

Interaction Between Standardisation and Research: A Case Study

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ABSTRACT

Standards-making is a design practice that relies on input from research and end-users, involving experts that represent diverse stakeholders spread all over the globe. However, the standards-setting culture and formal rules are sometimes at odds with the culture and practice of research. Based on previous research identifying the lack of openness and transparency, and a suboptimal interaction with academic research as issues that could explain a lack of success in a European setting, this article studies how an ongoing international standards project on privacy and data protection policies for learning analytics has interacted with an international academic research community. The results of this study show that establishing feedback loops between standardisation, research, and development is essential in order to produce results. However, the study also shows that in individual projects, internal processes and culture in the standard setting group could be of crucial importance for the outcome.

KEYWORDS

Data Protection, Design Practice, Interoperability, Learning Analytics, Learning Analytics Systems Design, Privacy, Standardisation

1. INTRODUCTION

Standards' key role in encouraging innovation, improving markets and creating competitive opportunities are strong selling points when explaining the benefits of interfacing with standard bodies (Copras, 2007a, Blind, 2013). In Europe, the launch of the new version of the European Interoperability Framework (EC, 2017c) has connected standards work even stronger to laudable activities like designing and delivering "seamless European public services", "promoting interoperability", and contributing to the "establishment of the Digital Single Market" (EC, 2017d). With the importance assigned to standards one would expect that a lot of resources and manpower were allocated to standards-making. This is not always the case. Many potential standards experts experience barriers to participation, e.g., lack of time, travel budgets, and other resources (Blind, 2006); lack of support from their employers (Blind, 2013), distrust in the process (Hoel, 2014a, 2014b), etc. Lack of participation, however, is only part of the problem, as we do not fully know what contributes to the quality of a standard (Hollins & Hoel, 2010; Sherif, Jakobs, & Egyedi, 2007), and how standards are related to innovation (Blind, 2013).

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This paper focuses on a particular challenge of the standards-setting process, namely how interaction between the research and the standardisation communities could be facilitated in order to solicit necessary requirements and ideas for design. This challenge is not new. In 2004 - 2007 the European Commission funded the COPRAS (Co-Operation Platform for Research and Standards) project with the objective to improve the interface between research and standards. The project, run by the major standardisation organisations in Europe (CEN, CENELEC, ETSI, W3C, and The Open Group) found that research projects do not start thinking about standardisation until they are in the final stages of their activities, and then they discover they do not have sufficient resources and time to pass their output through standardisation. On the other side, it was found that the standards bodies do not have mechanisms for addressing the output of research projects (Brusse, 2005). One of the outputs of the COPRAS project was suggestions for guidelines how Information Society Technology (IST) research project should interface with ICT standards organisations, explaining the benefits of standards and standardisation (Copras, 2007a).

The COPRAS research had an organisational perspective, exploring how research and standardisation could work better together through identifying possibilities for cooperation. This paper, on the other side, is written from the perspective of a standards group, with the focus on processes for enhancing quality of the standardisation work by seeking contributions from research and searching for means to make them an active part of design in standard-setting in particular domain. This study adds to the body of knowledge on the interface between research and standardisation in other domains, e.g., see Blind and Gauch's study (2009) of technology transfer in nanotechnology.

Let us first briefly introduce the standards project used as a case in this study before we explain the methods used to explore where new understanding of interaction between research and standardisation is needed in this domain. The project is under the auspices of the sub-committee 36 of the Joint Technical Committee 1 of ISO/IEC (SC36), which in Working Group 8 is developing standards for learning analytics interoperability (LAI). Learning analytics (LA) is a new domain of applications and practices driven by the easy access to data provided by mobile devices and an increasing number of sensors. The aim is to achieve actionable insights from data derived from the full spectrum of learning and teaching activities. By sourcing analytics with data from both within and outside of formal institutional settings, LA has the potential to boost system integration in learning, education and training (LET), bringing both institutions and vendors together. LAI standards are needed to make sure that data can be integrated from different sources and used in a consistent, safe and purposeful way by different systems and stakeholders.

LA is an emerging field with few solutions in full-scale production. LA is part of a dynamic development of Big Data and so-called smart learning environments. Hoel & Mason (forthcoming) have observed that the more these environments use educational big data and technologies that could be classified as smart, the less is to be found in terms of relevant standards or even conceptualisations of standardisation challenges. This gives an incitement to study the relationship between research and standardisation in this field; and it gives standards experts a need to interface extensively with research to gather requirements for their standards work that is inherently anticipatory of nature (Umapathy, Purao, & Bagby, 2011).

The guiding questions for this study are derived from participant concern of being able to develop a standard that not only represents the consensus of the national bodies taking part in the project, but also represents state-of-the-art in research:

- How can a high quality and research-based draft specification be developed within the current formal and informal rules of an ISO standards group?
- What are the areas of concern that need further research in order to come up with suggestions for improvement of the standardisation process in the LET domain?

The paper is organised as follows: First, in section 2, we will establish a backdrop on which the embedded case study (Yin, 2009) in section 4 will be projected. The backdrop will establish the context and challenges for the domain, raising questions related to how to optimise the standards development process by interfacing with academic research and the users of standards. In section 3 a model of standards-setting is described. The model is used in the foreground study in section 4 to show how challenges are met in a particular project. In section 5 this projected case is analysed from the perspective of the highly structured and formalised process defined in the ISO directives, triangulating the data included in the foreground and background studies (Yin, 2009, p. 116). In section 6 research gaps are identified, and section 7 summarises the study and outlines ideas for further work.

In this study, standardisation is unpacked through analysing data made available through one of the authors' yearlong participation in European and international standards groups and other open data sources. The particular set of events chosen for this study falls under what Stake (2008) describes as an instrumental case study designed mainly to provide insight into an issue: "The case is of secondary interest, it plays a supportive role, and it facilitates our understanding of something else" (Stake, 2008, p.123). This *something else* is the aim to identify knowledge gaps and challenges that need to be addressed to allow high quality development of anticipatory standards. The case is from standardisation in the domain of learning technologies; however, the results of this study will also have implications for other domains. The case study approach allows us to deal with a full variety of evidence - documents, artefacts (e.g., specifications), interviews, and observations - beyond what might be available in a conventional historical study (Yin, 2009). Table 1 gives an overview of units of analysis, focus and data used in this study.

2. BACKDROP: ICT STANDARDISATION FOR LEARNING, EDUCATION AND TRAINING

ICT for LET (ITLET) is an emerging field of technology, and we have seen a proliferation of standards and specifications addressing different needs (Hoel, Hollins, & Pawlowski, 2010). The inherent need for stable standards is difficult to reconcile with the aim to develop state-of-the-art standards, and to combine standardisation with innovation. Standards' dynamics (Egyedi & Sherif, 2008), especially in the field of anticipatory standardisation, imply that specifications and technologies co-evolve, something that requires a well-coordinated interaction between the standards community and the R&D community.

Blind and Gauch (2009) used a simple technology transfer model to study transfer of relevant codified and tacit scientific and technological knowledge in the field of nanotechnologies. They also analysed how different types of standards, i.e., semantic, measurement and testing, interface, and compatibility standards, played specific roles in the various phases of the research and innovation process. Jakobs (2009, 2000) has focussed more closely on the work of standards groups, exploring how different stakeholder agendas, and individual factors like external forces,

Table 1. Units of analysis, study focus and data sources

Unit of analysis	Focus	Data
LET domain	Characteristics of domain	Documents, Research literature, Participant observations
Standards group	Background & cultural composition, Standardisation process	Documents, Participant observations
Editorial group	Group dynamics related to production of draft specification, Standardisation domain knowledge	Documents, Participant observations

individual major stakeholders' preferences, and the context within which working groups works impact on the final standards.

In this study, however, we will point to another factor, differences in organisational cultures, that has not been fully addressed in the previous studies on the interface between research and standardisation. We have found that for the domain we are studying, the ways the two communities organise their work are different, and that to a degree that potentially leads to conflicts. In this section, we will give examples of tensions that impact standards development. We will describe the tensions at group level (ITLET researchers taking part in standardisation), and from a system level (European ITLET standardisation).

Openness, Confidentiality and Handling of IPR

The majority of the experts engaged in ITLET standardisation have some kind of relationship to education and academic research. The academic research community is used to confidentiality and strict governance of IPR. General design ideas and opinions, however, are shared openly among researchers who know that openness fosters innovation (Bolin, 2003). In the requirement phase of standards development one does not expect to find confidential or business sensitive information and researchers therefore expect an open process with free sharing of documents. When the same researchers meet in the role of standards experts they may experience a different culture, where the norm is secrecy and uncertainty whether non-controversial information may be shared (Hoel, 2014b).

How the directives of the standards organisation influences work will be discussed in section 5. Here we note that Hoel (2014a) concluded that the document-for-profit model of formal standards bodies drives a wedge between the standards community and the research community. When the sustainability of the standardisation system rests on sale of documents open distribution of drafts for input and comments becomes a threat to the standards organisation. In the case of European ITLET standardisation, this position has had detrimental effects on the practice as a whole.

European ITLET Standardisation on Hold

Each year the European Union publishes a Rolling Plan for ICT Standardisation, viewed as “a unique bridge between EU policies and standardisation” (EC, 2017a). This plan is followed up with a work programme for European standardisation (EC, 2017b). The plan sets out e-skills and e-learning as one of the societal challenges on par with e-health and active and healthy ageing, web accessibility and accessibility, emergency communication and ecall, and e-government (EC, 2017a, p. 6). Compared with the proposed actions in the other fields, however, the challenge of e-skills and e-learning is modestly specified with only one target within e-skills: “to develop standards for a comprehensive European framework for the ICT profession”. Knowing that this work has been going on for years in European standardisation, and noting that the EU Rolling plan is aware of the needs for standards development in e-learning, this low level of activity is striking. The reason is hinted to in the rolling plan's overview of ongoing European and international standards development: “CEN/TC 353 Information and Communication Technologies for learning, education and training. *It has been dormant for a while*” (EC, 2017b, p. 64, authors' italic).

Why European information technology for LET (ITLET) standardisation in this domain is sleeping (as the EC puts it) despite extensive and documented needs for new standards has been researched for years by one of the authors of this paper (Hoel, 2014a, 2014b). In 2015, European Committee for Standardization (CEN) Technical Committee 353 was put on hold due to lack of new projects. In principle, TC 353 could be brought to life at any time if new projects should emerge. However, this does not seem to happen, and the reason for this is a situation where no ITLET anticipatory standardisation work is taking place. In 2014 the Workshop on Learning Technologies was disbanded by CEN Technical Board after years of conflict about working process and procedures with the workshop's own experts. The outputs of the Workshop were the basis for standards development in the CEN TC 353.

Between the lines, EC policy documents seem to realise that there is a discrepancy between needs and ongoing projects within ITLET standardisation. Analysis of the history of CEN activities in this field points to factors that could explain the predicament. Disagreements between the LET research community and the standards community about how design activities should be carried out may be one factor. The question is whether the work should be done in an open way according to academic norms, or in a closed way according to a strict interpretation of standardisation directives. Another factor is the relationship between anticipatory standardisation (as done in the CEN Workshop) and de jure standardisation (as done in the TC). In an emergent field as ITLET it seems that more lightweight consensus documents typically developed in a workshop setting is a precondition for more formal standards work to be initiated in a technical committee. This could be explained with the different nature of participation in a workshop and TC. In a workshop, you will find experts with an identity as researchers representing themselves and the field of interest they identify with. In a TC, on the other hand, you will find mainly standardisation bureaucrats representing the national standardisation bodies. In the case of TC 353 it has been proven that for work to progress there is a need for preparatory work in a workshop setting, unless one builds on mature documents developed by a national body or other standards groups.

3. TOWARDS AN IDEAL MODEL OF STANDARDS-SETTING

Openness and transparency are identified as important factors in the above cases. What does this mean for organising new projects, e.g., in the field of LAI, which we will focus on in our foreground case study in the next section of this paper? Clearly openness and transparency highlights the exchange between stakeholders playing different roles in standards-setting and use of the outputs, i.e., (1) the research community, (2) the standards practitioners, and (3) the users of standards. Low output and even low technical quality (Hoel & Mason, 2011) could be attributed to insufficient input from research and development, and insufficient testing and feedback from the implementers of standards. How could this process be improved?

Standardisation is a design practice. Methods and organisation of work should reflect the task at hand, and therefore it would be worthwhile to look at design science research methodology to learn more about how to design processes for knowledgeable outputs. We will conclude this background study with construction of a framework for standards-setting based on Design Science Research (DSR) methodology. The framework will be used to analyse the foreground case presented in this paper.

According to Gregor and Hevner (2013, p. 345) DSR activities are positioned in one of four quadrants in the cross-section of application domain maturity and solution maturity (Figure 1).

The definition of LA¹ most used in the field today was given in 2010 in a call for papers to the first learning analytics and knowledge (LAK) conference (Long & Siemens, 2011). The field of LA is quite immature, both in terms of conceptual understanding and access to applications. Therefore, the solution maturity is low, which positions the design activities as invention of new solutions for new problems, contributing to knowledge creation and exploration of research opportunities. While DSR contributes to both descriptive and prescriptive knowledge creation (Gregor & Hevner, 2013, p. 344), the main objective of standardisation will always be to harness prescriptive knowledge. Action Design Research, a near-standing field to DSR, is defined by Sein, Henfridsson, Puroo, Rossi, and Lindgren (2011, p. 40) as “a research method for generating prescriptive design knowledge through building and evaluating ensemble IT artifacts in an organizational setting”. Figure 2 is an adaptation of Sein et al.’s generic schema for IT-dominant Building of the IT artefact, Intervention in the organisation, and Evaluation (BIE) (*ibid.*, p. 42).

In this section we have analysed the LET standardisation practice with regard to interaction between standards practitioners, academic researchers, and users of standards. The model in Figure 2 assumes that a project initiated in a standards group actively seeks input from research, tests the

Figure 1. Design science research knowledge contribution framework (adapted from Gregor & Hevner, 2013)

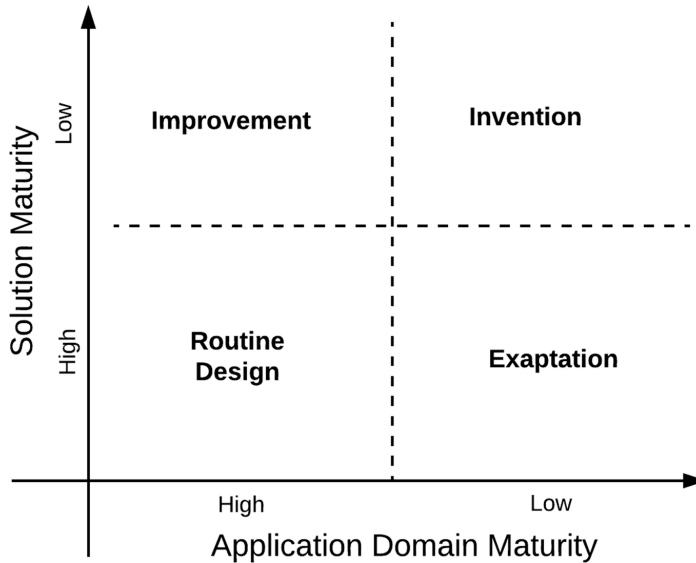
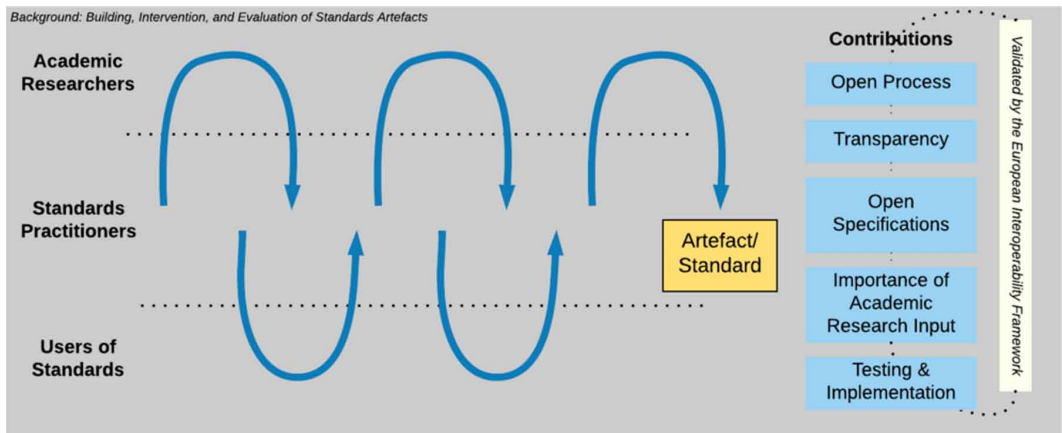


Figure 2. An ideal model of standards-setting coming out of the background research contribution (adaptation of Sein et al., 2011)



developed draft concepts and design ideas with the implementers community through several iterations, before finally agreeing to go for a final design, e.g., setting a standard.

The output of the BIE process is a contribution to the knowledge base. In Figure 2 we have included the output from the background research, i.e., the importance of academic input, openness and transparency, and open standards for testing and implementation in the adoption community. These contributions, we would claim, are supported by general policy recommendations in the newly published revision of the European Interoperability Framework (EC, 2017c). (This is further elaborated in the Discussion section of this paper.)

Superimposing the DSR process model on standardisation as done in the model in Figure 2 gives us a new lens to analyse anticipatory standards projects, as the one to be presented in the next section. However, if this model were to be proposed as a new and ideal model for standards-setting it would raise a number of questions related to how standardisation is justified and how participation in the

process is regulated. The scope of this research is merely to explore how standards-setting in a particular domain can take place when the field of knowledge is emergent and the knowledge development is in the Invention quadrant of knowledge contribution model described in Figure 1.

4. FOREGROUND: LAUNCHING AN ISO PROJECT ON LA PRIVACY AND DATA PROTECTION POLICIES

In the following case study, we present the SC36 project “20748-4” with the title “Information technology – Learning, education, and training – Part 4: Privacy and data protection policies”. Formally, this project developing a technical specification was established end of 2017. However, the project has been prepared in SC36 WG8 for more than one year as a natural offshoot of a multipart standard project on LAI. Though several meetings editors had prepared a lengthy draft that was submitted as a base document for the new work item proposal.

The following is a participatory observation account of how the lead editor of 20748-4 has experienced preparing the first draft of this part of the multipart standard.

Preliminaries

The project on privacy and data protection policies originates from the reference model of LAI (ISO/IEC TR 20748-1, 2016). The model identifies six main processes of LA, i.e., selection of learning activity, data collection, storing and processing of data, analysis, visualisation, and feedback actions. In developing this model, it became clear that each and every process had issues related to privacy and data protection. Participants in the Part 1 project (20748-1) had struggled to make sure these issues were represented in the model, as privacy had not yet surfaced as an important issue related to LA in some constituencies, and in some standards-setting consortia privacy was beyond the scope of LA systems (Hoel & Chen, 2016). By identifying privacy and data protection policies as a cross-cutting concern affecting all LA processes a consensus formed in WG8 on the need for a separate part on privacy for LA.

When the drafting work of the new part started in 2015 it became clear that one was specifying a moving target. In Europe, the EU General Data Protection Regulation was passed 14 April 2016 after more than four years of negotiations, to become active 25 May 2018 (European Commission, 2016). Also, in Asia, privacy was discussed. Japan’s update of their privacy laws took effect in mid-2017 (Lovells, 2017). An analysis of the privacy frameworks of OECD, APEC, and EU showed that there was a lot of common ground in how privacy was conceptualised (Hoel, Griffiths, & Chen, 2017). However, privacy is also a contextual concept; when putting a data collection scenario to the test of contextual integrity² (Nissenbaum, 2014) the responses of Korean stakeholders and Norwegian stakeholders may differ considerably. The former may value the benefits for the group and go along with collection as long as there is no breach of confidentiality; while the latter may value the active consent of the individual and block collection until an affirmative action is registered. The new standard has an international reach, which means an ambition to reconcile very different expectations. In WG8 some participants expect an implementable specification that ensures privacy and data protection through technical means. Others may think such a solution would narrow the scope too much and expect a specification that also addresses the organisational and political levels of interoperability (EC, 2017c). While requirements for the one or the other solution are gathered LAI practices are formed and reflected upon in research. As an example, in supporting LA implementations UK Jisc has limited the scope of consent as a justification for data collection based on research by Cormack (2016a, 2016b). Jisc now stresses “a more dynamic idea of consent: consent as an organic, ongoing and actively managed choice, and not simply a one-off compliance box to tick and file away” (Cormack, 2017).

In summary, the setting up of a new project proved that the task was both complex and dynamic. Just keeping up to date with the new development in the field would be a challenge in a standardisation setting.

Standards Committee Context

International standardisation is done according to directives regulating how to establish projects, develop drafts, building consensus, etc. Formal standardisation on national, regional and international level tend to follow similar rules as found in the ISO directives (ISO/IEC, 2016). Technical work is done in technical committees or working groups. Quality assurance and publishing is done by the standard body's management organisation, which is represented in the standards group by a secretary that makes sure the document centric process is followed by carefully archiving written records of progression of work.

Technical work should be done according to the directives, both in spirit and letter; however, sometimes the two are not easily consolidated. Standards experts want to find solutions to wicked technical problems; the standards bureaucracy wants adherence to rules. For example, if appointment by a national body is necessary to take a seat at a working group (WG) table, one cannot just invite a domain expert out of the blue because of possible valuable input. Or, maybe there are ways to combine innovative specification with strict formality?

Working Group Context

WG8, the working group in question, is the latest WG to be established in SC36, with participation from a wide range of countries, e.g., Australia, Canada, China, France, Japan, Korea, Norway, and UK. Traditionally, editorial roles have been allocated between participants with representativeness in mind, even if the number of active editors has not always matched the nominal number. For the new project, editors from Norway, Canada, Korea and Japan were approved (joined by a second Korean editor at a later stage).

Drafting Process

The key to a good drafting process is a well-defined scope (Hoel & Mason, 2012; 2011). The proposed scope of 20748-4 is to specify attributes and requirements for privacy and data protection with the purpose to inform design of LA systems development and LA practices. In delivering on this scope, it is a challenge to solicit requirements and other input, knowing that formal standardisation of this type does have a major problem in engaging with stakeholders that walk the talk (Hoel, 2013).

Another challenge is related to the drafting and consensus process itself. The process is document centric, with emphasis on version tracking and storing in a dedicated repository. Once the document is circulated as a working draft at the preparatory stage, experience from participation in SC36 working groups shows that it is very difficult to suggest restructuring of the text or adding new perspectives. When formal commenting is initiated, – with each national body entering comments into a spreadsheet, detailing the issue related to specific text fragments, and suggesting replacement text –, the drafting changes mode and takes the form of wordsmithing. Therefore, it is essential to present a draft that is as coherent and finished as possible, before it is being discussed in the working group (and even in the editorial group when it consists of several persons). In some projects, this challenge is addressed by initiating a study period, which could end up with ideas for a draft text. However, in the case of 20748-4 the editorial group was supposed to develop the first working draft from scratch.

Standards Drafting as Part of Research

Even though there was a formal call for contributions, the lead editor of 20748-4 knew that the necessary input solicitation and testing of ideas had to take place outside the standardisation process as such. With the European debacle of the CEN working group fresh in mind (see section 2), it was clear that all activities involving sharing ideas and documents, inviting comments and inputs, etc., had to be balanced against the formal statues of ISO. In practical terms that meant keeping a paper trail, feeding the document registry and organise announced meetings.

Within the research community there is a growing interest in privacy issues related to LA due to the fear that ethics and privacy might pose a *show-stopper* to large-scale implementation (Griffiths et al., 2016). In 2016 the Journal of Learning analytics published a special issue on ethics and privacy in LA. A number of workshops on the issue were organised as part of academic conferences. These academic contributions were valuable input to the 20748-4 project, and research papers that discussed and tested ideas and perspectives were contributed as experts' contributions and filed in the ISO document store. In addition were WG8 meetings co-located with academic conferences and meetings; and national experts that later would have formal roles in the standard-setting group were engaged to discuss privacy and data protection issues at workshops. Overall, the editors of this project have felt that the research community is more than willing to share their work and comment on issues on privacy and data protection for LA.

Consensus Process

Without knowing the final result of the project under study, we can only report on the processes that we have observed so far. By establishing conduits between a research community with an ongoing conversation about issues of ethics and privacy for LA, and the standards community we have created an influx of viewpoints and perspectives that also is reflected in the draft project document. When co-editors step up to representing national positions we will see how draft text will be evaluated against different conceptions that could take the document in different directions.

The normative basis for privacy varies considerably among the experts taking part in this work, and one would expect that this will play a role in further development of the project. Figure 3 describes balancing interest data controllers will do collecting data for LA, depending on legislative regimen (Hoel & Chen, 2017).

In education there are both legitimate interests of the institution to collect data (without asking for consent) and an ethical obligation of the educator to see the individual as self-asserting person (with the right to consent). Where one would put the emphasis could depend on how the culture value the individual versus the collective as described in Figure 4.

In addition to different normative perspectives a potential conflict may arise from different expectations to what a technical specification should encompass. Should it be limited to a technical system view, or should also organisational and policy guidelines be included?

5. ATTEMPTING INNOVATION WHILE ADHERING TO THE RULES

Projecting the 20748-4 case onto the idealised model of standards-setting coming out of our background research (Figure 2), we see that there is only a partial fit. The interaction between academic researchers and the standard group participants was established in the project; however, the interaction with the users of standards seems to be missing. One might say that user perspectives were communicated through workshops organised as part of academic conferences. But there is no systematic testing of

Figure 3. Balancing of interests, asking for consent to process personal data. (Hoel & Chen, 2017)

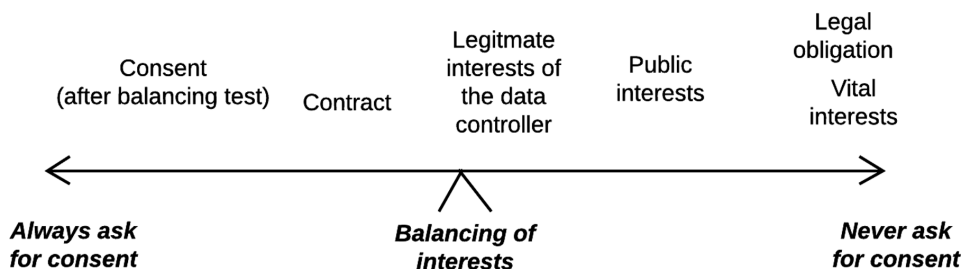
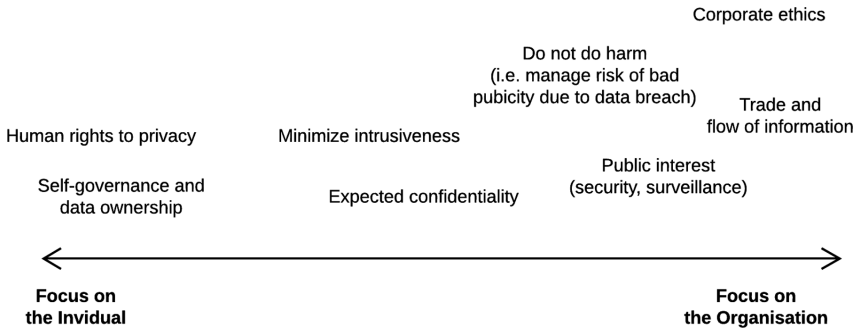


Figure 4. Normative basis for privacy policies (Hoel & Chen, 2017)

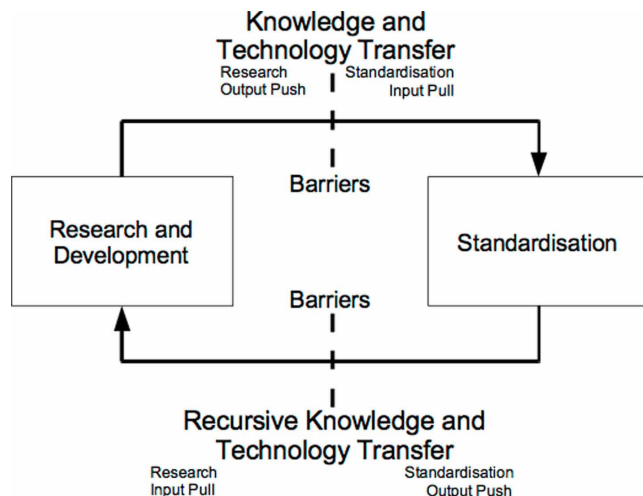


design concepts that are part of the 20748-4 project. However, this is a weakness that is inherent in anticipatory standardisation, where there is no clearly defined need when projects are initiated, and where the stakeholders are busy inventing new technologies, with no time for applying standards to level the playing field (Baskin, Krechmer, & Sherif, 1998; Jakobs, 2003; Umapathy, Puro, & Bagby, 2011). How the technical report on privacy and data protection policies for LAI will be received by vendors and educational stakeholders will only be known after publication. However, it is clear from the start that standards of this nature need to go through several development cycles to be able to serve its purpose.

Another observation comparing the 20748-4 case with the model in Figure 2 is that, in practice, there is an overlap between the roles of academic researchers and standards practitioners. In Action Design Research, teams are built where researchers work together with practitioners to design and test artefacts. In research on how Research and Development (R&D) interact with standardisation one has focused on how the different institutional contexts interact, and which barriers there are for effective knowledge and technology transfer (Figure 5) (Interest, 2007).

In the case we have reported, the role as researcher and the role as standards practitioner are often maintained by the same person. However, the acting out of the particular role is heavily influenced by the setting. In SC36, some participants fill roles as professors at national universities, and when observed in their own cultural context they act, as expected, very strongly and vociferously. In the

Figure 5. The relation between research and standardisation (Source: Interest, 2007, p.4)



setting of an international standards meeting, however, many of the same persons are hardly uttering a word and are very reluctant to expose their obvious mastery of the subjects in question. In order to establish the necessary basis for any design to take place, this pattern of acting out established roles needs to be broken. The work culture and directives of the formal standards organisation serve, as we have shown, as a considerable barrier against taking on multiple roles, switching between representing one's country or a stakeholder group, and entering a more open brainstorming and creative role. Therefore, in standards-making of the type described in this paper, there is a need to establish a repertoire of instruments to be used to soften the barriers against crossing role barriers.

What instruments do standards experts have in their toolbox to increase the knowledge base, on which anticipatory specification work builds? Are the rules intended to protect intellectual property and the standardisation organisation's business interest barriers to knowledge exchange?

In the case of sub-committees like SC36, the influence of the central ISO Technical Management Board (TMB) is mostly felt when projects are marked red because the deadlines are exceeded. How information is exchanged and the experts communicate are not interfered with from ISO TMB, providing they find a paper trail and the committee as such is not under special observation because of mismanagement or conflicts. If the experts want to do expansive knowledge seeking and exchange, not much could prevent them from doing so. The barriers are mostly cultural. Formalities are invoked only if there are disagreements, as long as the minimum level ISO document management process is followed.

It shall be noted, however, that the flexibility is quickly diminished as soon as the document is moved beyond the preparatory stage. In Table 1 we have summarised some instruments that are available to enhance knowledge and technology transfer in anticipatory standardisation and listed who could act at different stages of the standardisation process. The table is constructed by contrasting the provisions in the ISO directives with observations made in the context of SC36 work. Table 2 provides a summary of settings.

Standardisation is a carefully staged process, where the window of opportunity for new and alternative perspectives closes early. Standardisation as an activity is as much about consensus-making as about design. Of course, without any design, there is nothing to consent about. But one will be surprised how easy it is for a consensus process to 'dumb down' a technical proposition. As the 20748-4 case study showed, it is critical to get the preparatory stage right, as one does not get a new chance to bring in new content and perspectives when the committee stage is entered.

6. DISCUSSION – IDENTIFYING RESEARCH GAPS

Standardisation work typically involves conceptual, technical, and political activities that together are focused on achieving consensus among a group of stakeholders. The outcome – a standard – is essentially just a document that represents a stable reference point and sometimes includes detailed technical specifications. How this document is viewed, however, both by the stakeholders and the standard-makers may differ considerably (Ecke et al., 2008). In some countries, standards are seen as vehicles for execution of national or regional government policies. China may here serve as a case in point. While in other countries more driven by market economy, like in Europe and USA, standards are mainly recommendations that is up to the market to embrace. We would therefore claim that to understand the process and outcome of a particular standardisation process, one need to understand the national policy context of the national experts taking part in the project. This is an area where little research is done till now.

Standardisation is also a design activity that has much in common with innovation processes, both in the technical, organisational and political fields. In this paper we have pointed to the importance of relating to methods and approached from the academic research field, where for example openness and transparency play important roles in promoting innovation.

Table 2. Summary of settings that could be used as border crossing instruments in design of anticipatory standards

Stage (as described in ISO Directives)	Design-setting Actor	Instruments to improve design input & testing
Preliminary stage (→ proposing new work item)	Standards Committee (SC) Research Community End-Users	SC should avoid multipart standards projects to ensure new work item (NWI) proposal procedures with proposals for justifications and scope. Research should acknowledge standardisation as knowledge creation activity and plan for interaction through targeted input. End-user requirements should be solicited through Action Design Research projects.
Proposal stage (→ new work item)	National Standards Bodies (NSB) Standards WG	More rigorous examination of NWI justifications and scope. Selection of editor(s) based on technical qualifications, as well as relationship to research and stakeholder groups. Active planning of drafting process (allowing co-location with academic research events).
Preparatory stage (→ working draft)	Research Editors WG	Organise and coordinate research events and encourage publishing of workshop papers based on standard projects. Organise academic fringe events that pickup themes of active standards projects.
Committee stage (→ committee draft)	SC	Strict enforcement of deadlines; cancellation of dubious projects rather than resuscitation.
Enquiry stage (→ enquiry draft)	NSB	In doubt, NSBs should vote no (instead of abstaining) to projects they don't see the value of. Ballot commenting should be used to either improve or block standards (no automatic sanctioning because "standards are inherently good").
Approval stage (→ final draft international standard)	NSB WG / SC	At this stage it is the vote of the NSBs that matters, however, WG/SC should start planning supplementary documents supporting implementation.
Publication stage (→ international standard)	NSB	NSBs should have an implementation strategy that solicits feedback from end-users that are fed into the revision loops.

Interestingly, when the European Commission in 2017 published a new and updated version of the European Interoperability Framework (EIF) these principles got a prominent role (EC, 2017c). In the new version openness is an underlying principle that is defined in terms of a preference for open data (Recommendation 2), open source (Rec. 3), and open specifications (Rec. 4). The new version of EIF also underlines the principle of transparency. In the EIF context, transparency refers to enabling visibility ("allowing other public administrations, citizens and businesses to view and understand administrative rules, processes, data, services and decision-making"); ensuring availability of interfaces with internal information systems; and securing the right to the protection of personal data. Under which conditions in a standardisation setting will innovation thrive, and what roles do the academic research principles like openness and transparency play for the process of standards-making and quality of specifications? This is another under-researched field we have identified in this paper.

Standardisation processes are also about group dynamics, often in a multi-cultural setting. It is important to understand how particular groups deal with the different processes of standards-making, described in Fomin, Keil, and Lyytinen (2003) as Design, Sense-making, and Negotiation. Hoel and

Pawlowski (2011) expanded on that model and constructed the new concept of Key Knowledge Sharing Point focusing on the intersection of Key Knowledge, Key Sharing Point, and Key Timing (Figure 6).

Key Knowledge Sharing Points are described as transition points moving from one sub-process to another. At these points one should question if key knowledge is shared with relevant actors. Interventions are embedded processes that make use of dedicated tools, e.g., conceptual modelling, study period, request for comments, etc. (Hoel & Pawlowski, 2012)

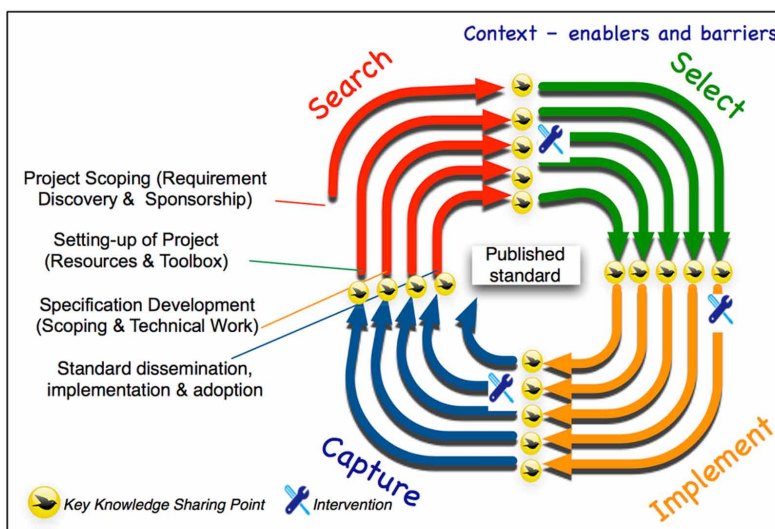
The third research gap identified in this paper is to find a better understanding of when exchange of key knowledge is necessary to support a process that both results in good design and consensus.

This paper has contributed to the understanding of how standards-making is situated in a multi-cultural, working group specific, and domain specific context. However, we would claim there is more research needed to fully understand how to design a process that will give an optimal result embarking upon a new work item in ICT standardisation for learning technologies.

7. CONCLUSION AND FURTHER WORK

This paper is part of an ongoing reflection on our own practice in the field of design for learning technologies, in particular through international standardisation. We have established a background of what we would understand as best practices related to the management of standardisation processes that would support innovation, especially in creating anticipatory standards. On this background, we have carried out a case study of an ongoing project in the field of privacy and data protection for learning analytics. Based on this case study we have reflected on the relationship between the academic research community, the standards community and the adopters of standards. The case study has contributed to identifying several gaps in current knowledge about the processes in question. However, as with any case study, we should acknowledge its limitations when it comes to generalise about standard-setting in other domains. Addressing the identified gaps in the work of SC36 and reflecting upon further research related to international standards development in the domain of learning technologies, this paper concludes with some ideas to pursue:

Figure 6. A model of Standard Development Processes and Stages (Hoel & Pawlowski, 2012)



Regarding the Multi-Cultural Aspect of International Standardisation and the Need to Understand National Policy Contexts

Current conception and organisation of work build on the idea that requirements flow from national stakeholders via national, regional and international standard bodies to the standards group. And when the work is done, the new design flows back and is welcomed by eager stakeholders who have waited for their problems to be solved. What if both perceptions are wrong? We would suggest the selection of a small number of projects being worked on by international standards groups, see who is active as experts, and then go back to their countries to see what are the national context for the standards work items. It might be that for a particular country the experts only needed the project to be accepted (not finalised), and having a role as editor to be qualified for national funding of related research. Or in another country, the might be no national interest for a new standard, only interest for experts to travel and be part of a community. These are speculative results that might come out of national case studies. It is easy to see that such data would enrich studies of internal standards group processes.

Regarding Academic Research Principles and Standardisation Procedures

It is more than a decade since the Copras project finished, identifying barriers against cooperation between research and standards, “such as confidentiality, IPR or membership of a standards organization, mapping research activities with standards work, or finding the standards and standards organizations most relevant to a project, and contacting them” (Copras, 2007b). We have in the Discussion section of this paper shown that the new EIF promotes transparency and openness in an unprecedented way related to interoperability projects. The last decade open access, open educational resources, open data, and open research have become the focus of most research communities around the world. Therefore, we would suggest there is scope to revisit some of the Copras project’s research questions to get an updated view on how the two communities cooperate.

Regarding Better Understanding of the Design Process

The process of drafting a standard does not usually involve many design cycles as prescribed by DSR. Therefore, the process will suffer from premature designs that are not tested and re-conceptualised before final publishing. We will suggest comparative research, exploring how standards development processes could be improved using some of the techniques from for example computer science design.

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ENDNOTES

- ¹ Learning analytics is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs.
- ² Does the appropriate information flow conform with the contextual information norms. These norms refer to the five independent parameters: data subject, sender, recipient, information type, and transmission principle.

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