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Abstract
As communications and information technology becomes ubiquitous in the delivery and management of education, the need for interoperability standards has become a high priority. Standards facilitate the description, packaging, sequencing and delivery of educational content, learning activities and learner information, to enable their sharing and reuse, and their compatibility with future technologies. As such, standards are arguably the key critical success factor for enabling technologies in elearning. Development of these standards is an iterative process, requiring testing and feedback from implementers and end users. The UK’s CETIS offers a model for educational community engagement with the emerging standards.

1: Introduction
The evolution of learning technologies has gone through many phases in recent decades, from early mainframe based systems, through CD-ROM based resources, to the current Internet explosion, which has brought web-based systems and virtual learning environments. For much of this time, little thought was given to enabling learning resources to survive the continual, rapid changes in technology. For example, many excellent learning materials are locked into CD-ROM based delivery. Additionally, sharing and repurposing of elearning resources has not been much considered, until recently. These factors have meant that much valuable content is underused. Those offering technology-supported learning sometimes waste precious time and money reinventing the digital wheel.

Other educational applications of technology suffer similarly. For instance, student records are often stored in proprietary formats, making it difficult or impossible to transfer them between different suppliers' systems.

Ultimately, teachers want to find content easily wherever it might be, and incorporate it into their courses according to their own pedagogical approach. They also wish to deliver elearning with good information support from administrative systems. Learners want to move between institutions taking their learning records with them. Under increasing pressure, they need efficient access to all the resources they require for their learning. And educational administrators wish to join the global education marketplace, and reach a widening audience of diverse learners, in the most economical ways possible. The development of international standards, which enable these requirements to be met, is, arguably, the key critical success factor for enabling technologies.

2: Interoperability standards
IEEE defines interoperability as: “The ability of two or more systems or components to exchange information and to use the information that has been exchanged” [1].

Standards are often confused with specifications. A standard is a recognized technology, format or method that has been ratified by a recognized standards body, e.g., international bodies ISO (International Standards Organisation), CEN (Comité Européen de Normalisation) or IEEE, or national bodies such as BSI (British Standards Institute).

Specifications have not been ratified by these official bodies, but can be useful in achieving de facto standardisation in the interim between identifying a need, and the relevant standard being ratified. IMS is a key developer of interoperability specifications. For instance, they developed the IMS Learning Resource Meta-data specification, which contributed to the IEEE Learning Object Metadata, which has recently become a standard.

3: Challenges
There are challenges involved in encouraging uptake of these standards and specifications, particularly in these early days of their development.

One is that implementation represents a cost for suppliers of learning technologies and resources. Enabling reuse or sharing of materials is a commercial issue for them. A user may, for instance, wish to buy a content management system. If the system is standards compliant, the user’s content will not be locked into it, and they will be free to choose a different standards compliant system in the future.

The second challenge arises from the concerns of teachers regarding control over the pedagogical delivery of learning materials. The priorities that different specifications and standards make can represent a bias towards one educational approach. Moreover, the evolving learning object economy implied by the use of standards [2], where learning resources are disaggregated and shared, equivalent to
the industrial age, which made inexpensive goods available to many, raises similar concerns, particularly in higher education.

Thirdly, there are challenges at the level of developing an e-learning resource. At a time when budgets are tight, some may see using standards as an altruistic act, which they don’t have time or money for. Others may feel that the use of specifications which are under development is unnecessarily difficult while problems are still being ironed out. Until critical mass is reached in the use of standards and specifications, and until users of standards can clearly see that they are enabling seamless sharing and reuse, encouraging their uptake is a challenge.

4: Meeting the challenges

In each of the above three areas of difficulty, potential solutions may be found in the engagement of, and cooperation within, educational communities in the development of standards.

In the case of supplier compliance, pressure applied to businesses by a significant number of customers is an effective way of ensuring that user needs are prioritised. If those customers are confused about what they need, or fail to ensure that a similar message is relayed across the board, suppliers will be understandably unable to make valid commercial decisions.

Secondly, where the concerns of teachers are an issue, it should be emphasised that the design of learning technology specifications and standards is an iterative process. Developing standards must be tested in the real world of e-learning, and the experiences and needs of implementers and end users must be fed back into the development process. Ultimately, standards should make teachers’ jobs easier, not take control of their teaching away from them.

Finally, implementing standards requires planning, time, and an understanding of what is required and why. Quick, reliable access to information about the appropriate standards and their implementation, including access to expert advice and exemplars of good practice, is vital.

5: Engaging user communities: CETIS

CETIS (Centre for Educational Technology Interoperability Standards) was set up by government funding body JISC to support and advise UK higher and further education, and to represent these communities on learning technology standards and specifications bodies.

CETIS has a small central organisation, with six special interest groups (SIGs): Accessibility; Assessment; Educational Content; Metadata; Learner Information & Enterprise; and Further Education. The SIGs are coordinated by individuals based throughout the UK, but their real value lies in the wide networks of interested parties that make up their membership, which includes learning technologists, teachers, librarians, computer programmers, etc. The SIGs run discussion forums where questions can be put to the most appropriate expert; they hold regular events, with practical demo’s of implementations, discussion of issues, and reports from standards bodies; and they fund small scale tasks. The CETIS website, which received a glowing review in Technology Source, covers international news, provides definitions of terminology and acronyms, and gives open access to the results of CETIS funded work.

CETIS as a model is dependent to some extent on the structure of education in the UK. However, it has successfully used the SIG structure to build and support communities of practice, providing a basis for meeting the challenges outlined above.

6: Conclusion: Critical Success Factors

Many factors contribute to successful delivery of e-learning. However, in thinking about what is critical to successful use of enabling technologies, think first about buying a new toaster, and taking for granted that when it is plugged in, it will receive the right kind and amount of electricity- a situation brought about by standards. Now imagine taking a CD-ROM based tutorial from last year, and putting its assessment section into a newly purchased learning environment, linking it to student records and new content. This is the world that interoperability standards are taking us towards. The engagement of those involved in e-learning, at whatever level is appropriate for their work, is vital to speed the day.

References
