due process, achieving high input legitimacy. If standards are not implemented, they could be considered as just research inventions and a contribution to academic careers.

In order to produce widely adopted sustainable standards we need to find effective ways to encourage meaningful interaction between the developers and implementers communities within a wide inclusive stakeholder engagement strategy. The approach is not new or unique to standards; there is a rich history of success in applying participatory design process to technology development processes. Participatory design views;

“Users perceptions of technology as being as at least as important to success as fact and their feelings about technology as at least as important as what they can do with it. It views computers and computer based applications not in isolation but rather in the context of a workplace; as a process rather than as products.” [7]

Based on this analysis we would propose a revision of the standards legitimacy theory of Werle & Iversen, put forward in Table 2.

Werle & Iversen		Hoel & Hollins	
Input legitimacy	Output legitimacy	Input legitimacy	Output legitimacy
Stakeholder representativeness	All 'interests' considered	All 'interests' considered and ideally represented	Inscription of stakeholders' interests
Acknowledged SSB	External tracking and monitoring	Open process	Enactment status (is the specification implemented and used in services?)
	Open discourse	Balanced choice of SSB (either formal or community based)	Technical maturity of the specification

Table 2 Summary of Werle & Iversen's theory of standards legitimacy, with revised version of Hoel & Hollins.

The authors assert that the proposal for revised definitions of the two legitimacies addresses the procedural characteristics and product characteristics of a specification or a standard, based on our practice in the LET domain. (It could be that this theory would apply in other domains.) The central dimension in defining input legitimacy is a *due process*, i.e. that development work is done in an open process [8]. We do not suggest that the consensus process should necessarily be managed by an established formal Standards Setting Body, in recognition of the emerging role of pragmatic community based standards in the domain.

Actor/Issue	Planning agency	Domain framework	Standards methodology	Standardisation education	Standards development support
Educational Government	X	X			X
R&D institutions and universities	X	X	X	X	X
Standards Setting Organisation (SSO)	X		X	X	X
Vendors	X				
Individual experts	X		X		
End-users (pupils / students & learners)					X

Table 3 Actors and issues in standards development

By “inscription of stakeholders' interest” in the standard we emphasise the need of central stakeholders to know that their business needs are built into the specification. This is not only a question of the specification's marketing value or the stakeholders' attitudes towards the specification, but also an objective characteristic of the specification that could be explored by examining the specification in enactment. We also have a concept of technical maturity defining output legitimacy, as we have shown that technical characteristics of a specification relative to its technological environment are essential to provide output legitimacy.

4.1. Stakeholders' agency

Applying a framework on standardisation where 'legitimacy' is a central concept implies a notion of agency. There are actors that play different roles in for instance learning technology standardisation. A good domain theory on standardisation should help us understand this agency and further help us develop a targeted strategy to improve legitimacy.

Table 3 summarises the actors and categories of issues we have identified so far. There are responsibilities on different levels, from the end-users, individual expert, via vendors, Standards Setting Bodies, R&D institutions, and Educational governments. These actors are faced with the task of understanding the current situation; developing a domain framework or theory; on which basis a standards methodology should be developed; which in turn should lead to the developing of standards education; and lastly a sustainable support service for standards development.

In the table we have indicated where the responsibilities to engage with these issues rest. We will briefly comment on two issues, standards education and development support.

Henk J. de Vries has found that *“many people that get involved in standardisation in their professional life lack the (standardisation) education that would enable them to carry on that task in a professional way”* [9]. The need for standardisation education is now being addressed on a more general level by some countries [10]. We would suggest that there is a need within the educational community to formalise standardisation education to improve both the quality and legitimacy of learning technology standards.

A number of projects funded by the European Commission (LIFE; INTEREST; and COPRAS) have identified a need for increased support for development and dissemination of standards. We would argue that the community building aspects of these support actions are essential to enhance legitimacy of the learning technology standards. According to this line of thinking, practical interoperability testing events to prove interoperability and compatibility will have a more profound effect on output legitimacy than entries in government standards catalogues.

5. Conclusions

“The question of why to standardize has become more important and also more difficult to answer, as the value of externalities in a globally interconnected society increases.” [11]

For a number of reasons the positive role standards play in promoting technology enhanced learning is under currently under question.

The dynamic development of new technologies with relevance to Learning, Education and Training might be one reason; educationalists fearing that standardisation might limit the scope for new solutions built on for example, Web 2.0 technologies, which, as a matter of fact, are largely standards based (XML, HTML, http and ReST). Furthermore, there might be a “clash of cultures” between the standards community and the educational

community⁹. When members of the LET standards community themselves starts to question the value of the current standards process it is time to examine it critically in order to improve that process as well as its products.

To achieve a better understanding of LET standardisation we need to understand how the LET domain is characterised compared to the eBusiness domain or other eGovernment domains. Legitimacy of a LET standard is both a question of the standard being developed in due process and implemented as a good product, i.e. the input legitimacy and the output legitimacy of the standard. To understand what contributes to high legitimacy of a LET standard we need to examine the enacted technology, in which the standard plays a role.

The authors have applied the analytical framework of Werle & Iversen to analyse two cases of specification work in Norway and Britain. As a result of this analysis we propose a revised framing of the concepts of input and output legitimacy, which we suggest could serve as a starting point for building a domain theory on standardisation of learning technologies. Such a theory would be of great value to the challenge of developing a much need strategy for enhancing the legitimacy of specification work for Learning, Education and Training. This paper has highlighted issues that should be addressed in such a strategy, e.g. standards education and standards development support.

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⁹ See the “Mind the Gap” project, <http://hoel.nu/wordpress/?cat=16> and <http://www.elearning.ac.uk/features/translation>

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