Standards and interoperability

Thematic synthesis report

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EdReNe

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e*Content*plus

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[1] OJ L 79, 24.3.2005, p. 1.

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Conclusions

It seems striking that many of the most successful repository initiatives – measured in terms of active users – have not heavily engaged with educational technology standards. Community based approaches would by nature tend to focus on solving user needs with already available tools – i.e. a focus on *iterative* "good enough" approaches instead of relying on implementation of specific standards. This leads to the question of whether current standardization bodies and organisations are in sync with actual user needs – a concern also raised previously by others[2]. This report attempts to take a look at standards from different user perspectives – with a broad scope for defining use cases not limited to e.g. a particular set of standards.

Important needs expressed by content users include:

- Minimize number of repositories necessary to access
- Make it easier to find quality content
- Present clear and easy-to-understand information on usage rights
- Support the development of 'sharing as a culture' being providing user friendly mechanisms for depositing and repurposing

Of these, the first bullet point clearly relates to interoperability of repositories, and indicates the importance of focusing on *repository federations*, including *metadata harvesting* and providing *central indexes* for searching for educational content.

For content suppliers stability of content standards combined with central guidance is important. Especially with the changes taking place in the content publishing industry in general, there is no doubt that establishing a solid, viable business model for digital content suppliers will have the highest priority – especially for new start-ups. And while standards can play a role in this it may be more fundamental changes to distribution/ production/ licensing/ innovative didactic design etc. that are currently in focus.

Drawing firm conclusions for repository owners and tool providers (e.g. authoring, LMS/VLE) is difficult. It does seem to be a clear trend that upcoming standards seem to aim for supporting ***existing*** user behaviour ("paving the cow paths") instead of being based on anticipated future use of digital content.
This would mean taking a lot at successful approaches from other domains – including those powering popular web tools and services.

Development strategies will to an even higher degree than currently focus on web services and APIs that can be easily tailored to specific needs dictated by the context in which digital learning resources should be authored, tagged, discovered, used, adapted and so forth. The general trend of opening up information silos will also influence both LMS/VLE and educational repositories.

The online version of this report will be updated when relevant, and supplemented by new reports and other resources relating to the topic.

[2] See for example "The way ahead" chapter in the LIFE project wiki; a number of the suggestions and pointers to future development are still valid.

Introduction

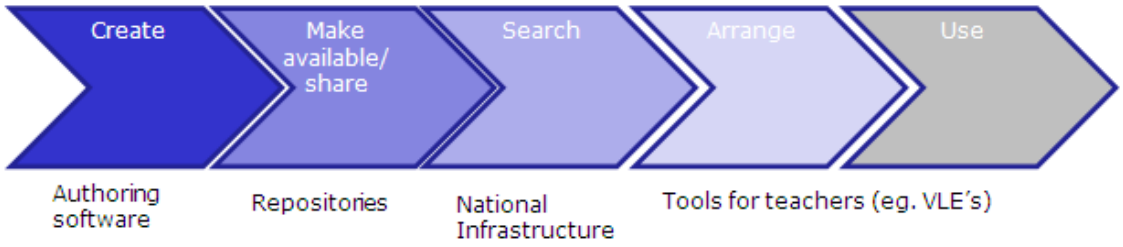
With repositories acting as a key infrastructure element for the discovery, storage, delivery, and management – and to some extent also development – of educational content, the need to have standardized ways to support these operations and functions are important.

> *"The nice thing about standards is that you have so many to choose from"*
>
> - Andrew S. Tanenbaum

The list of standards relevant to the use of technology in education seems however to be continuously expanding[3]. It is not easy to keep up with developments from a number of competing standards and specifications, and even for people working with this on a regular basis the sheer number of specifications can be overwhelming. In worst case this could lead to more effort being spent on the interoperability between different standards attempting to (at least in part) solve the same set of issues, than solving the original problems these standards were produced for.
Current efforts in the development of repository standards and software are also broad and varied, with players coming from nearly all major sectors. With such a diversity of interest an impressive number of competing standards and supporting technologies have emerged[4].

One of the strengths of the EdReNe network is the mix of different types of stakeholders represented. This allows for a broader discussion of standards not focusing e.g. solely on technical aspects. Of course the involvement of all stakeholders is necessary in order for interoperability to move forward.
The reason for (a broadly scoped set of) user stories as input for the discussion of standards is thus simple and pragmatic. As educational repositories often state their primary goal as supporting the (increased) use of digital learning resources by teachers and students, the relevant starting point for giving priority to any standard should be that it will remove one or more important barriers to achieving this goal. Not ***anticipated*** barriers by educational technology specialists, but rather what current practitioners, content developers and tool providers experience as the most important obstacles for integrating digital learning resources in (innovative) learning experiences. As in other areas, standards will only work once they are integrated in their relevant contexts to such a degree that they are invisible for the end users – when they represent the equivalent to something that you should not need to think about, something you just expect to work.

[3] See for example the Learning Technology Standards Observatory from CEN/ISSS or the JISC standards catalogue. The LTSO even states the rationale for its establishment as "widespread confusion and misunderstanding about the relationships between the relevant standards and specifications, as well as between the organisations that develop, define, profile or implement them".
[4] The large number of competing solutions was already evident in the report "Emerging and Enabling Technologies for the Design of Learning Object Repositories" published by ADL in 2002. Since then this has only escalated.



Repositories have to fit into the broader context of an educational content chain. This illustration is a (relatively simple) model of where repositories fit in – adapted from the Dutch educational content chain model used as a starting point for the generation of use cases at the 2nd EdReNe workshop on standards and interoperability.

Evaluation of whether standards are fit for purpose is not an easy task[5], and there is currently significant room for improvement both concerning quantity and quality of studies within this area. Where evaluation has been performed it has often been limited to measuring uptake and/or proving feasibility of an approach and has not gone into depth describing the reasons for e.g. a lack of use of a specific standard – for example whether they are primarily based on organizational, domain specific, technical or other reasons.

The ambition of this document is not to recommend or evaluate specific standards. Rather, it attempts to:

- summarize discussions from the two workshops focusing on standards and interoperability organized within the EdReNe network
- take a high level view on standards and interoperability from different user perspectives, and based on this identify the key issues to solve first for repositories

Likewise, it is not a technical document diving into the finer details of individual standards, but instead attempts to provide an overview of important focus points for repository owners.

[5] As discussed and noted for example in Evaluating Standards – a discussion of Perspectives, Issues and Evaluation Dimensions, Adam Cooper, JISC CETIS, April 2009

Issues prioritized at EdReNe workshops

An initial set of priorities relating to standards and interoperability was developed among network members during the first strategic seminar. These priorities have been continuously refined and added to during the project period. At this point in time it is still a relatively fragmented picture that remains.

Although numerous examples exist of use of standards, no clear evidence of exactly which mix of standards and specifications is "the better choice" can be extracted.

A cohesive, central approach with clear guidance on *necessary, manageable and stable* standards for the educational sector – in parallel with ongoing involvement of all relevant stakeholders – would seem a logical way forward for ensuring the adoption of standards and linking repositories to users. Mature examples of such strategies are however still hard to find[6].

> "Currently, there are no agreed profiles that address the needs of the learning domain, and no established practices for combining existing specifications into complete solutions. Individual organizations are creating their own solutions, and an opportunity to establish broader interoperability is being missed. There is also no way of measuring or testing the compatibility and conformance of specific solutions."
>
> *– quote from IMS Learning Object Discovery and Exchange*

Mapping the landscape of standards was an issue given priority by network members. Despite numerous projects, reports, and extensive work within this area it still seems difficult to answer first questions like:

- Which standards help provide which functional requirements of educators/learners - including examples of interesting practice which have actually impacted the learning experience
- What is the current use and uptake of standards – and which (context specific) barriers and drivers has led to this

A number of initiatives[7] - both international and national - are aimed at continuously providing such information about standards and this is outside the scope of this report.

With the risk of focusing too much on the individual pieces of the puzzle, the following areas were instead given priority during the EdReNe workshops on standards and interoperability:

- Metadata standards:
    - LOM profiles
    - Automatic metadata generation

[6] An example of a national level approach in its first phase of implementation is Bectas suggested "Ecosystem for discovery, delivery and exchange of digital learning resources" (strategy and implementation roadmap online). Correlating all new major initiatives to the continuously refining model of an educational content value chain in the Netherlands constitutes a similar approach.

[7] A few examples: *International*: CEN/ISS WS-LT Learning Technology Standards Observatory. *National*: Information Standards Board for education, skills and children's services (England); Nasjonalt Sekretariat for Standardisering af Læringsteknologi (Norway); EduStandaard (Netherlands).

    - Strategies for vocabularies and curriculum mapping
- Standardized content packages
- Repository integration with Learning Management Systems / Virtual Learning Environments
- Authentication / Identity management

These are broad topics on their own and have been the topic of a number of presentations and group discussions during workshops[8]. Focus has been on use cases and not the technicalities and details of individual standards. During group discussions it has become increasingly clear that most of these issues are to a high degree closely linked indicating the need for a centrally coordinated approach. At the same time it is however striking that some of the most successful repositories – in terms of a thriving community of actively contributing users – are the result of bottom up initiatives often paying little or no attention to the educational standards discussed. This is one of the reasons for attempting first to present standards from different user perspectives, followed by insights on the individual topics mentioned above.

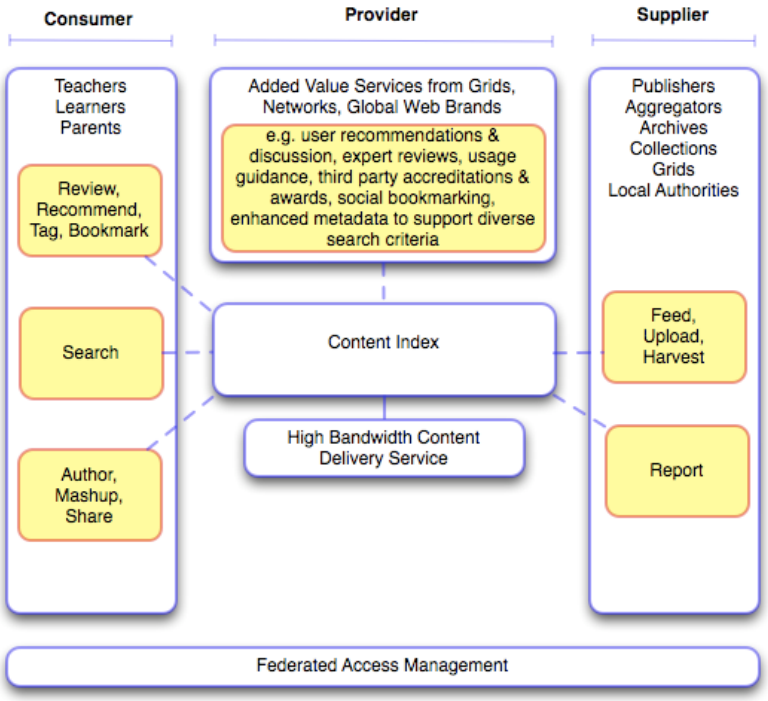
[8] Find links to proceedings and all presentations from the 1st and 2nd workshop at the EdReNe website.

Standards and interoperability from a user perspective

The intention and goal of most educational technology standards and specifications is to help in providing better education through the use of technology – by removing specific barriers and problems for users.

As an attempt to explore whether the current set of specifications and standards match what is perceived as important to support the desired use of technology in education, a set of broadly scoped use cases were drafted at one of the EdReNe workshops. Workshop participants were grouped according to their expertise as teachers, content producers, tool providers, repository owners and or policy makers/implementers. Of course the relatively limited number of workshop participants do not adequately represent the true views of these user groups but the approach serves to illustrate the importance of involving all stakeholders when attempting to implement technology standards – both to make sure that attention is given to the most pressing problems and that any chosen standard will accommodate needs from all relevant user groups.

Quite a number of the use cases are not at first glance directly related to repositories. But as they represent a (dramatically simplified) version of the context(s) where repositories exist they should help in understanding whether other problems are in fact important to solve first, in order to have repositories



A high level grouping of stakeholders into consumers, providers and suppliers and the related functions centered around a central content index - illustration from "Promoting an ecosystem that enables the discovery, delivery and sharing of digital learning resources" (Becta, June 2009).

exert their often anticipated but still seldom played role in helping educators and students to provide better learning. This again highlights the importance of having an informed dialogue between all relevant stakeholders.
The collected user stories can be found in the Appendix, whereas the following paragraphs attempt to present important points made from different user perspectives.

Although the goals for educational repositories differ, they almost inadvertently include the intention to:

- reduce the time taken for users to find educational quality resources
- improve sharing and reuse of resources
- reduce the inappropriate use of rights protected resources

Matching these goals with enablers and barriers as seen from different user perspectives should reveal important focus areas – including relevant interoperability issues to deal with first in an iterative approach.

Content consumers

For most educational repositories focus has been on teachers as the primary target group falling into the category of content consumers. In tune with the increased focus on collaborative learning paradigms and the importance of creating your own products as an important part of the learning process, more focus on students as a user group is also becoming evident.

When considering the sample use cases (in the Appendix) from these two stakeholder groups the following barriers stand out as being important:

- A mix of licensing terms, digital rights management solutions and copyright law making much of current practice illegal and desired innovations impractical or even impossible [student/teacher]
- Ensuring a social component when using technology from home – interaction between learners [student]
- Better possibilities of “personal tracking” – for example note taking and bookmarking in digital content [student] as well as better tools for teachers to evaluate students’ interaction with content [teacher]
- Standards perceived as a barrier to innovative learning designs [teachers]
- (Synchronous) communication across school (i.e. LMS) boundaries [teacher]
- Easy to use authoring tools that can be used by teacher to create content mash-ups (which will also allow tracking etc.) [teacher]
- Better content interoperability between different learning platforms [teachers/schools]

A number of these scenarios are currently not mainstream practice but represent the advanced and technically skilled teacher. To supplement these user stories, the table on the following page also adds a number of drivers and blockers influencing the sharing and reuse of digital learning resources by teachers, which help identify a broader picture of teachers.

Examples of	Drivers	Blockers
Technical	• Availability of: Intranets, VLEs and other shared space; email, broadband access; online discussion groups and email lists • Availability of: repositories populated by teachers; complete schemes of work • DLRs are often more up-to-date than text books • Huge quantity of freely available resources online • New technologies act as an affordance for sharing; increasingly easy to share and upload; ease in which some resources can be linked; easier to locate software that allows repurposing	• Need more effective search engine ranking mechanisms • Too many repositories – where to start? • Good content is not visible enough • Difficult to repurpose many resources • Often difficult to tell whether the resource is current • Many resources are too large: should be smaller than a lesson • Repositories are too difficult to use • Poor resource quality and relevance • Above school-level technological constraints • Poor learning platform design • Lack of learning design tools for non-traditional pedagogies of learning
Organisational (from school to government)	• Potential to reduce costs • Schools promoting an environment of innovation • Increases school efficiency • Availability of support services • Financial incentive might promote sharing • Promotes sharing and collaboration between schools • Saves paper • Information is available from schools who have already trialled learning platforms	• Few pro-active IT support mechanisms • Insufficient or inadequate teacher training; how to use IT, not how to make good learning with it; little year-group specific advice; no follow-up to promote integration into teaching practices • Finding resources may be left to support staff; too few support staff to assist with creation and sharing • Perceived competition with other local schools • Managers unsure how to deal with inappropriate use • Lack of training can lead to ineffective use of platforms • Sharing as a culture' is less well developed than is 'taking as a culture'
Process (impacting the process by which teachers work)	• Teachers acknowledge that ICT can have a positive influence on students; improves quality of teaching; allows to personalise learning • Teachers increasingly influenced by students; can see how students work outside of school • Furthers personal knowledge and employability • Can reduce time and increase productivity • Teachers want access to useful datasets • Teachers like to incorporate e-assessments and quizzes • Special needs teachers have the mindset to alter and adapt from the 'norm'	• Takes time to create materials relevant to a range of abilities; requires technical skills beyond teacher competence • Many teachers prefer to create their own rather than re-purpose; can take more time to repurpose than create - most will only make minor edits; lack of an extensive culture of re-purposing • Teachers unsure how to search for and manage so much information • Low teacher and student technical ability • Confusion as to whether teacher owns the copyright • Teachers feel their resources are only relevant to their specific class context • Few teachers use learning platforms
Emotional (caused by teacher feelings and emotions)	• Teachers often curious to view other teachers' work • The importance of a sense of ownership	• Lack of a sense of mastery • Sharing is an informal, human action and should be recognized as such • Teachers need a sense of ownership over resources • Teachers are very picky about resources that aren't their own • Teachers unsure whether to trust another's work • Valid concern that work will be 'stolen' by others • Fear of looking stupid in a very public forum

The table shows examples of drivers and blockers to teachers using digital learning resources (DLRs) created by others when lesson planning and teaching.
Adapted from a study commissioned by Becta in 2007 and summarized in a presentation by Will Ellis at 2nd EdReNe strategic seminar.

It is evident that many of the important barriers to be removed in order to achieve the goal of increased use of digital learning resources are not necessarily linked to standards and interoperability issues – but still include important, long standing focus areas such as providing necessary technical infrastructure, guidance on copyright issues and teacher training.

Many of the standards related issues initially seem to be mostly providing messages to authoring tool and VLE/LMS providers on inadequacies and/or differences in implementation of current content packaging standards. Another interpretation could be that there is a lack of clear guidance and possibilities of conformance testing concerning content packaging.

Directly targeting the core functionalities of repositories are:

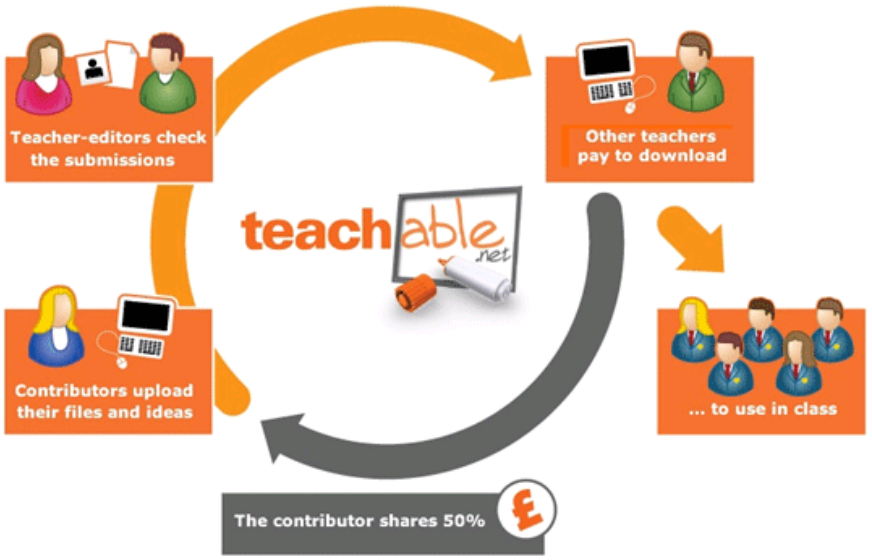
- Minimize number of repositories necessary to access
- Make it easier to find quality content
- Present clear and easy-to-understand information on usage rights
- Support the development of 'sharing as a culture' being providing user friendly mechanisms for depositing and repurposing

Of these, the first bullet point clearly relates to interoperability of repositories, and indicates the importance of focusing on *repository federations*, including *metadata harvesting* and providing *central indexes* for searching for educational content. This indeed seems to be in accordance with what is one of the main focus areas of repository members of the EdReNe network.

Content suppliers

Educational content suppliers fall into quite diverse categories. At first glance, one would think the incentives for commercial and non-commercial content suppliers would often differ considerably.
As public content suppliers often outsource the actual content development to commercial publishers and/or have teachers as consultants they would however to a great extent share the same barriers and incentives to adopting content standards as commercial suppliers. As the sample use cases in the appendix indicate, quite a number of important issues are shared between commercial/non-commercial content suppliers. Barriers are suggested to include:

- A discrepancy between innovative design and compliance to standards as these are often not flexible enough or based on assumptions that are no longer valid [commercial/non-commercial]
- Better tools allowing easy and affordable production of standards compliant content [commercial/non-commercial]
- Lack of a clear market incentive to produce standardized content - e.g. there seems to be no correlation between quality and compliance to standards [commercial]
- If you are already successfully selling your content, then why bother about standards (if buyers say it works, suppliers won't change) [commercial/non-commercial]



Even though interoperability can play a role in establishing viable business models for (new) digital content suppliers much more fundamental issues often take priority – especially with the current lack of success stories, and limited knowledge/demand for standard compliant content from end users ('they know how to handle Powerpoints, pdf and Word documents'). The illustration shows the approach presented by teachable.net.

- Many existing successful content authoring tools have been/are based on proprietary formats (e.g. Microsoft Office, Adobe Acrobat, Flash). Formats backed by investment from major private companies have previously proven to be more stable [commercial]
- Differences between implementation of content standards in different learning platforms means it is often still necessary to build, test and develop for each of them [commercial/non-commercial]

It is interesting to note that a number of these point echoes the concerns of teachers taking the role of content suppliers, as seen in the preceding section.

The user stories collected do not enter the discussion of providing relevant metadata, exposing it in common repositories, allowing user tagging, evaluations, rights issues concerning digital learning resources etc. A number of issues have been raised during group discussions in connection with this though; most of them are however not related to standards but more strategic issues.

One recurring theme equivalent to the comments made on costs of producing standards compliant content is the costs of producing (descriptive) metadata. If comparing commercial repositories with public repositories there seems to be a more limited number of descriptive metadata elements – or more focus on need-to-have than nice-to-have.

With the dramatic changes taking place in the content publishing industry in general, there is also no doubt that establishing a solid, viable business model for digital content suppliers will have the highest priority – especially for new start-ups. And while standards can play a role in this it may be more fundamental changes to distribution/ production/ licensing/ innovative didactic design etc. that are currently in focus.

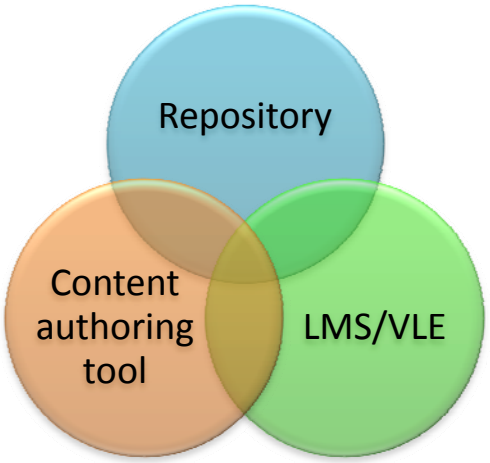
At the same time the many new players on the field of content suppliers increases the need for both the suppliers themselves and end users to have better search possibilities. In the long run semantic web technologies might help in this but in the short to medium term approaches to building central repositories/indexes seems more feasible. A first priority would thus still be on common, stable and manageable metadata formats.

Tool and service providers

The broad and vaguely defined user category of "tool and service providers" is meant to include at least repository owners, LMS/VLE vendors and providers of authoring tools.
The two latter of these categories present the tools most needed to interface seamlessly with educational repositories.

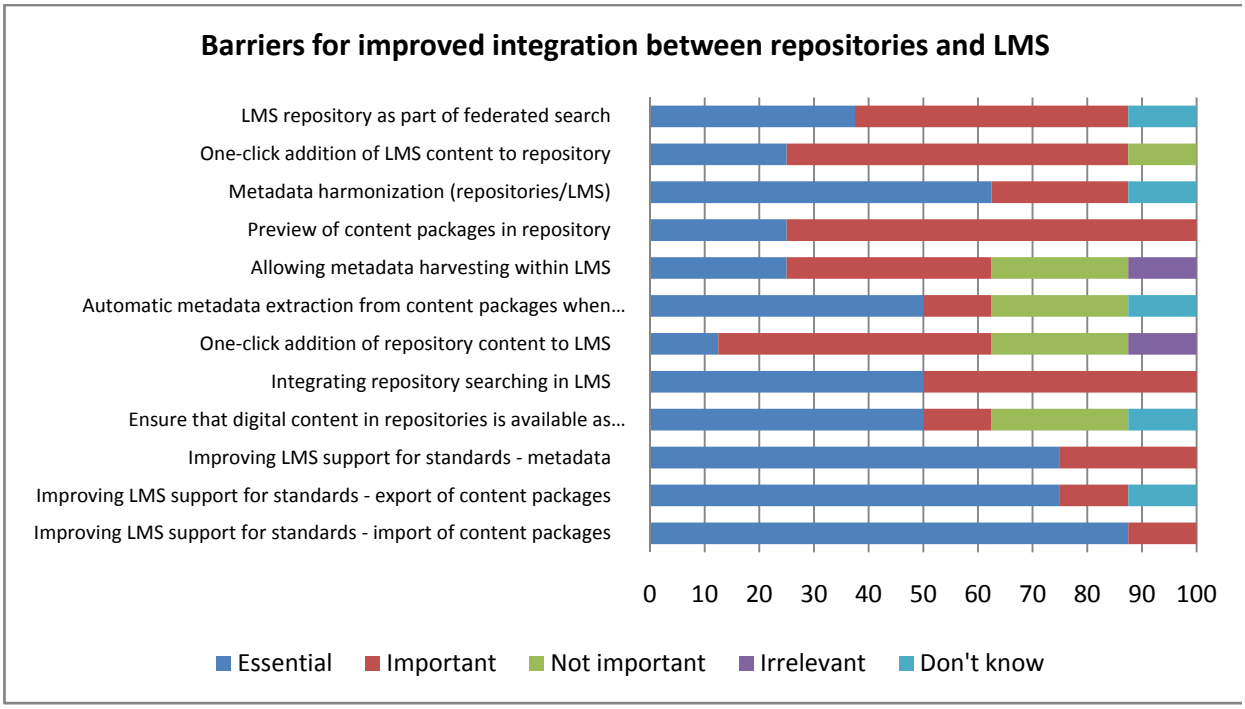
Such tight integration would support a number of the desired scenarios presented in the user stories, including:

- Depositing to (one or more) repositories from a VLE with a single click; providing much of the relevant descriptive metadata from the VLE context.
- Depositing to (one or more) repositories from an authoring tool with a single click; providing much of the relevant descriptive metadata from templates/profile data of the content supplier.
- Searching repositories from within a VLE – and adding relevant resources with a single click.
- Using best-of-breed content authoring tools within a VLE



Interfacing with authoring tools and LMS/VLE systems is on the agenda of many educational repositories. Providing seamless interoperability between these systems could potentially provide dramatically increased ease of use both concerning depositing, searching and metadata tagging. Somehow there seems to be a tendency for all three types of tools/services to include elements of the functionality present in the others – attempting to build 'all-in-one' solutions instead of integrating with best-of-breed tools. Many other relevant interfaces of course exist – including e.g. authentication services and the web at large.

As mentioned in the user stories, relevant standards (an abundance of them) exist for all of these scenarios. Examples of such tight integrations is however still rather rare. Instead it is in fact often the case that elements of functionality from the other tool categories are built into attempts of providing 'all-in-one' solutions. Examples of repositories built on the basis of authoring tools, VLEs with both built-in repositories and authoring tools, and repositories including authoring tools and e.g. communication tools are abundant. A common trait for these 'all-eggs-in-a-single-basket' solutions is a tendency to establish closed information silos with little intention or need of interfacing with the 'outside world'.



It is noteworthy that the barriers rated as the most important by EdReNe network members concerning repository/LMS integration to a very high degree reflects the differences in implementation (or lack) of support for content and metadata standards in current LMS solutions.

At the same time, the move towards a more open structure embracing the web as such to a much higher degree than is currently the case in most VLEs, point to other integration activities building more upon general web technologies and specifications instead of specifications tailored to educational needs.

The successful integration between an abundance of 'general purpose' web services evidenced by easy-to-use mash-up tools is something well worth considering as a model for tools and services within the educational sector.

Political decision makers

As discussed in preceding sections many of the interoperability issues call for a cohesive, central strategy in order to point out a clear direction and provide some of the necessary incentives for stakeholders.

Approaches for repository strategies will be discussed in further detail in an upcoming EdReNe thematic report on this issue, but some initial reflections on issues relating to the political level follow here.

The reasons for policy makers to have interest in standardization and interoperability are often on a higher level, including examples such as:

- An intention to increase efficiency in the educational system to get more value for money.
    - Central government often lacks the central control on the spending of public funds by educational institutions as the prevailing philosophy is to give users choice. Consequently the opportunity for efficiency gains is limited. As regards adoption of standards this make clearer sense at the highest levels of government so national strategies for interoperability can best be developed at the national level. At local government level it is not as easy to achieve national coordination and standards may only be applied at this lower regional level. If choice and control is given down to the lower level there is even less likelihood of standardisation. Part of the problem here is end users may not appreciate the need for interoperability and would not want to be engaged in discussions on technical standards.
    - There can be agendas that conflict with open and flexible interconnected systems at a local level e.g. standards and technology adoption often falls to corporate IT support in local authorities. Their experience could be limited to common proprietary products and their overriding priority is ease of management and security.
    - Users and decision makers at all levels are ultimately dependent on the technical expertise of others. It can be common that the technical experts particularly in the world of evolving open standards are more interested in working with problems than developing solutions - and as a result specifications evolve continuously with poor adoption by commercial providers who prefer to develop their own proprietary solutions which would be more stable or at least under their control.
    - Many of the challenges that governments face do not have short term solutions yet governments need to demonstrate short term success to those they represent. This is a barrier to investing in change that only has long term investment. This challenge can be tackled by providing evidence that action and investment now will bring benefit in the future but this evidence is difficult to obtain - e.g. evidence that technology has measurable educational impact.

- A need to provide evidence of the effect of investments in technology in education, to motivate the investments.
    - One step could be a discussion of different types of evidence and how to monitor the effect of investments. This is basically a question of quality and quantity – what can be measured and how[9].
    - The use of open standards makes it possible to have real competition during procurement processes.

To obtain the improvements we need in education, policy makers need to win the support and understanding of the key stakeholders. One example of where the message could be improved is use of language such as "increasing efficiency" and "saving money". This language gives out false and threatening messages. A focus on "less wasted time" and "improved quality" instead would be better in promoting the adoption of technology and interoperability standards and specifications.

Decision makers have two key levers which can be pulled in a number ways. The first is influence over the user/purchaser to ensure they are better informed about the services and products they are buying. Awareness raising and training have a role in this and the way funding is provided is also key[10]. The other lever is influence over suppliers from agreements and standards development and adoption strategies.

Currently many governments and education agencies are acting to promote the use of open standards and open source solutions. Users tend to be drawn towards commercially provided products and services that often use proprietary standards as part of a traditional business model. While a number of examples show that commercial providers previously have been reluctant to use open standards where this could interfere with their dominance on the market, there has recently been a growth in suppliers with business models based on open source and open standards – in part due to political pressure.

[9] One example is that in connection with Glow – the Scottish national intranet - the investment is monitored on a yearly basis, http://www.ltscotland.org.uk/glowscotland/

[10] In the UK Becta provides purchasing frameworks which encourage purchasers to procurement from suppliers that meet certain standards.

Repository services and integration with other systems

In addition to the user centred approach taken in the preceding sections, this section presents a summary of the discussions around the topics given priority by EdReNe networks members in categories more resembling the way standards are normally grouped by educational technology experts. It highlights some of the basic functionalities provided by a repository as well as some of the important interfaces to other systems.

In tune with the need to focus much more on user needs, it is useful to approach the implementation of standards in the context of service oriented architecture. The concept of services draws the attention towards user needs; the systems and systems design are not the primary focus of attention.

The following sections will focus on the issues given the highest priority by EdReNe members for discussion at workshops:

- Metadata standards – including establishing IEEE LOM profiles; federated search and harvesting; automatic metadata generation; strategies for vocabularies and curriculum mapping
- Authentication / Identity management
- Standardized content packages – with a focus on repository integration with Learning Management Systems / Virtual Learning Environments

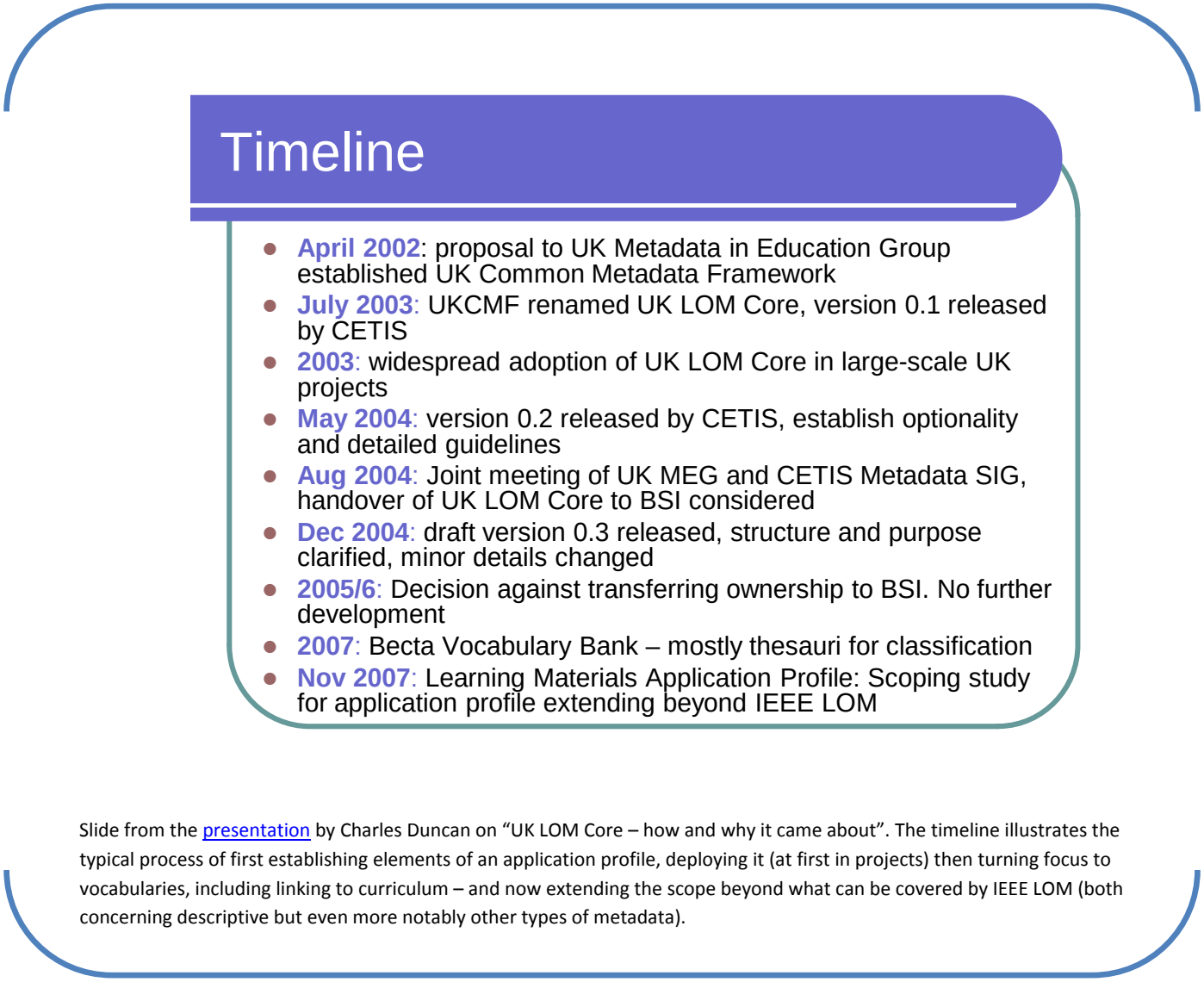
As discussed previously these issues are far from including all relevant interoperability issues related to the discovery, delivery and sharing of digital learning resources but instead represent the current focus of many educational repositories. A brief section on possible future trends will initiate the discussion on a few of the topics not covered by the EdReNe network so far.

Metadata

Metadata and vocabularies are fundamental components in the authoritative descriptions of learning resources. Descriptive metadata in educational repositories almost invariably conform to either Dublin Core or IEEE LOM. As in other areas establishing vocabularies is however still a concern – especially if resources have to cross borders, or even just different segments of the educational sector. One specific aspect is linking resources to the curriculum to provide search mechanisms based on this.

The traditional perception of metadata as an aid to resource discovery, definitely still holds true. But as our access to information becomes more abundant, the importance of metadata as an aid to *discriminate* also becomes more pronounced.

Metadata can support discrimination by providing additional information, often about relationships that helps clear a path to discovery. If you search in a repository for a resource on grammar the discovery function of metadata might tell you that there are 10 resources on the topic. However, it might also tell you the number of other grammar resources that each author/content supplier has produced which will allow you to discriminate and select a resource by someone who is clearly devoted to producing grammar resources. Yet another use of metadata is for recommendation. While discovery and discrimination are based on activities and choices dictated by the seeker, recommendation systems push information based



Slide from the presentation by Charles Duncan on "UK LOM Core – how and why it came about". The timeline illustrates the typical process of first establishing elements of an application profile, deploying it (at first in projects) then turning focus to vocabularies, including linking to curriculum – and now extending the scope beyond what can be covered by IEEE LOM (both concerning descriptive but even more notably other types of metadata).

on the activities and choices of others. As a result they can lead to the discovery of resources the seeker might never have otherwise considered. The repository could for example point out that users downloading a specific grammar resource also downloaded resources on mobile dictionaries, or on podcasting, or ... The point about recommendation systems is that the results are often unanticipated[11].

Considerations along these lines means that the current focus for educational repositories is shifting away from descriptive metadata produced at the time of depositing/publishing a resource. Current focus is much upon best practice for producing social, usage and attention metadata. To this end focus is on existing best practice outside the educational sector instead of developing new standards.

[11] A vast number of prominent examples from outside the educational sector exist, for example book recommendations at Amazon, iTunes Genius, YouTube related videos etc.

Metadata harvesting and federated search

OAI-PMH is the preferred protocol used for metadata harvesting between educational repositories. Whereas (subject based) repositories in higher education often will have a global aim, the context for harvesting metadata in K-12 repositories more often seems to be national; reasons for this being primarily language and cultural barriers[12].

The generality of OAI-PMH is an advantage as it allows it to be used for creating a central index solution relevant for educators based on fairly different metadata sources (e.g. cultural heritage sector, public and commercial content supplier repositories).

The use of federated search schemes not based on metadata harvesting seems to be diminishing, with the most cited reasons for this including inconsistent search results for end users and technically complex implementation models.

Automatic metadata generation

Most educational repositories have had a strong focus on providing (high quality) descriptive metadata at the time of publishing – balancing the number of desired metadata elements with resources and expertise available to tagging resources.

Better solutions are needed and simplifying the process of metadata creation by automatic tools has high priority among network members. The reasons for the focus on (semi-) automatic tools include the trivial fact that i) metadata creation by professional indexers is (too) expensive and ii) the quality of metadata produced by authors at the time of deposit is often not sufficient to provide good search and discrimination possibilities. Many repositories currently do some sort of validation/moderation of teacher produced metadata for exactly this reason.

The content of a number of "simple" metadata elements are already automatically generated in many repositories as part of the depositing process – most notably: file type/size; user details; dates and other elements directly available from either uploaded files or the user currently logged in/tagging/depositing a resource.

The biggest potential to be realized in the near future is probably evolving around title, keywords and description elements. As these are not education specific, other content producing sectors are well worth watching for relevant tools and services[13].

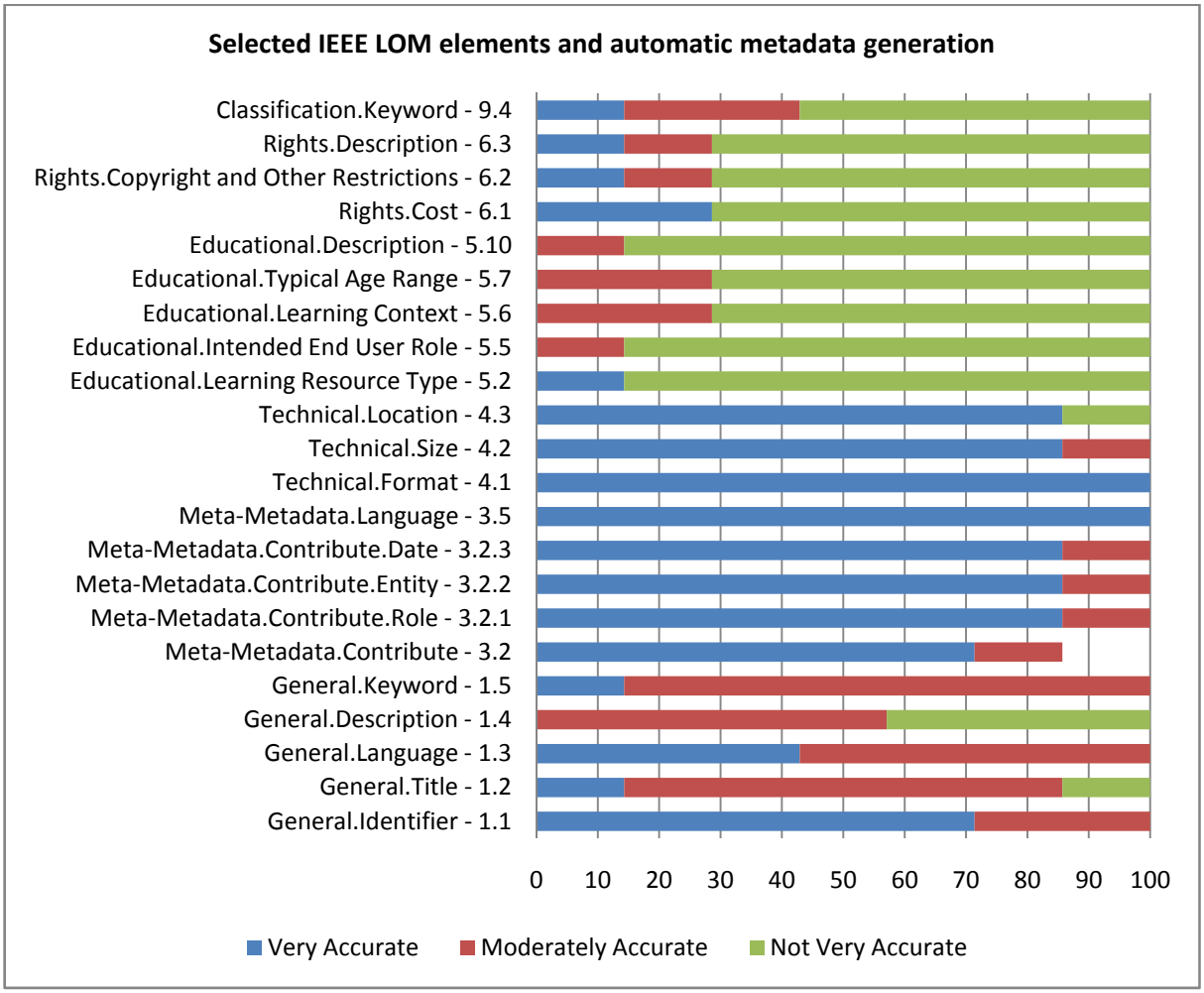
To help improve the quality and simplify the process work is currently undertaken on for example:

- filling in more default element values by use of profiles/templates
- (semi-) automatic metadata creation based on a range of different tools[14]
- include possibilities for user tagging
- integration of descriptive metadata generation into authoring tools
- context aware metadata creation (e.g. when depositing directly from VLE)

[12] Experiences on what resources "travel well" have been gathered in e.g. the LRE for Schools project.

[13] Examples include DocumentCloud and OpenCalais both rooted in the news publishing industry.

[14] For a recent discussion on available tools and the different types of metadata they can help produce see the synthesis report from the JISC funded project on "Automatic Metadata Generation: Use Case Identification and Tools/Services Prioritisation"



The perception among participants at the first EdReNe workshop on standards and interoperability is that quite many of the mandatory/recommended elements included in the "typical LOM application profile" can be generated automatically with reasonable confidence. The diagram indicates the percentages where automatic metadata would be considered very, moderately or not very accurate. It is worth noting that especially education specific elements are not judged to be easily generated automatically. This is in contrast with the perception that exactly these elements are among the most important in discovering and discriminating content for educators.

Authentication and authorization

Once a digital learning resource has been found and an initial evaluation based on the available metadata has taken place the next step is providing access to the actual content.
In an ideal system a user shouldn't need to remember multiple usernames and passwords to access a mix of content services that are either freely available, needs registration or require a subscription (personal, provided by their school or otherwise). Access should be as straightforward and efficient as if the resources were freely accessible.
To this end some sort of federated access management will be necessary to improve the user experience from the point of discovery to the point of use.

Establishing an (national) infrastructure supporting this type of access is important to allow users the possibility of mixing different types of content within e.g. their VLE. Different approaches have been taken to this end but a major trend among members of EdReNe seems to be moving towards SAML 2.0 based strategies. Establishing a link to (or simply using) authentication solutions provided for accessing public online services in general – part of many current eGovernment initiatives – is another issue common across a number of countries. In most cases a specific solution for the educational sector is the current focus though.

Links to different approaches on national identity management for the educational sector, presented at 2nd EdReNe workshop on standards and interoperability
Norway: Presentation – Introductory video for schools (in Norwegian) and English summary
Netherlands: Presentation – Introductory video
Denmark: Presentation

The uptake and success is however much less dependent upon the details of the technical solution chosen than i) political decisions - such as mandatory use of the authentication solution for important services and ii) cooperation with content and service provider to ensure broad uptake.

Content exchange

The use of content standards is still not wide spread in Europe in general and in addition there seems to be a lack of thorough analysis and evaluation as to why this is the case. One recent survey of a (relatively small) number of European content producers was done in the ASPECT project[15], confirming the notion that SCORM content packages seems to be the most widely supported both in terms of authoring tools, support by Learning Management systems and the number of available content packages.

[15] See aspect.eun.org and more specifically "Best Practice Report for Content Use" http://aspect.eun.org/sites/default/files/docs/ASPECT_D3p1.pdf

The overall impression is however still that content is produced with an emphasis on 'first-use' quality rather than reuse as also discussed for Higher Education in the iCOPER project[16]

Another explanation as to why content packaging has not been adopted could be a mismatch with current learning paradigms. The focus on content, leaving the learning activity dimensions less explored, might be inspired by learning theories holding that learning is more about transmission of information than of knowledge construction. And even though the European pedagogical landscape is very complex, the 'constructivist' position has undoubtedly been gaining momentum the last years, something not currently reflected in standardization work.

There is no lack of standards and specifications aiming at solving interoperability across learning platforms. Perhaps due to lack of centrally provided guidance, a range of different implementations and varying degrees of support of content standards in learning platforms means that it is often still necessary to develop and test content for several platforms as a content supplier. This in turn has now spurred *national* initiatives like the Becta lead "Achieving content interoperability across learning platforms" which will aim to foster closer collaboration between platform providers and content suppliers to realize the potential benefits of using the same content package application profile, and at the same time provide implementation guidance and rationale documentation.
This type of cooperation is also evident in the partners backing the Common Cartridge specification. With a more rigorous conformance testing suite and both major publishers and learning platforms vendors being actively engaged this could help uptake. Focus seems primarily to be within higher education at the moment though. An important aspect of such work will be the stability of any content standard minimizing the risk of investment for content suppliers. As this is at odds with a changing pedagogical landscape it could be wise to focus solely on content packaging and leave the heavy focus on e.g. sequencing and tracking strategies.

The most widespread content standards in the educational sector are still by far the same as on the web in general – including pdf, Microsoft Office documents, Flash and anything that can be displayed in the major Internet browsers without too much hassle.

When looking at the user stories from content consumers it may also very well be that exactly such a pragmatic approach, combined with the possibility to *legally* remix from a multitude of different content sources would be a major leap forward, even if not fulfilling all of the *anticipated* needs of interoperability.

There is also an inherent discrepancy in the fact that educational technology standards are often still relatively complex to incorporate in a content production process and at the same time there is a clear trend of many new and smaller players on the educational content market – including a vast amount of user generated content.

[16] See iCOPER web site and specifically "Deliverable 4.1: Content-Development Methodologies Survey"

Upcoming standards and trends

It does seem to be a clear trend that upcoming standards seems to aim for supporting ***existing*** user behaviour ("paving the cow paths") instead of being based on anticipated future use of digital content.

This would mean taking a lot at successful approaches from other domains – including those powering popular web tools and services.

Development strategies will to an even higher degree than currently focus on web services and APIs that can be easily tailored to specific needs dictated by the context in which digital learning resources should be authored, tagged, discovered, used, adapted and so forth. The general trend of opening up information silos will also influence both LMS/VLE and educational repositories.

Many repositories are considering involving users to a much higher degree – especially in providing tagging and other types of usage and attention metadata. The illustration shows a couple of examples from EdReNe network members lektion.se and klascement.net.
It is noteworthy that these popular repositories are bottom-up initiatives which have a teacher community as their foundation. Likewise it could be worth mentioning that they do not include standard content packages and still have plenty of loyal users downloading and commenting upon the usefulness of Creative Commons licensed pdf, Powerpoint, flash and other common file formats, with the important inherent quality of allowing them to remix and adapt content, using familiar tools.

Presumably this will mean that general web standards and specifications will come much more into play than education specific ones. The intention of this section is not to go into any detail on this but instead give a few indications of this already evolving rapidly.

Recommendation systems

As discussed in the section on metadata – and illustrated with a couple of examples on the preceding page – much attention is given to more actively using any kind of usage and attention metadata, tagging, evaluations etc. as new means to help discriminate quality resources. Something which is completely in tune with some of the most popular ranking mechanisms on large sites like YouTube and flickr, which provide little descriptive metadata but still produce fairly good search mechanisms.

Depositing

Getting content into educational repositories is undoubtedly one of the greater barriers. One of many reasons behind this is the time spent doing a single deposit, which in itself acts as a barrier to potential depositors.

An example of a new take on repository depositing is SWORD – Simple Web-service Offering Repository Deposit – which is a lightweight profile of the Atom Publishing Protocol aimed at making exactly this part of the contribution process easier. A number of examples and demonstrations are already available from the SWORD advocacy page[17]. Use cases for SWORD include single-click deposit from desktop/online tool, simultaneous deposit to multiple repositories, automated deposit.

It is worth mentioning that also in this case, quite a few competing specifications and standards are at play, such as SPI , APP, PENS, SRU Update, OAI-ORE,... The simplicity and ***general uptake*** of the Atom publishing protocol being the main discerning characteristic of SWORD.

Widgets

When looking upon educational repositories as providing services to end users, this also implies that the core functionalities of repositories should be available *when and where* users need them. In other words you should be able to search and deposit from e.g. your personal web page, your school intranet/LMS – or in short provide these services as part of any mash-up.

One approach to this could be through the use of widgets allowing e.g. depositing, searching.

A similar approach is the possibility to allow discovery of learning resources through open search, allowing the addition of repositories to most major browsers' list of search engines.

[17] These currently include a number of demonstrators such as a Microsoft Office plugin, clients allowing multideposits and interfaces to several repositories (open source and commercial)

Semantic technologies and new moves from major search engines

The increasing uptake by major sites and accompanying usefulness to the average web user of micro formats, RDFa, eRDF is a trend worth watching as it might also impact possibilities for searching for educational materials[18].

The number of major sites implementing microformats and RDFa is rapidly increasing[19], and quite a number of major sites like Google, Yahoo!, Facebook, Twitter, Flickr, and LinkedIn have already implemented this to varying degrees and in different forms. An indicator of the current extent is that according to Yahoo! SearchMonkey, there are 1,450,000,000 web pages that publish hCard and 36,200,000 pages marked up with hCalendar.
Another relatively recent example is the simple license attaching for images picked up by Google Image search, now allowing educators to also find Creative Commons licensed images via this service[20].

Example showing the Swedish broker service "Spindeln" implemented as a Google gadget (widget), allowing search from a personalized home page.

Once search engines parse structured data as RDFa, it gives further incentive to publish more data, thereby possibly completing a good circle for search enhancement. If these trends continue widespread publication and use of structured data on the Internet will become commonplace in the next few years.

Another existing hint for increased search engine visibility relevant to repositories is the use of Sitemaps – perhaps especially after Google dropped support for OAI-PMH.

[18] See for example a discussion on this in the ccLearn paperEnhanced search for educational resources – a perspective and a prototype from ccLearn

[19] The support for microdata in HTML5 is another relevant pieze in the puzzle, but it ads to the general trend of small, simple formats allowing computers/search engines etc. to extract much more relevant structured information from - and users to interact with - web sites in novel ways.

[20] See e.g. http://www.youtube.com/watch?v=quyhasVn2jw

Appendix – User stories

This appendix holds a number of use cases and accompanying notes produced during the second EdReNe workshop on standards and interoperability. Workshop participants were grouped according to their background to produce the most realistic set of use cases – although many of them will of course still be biased. The primary aim was thus to illustrate the importance of a perspective including all relevant stakeholders when trying to develop or adopt any standard.

Content consumers

Student

Student story 1: working with mixed types of content

As part of a project I have to create a presentation or report in which I use resources and materials that have been created or put together by my teacher, as well as resources that I have found myself on the internet or in the library.

Comments

A typical student task involves creating a presentation or report based on the resources and materials provided by the teacher, either as on-line learning resources, hand-outs or as part of textbooks. The student is expected to make a presentation having researched and digested a range of sources of information including that presented by the teacher, as well as information from other students and from external sources on closed, subscription-based repositories and the open internet. The underlying pedagogy is constructivist, in that re-articulating ideas both is learning and demonstrates learning.

The goal of the process is to ensure that the report reflects the learning process, and thus it involves processing information provided by the teacher as part of the learning scenario as well as locating and processing relevant additional material.

This scenario can be characterized as mainstream practice.

The prerequisites of the scenario are the ability of the student

- to disaggregate content, both content packaged according to existing standards and specifications such as SCORM or Common Cartridge as well as content found as part of other resources
- to digitize contents from textbooks, for instance,

One of the main prerequisites, however, is not purely technical, although there may be a number of technical solutions designed to impede the disaggregation. It is very much a question of:

- Digital Rights and Digital Rights Management

Current status

In most cases it is possible, but not always legal, to take out parts of learning resources found on the web – and possible to take copies of paper-based resources by scanning them or by simply taking an image with a digital camera or mobile phone. Some specifications and formats such as SCORM attempt to make the process difficult because they do not easily allow disaggregation of packaged content. Pulling out a flash-

based animation that illustrates a central point for use in a presentation may be too difficult to have any relevance.

Barriers and possible incentives
The main reason for not allowing disaggregation is probably rights-related. Content providers and developers need to acknowledge that in order for their resources to be used effectively in learning they need to allow 'disaggregation' within the context of the classroom and learning-related activities. Once they do that, and once licensing schemes allow such a use of resources and assets, standards such as SCORM can be changed to more easily allow disaggregation.

The main incentive in this process is probably economic: if the market, i.e. schools and municipalities buying educational resources, demand an extended use of the resources, the providers will no doubt be willing to change their licensing conditions.

Important next steps / focus areas
It is important to have copyright discussions and develop new models of copyrights for educational materials and new terms of licence.

Student story 2: the social context of VLEs

When I work in our VLE/LMS, I want to be able to see what my classmates and my teachers are doing, when they are online, what interaction is taking place between them etc. Working online is much more fun if you feel that you are part of a community.

Comments
Social interaction is an important part of school life. When working in a VLE or an LMS, students want to able to see themselves as taking part in 'social' interaction. The technical platform should enable them to view relevant aspects of their interactions with other learners, their teachers, and repositories.

By having access to interaction-related information in the VLE/LMS the student may benefit from reflection on the behaviour, history and relationships that his/her peers and teachers engage in.

Current status
In some systems it is possible to get access to interaction-related information. And seen from the point of the user it is mainstream practice to use automated gathering of information concerning usage history to give some picture of the social interaction.

Student story 3: keeping track

I want to be able to keep track of the materials and exercises I have already worked with, so that I can return to the system and resume work where I left off.

Comments
Continuity and progression are vital concepts for learning – in particular in the case of individualized learning. When working with traditional books, students use bookmarks to remember where they stopped last time. We need the same functionality in connection with digital learning resources.

Bookmarking is not the only thing tracking can be used for. Extended tracking may also enable the student to review his or her progression through the material and thus allow him/her to reflect on the learning experience.

This is mainstream practice in learning contexts. It is only implemented in specifically designed environments based on SCORM packaged materials.

Current status
Most content suppliers rarely use tracking, so it is not usually an option that students have.

Barriers and possible incentives:
Tracking is difficult to implement, mainly because standards are complex and tools in many cases inadequate.

Suppliers are probably – in some situations – sacrificing tracking and other standards-related aspects in order to allow innovative learning design. Content producers want flexibility to assemble content and create new innovative kinds of interaction and presentation. Most tools and specifications are designed to handle standard presentations and standard exercise types, and thus do not support or allow innovative learning design.

It is a trade-off between innovative learning design solutions and flexibility and ease of use of tools and standards. Innovative learning design requires flexibility, but standards are often perceived as unnecessary barriers to that. In some cases it may be a problem of quality versus quantity: quality in the sense of tailored, innovative learning design is expensive, whereas a standards-based 'template' will make production of resources cheaper.

Important next steps / focus areas
We need a discussion of innovative learning models and standards in order to create awareness on behalf of the standards organizations of quality issues, and the issues of user control rather than application control.

Student story 4: history of work

I want to be able to access and work with online materials in such a way that the teacher will be able to see what I have done - and that I have done what I should, and I can see what I have done in order to reflect on learning.

Comments
Extended tracking or 'history' information may also enable the student to review his or her progression through the material and thus allow him/her to reflect on the learning experience. This is mainstream practice in learning contexts. It is only implemented in specifically designed environments based on SCORM packaged materials.

Current status
Most content providers rarely use tracking, so it is not usually an option that teachers and students have.

Barriers and possible incentives:
Tracking is difficult to implement, mainly because standards are complex and tools in many cases inadequate.

Important next steps / focus areas
We need a discussion of the relationship between pedagogical needs and technological standards and solutions – not just the standards relating to packaging, tracking and sequencing, but all relevant ways of working in class, in groups or individually. What sort of support do teachers and learners need – and what sort of support can technology provide in response to those needs?

Teacher

Teacher story 1: collaborative projects

I want to set up a project based on synchronous communication between the students of my class and the students of a class in another part of the country. The students will be collecting, sharing and discussing information on local issues.

Comments
Teachers should be able to set up collaborative projects with classes in other schools based on synchronous communication. Such projects may have several benefits. For one thing students are motivated by the interaction with other students of the same age group; for another, the students may get access to information that would otherwise be impossible to include in the teaching/learning process.

Current status:
Scenarios of this kind are currently more wishful thinking than mainstream practice.

Barriers and possible incentive:
It is possible to set up collaborative spaces, though not typically within the framework of VLEs or LMS systems. The technical and organizational requirements of integrating synchronous on-line communication into traditional classroom teaching are prohibitive for most teachers as few if any VLEs or LMSs support synchronous communication across schools.

Important next steps / focus areas
With the IMS tools interoperability initiative this may in time become possible. It is important to raise awareness among platform providers regarding the interoperability framework and other standards that allow systems to interact. We need an open, cross-system framework of communicating and collaborating.

Teacher story 2: collating content

I would like to be able to collect and organize materials from any source and structure a series of lessons based on any combination of my own materials and materials from other sources – the web, text books, resources from commercial publishers etc.

I want to be able to use the materials for classroom-based teaching, group activities and home-based individual learning. So the student should be able to access the materials from home/anywhere.

Current status:
Currently, scenarios of this kind are probably more wishful thinking than mainstream practice. The scenario involves three different sets of issues:

1) Technical issue: How do I disaggregate digital resources?
2) Technical issue: How do I make a unity out of the resources I have selected?
3) Rights issue: Is what I want to do legal?

Barriers and possible incentives:
The first barrier is no doubt technical. Disaggregating content requires technical skills. Depending on the packaging format, it may even be impossible to disaggregate a specific resource. Once you have disaggregated and collected content, you need an additional set of technical skills in order to 'package' content.

Last but not least, copyright and licensing terms may restrict the use of assets and materials.

Teacher story 3: creating on-line learning resources

I would like to be able to create and structure my own on-line learning resources where I track student progress and output evaluation result or scores. This will make it easier for me to deliver individualized learning and receive feedback on the current status of each individual student.

Current status:
Currently, scenarios of this kind are probably more wishful thinking than mainstream practice.

Barriers and possible incentives:
The main barrier is no doubt technical. Creating packaged content with tracking and scoring requires not only technical skills, but also instructional design skills. A second problem is the rights issue, unless the teacher actually creates all assets him/herself, which again will require a different set of technical skills.

Important next steps / focus areas
In order for this to be possible we need user-friendly tools, based on standards, that will make it easy to create learning resources, and VLEs/LMSs that will are capable of handling tracking and scoring information.

Teacher story 4: collaborative work spaces

I want to set up a project based on closed, common collaborative work spaces for the students of my class and the students of a class in another part of the country where they collect, share and develop information on issues of interest.

Current status:
Scenarios of this kind are currently more wishful thinking than mainstream practice.

Barriers and possible incentive:
It is possible to set up collaborative spaces, though not within the framework of VLEs or LMS systems. The technical and organizational requirements of setting up closed collaborative spaces are prohibitive for most teachers as no VLEs or LMSs currently support cross-platform/system communication.

Important next steps / focus areas
With the IMS tools interoperability initiative this may in time become possible. It is important to raise awareness among platform providers regarding the interoperability framework and other standards that allow systems to interact. We need an open, cross-system framework of communicating and collaborating.

Teacher story 5: making resources available

I want to make resources that I have produced and uploaded to the university repository available to students and other teachers so that my resources can be located by means of search engines.

Current status:
Scenarios of this kind are currently relevant only to few people, and thus wishful thinking rather than mainstream practice. But if the technical setup is in place, which means that the university has a repository that can be searched by search engines, and if the repository uses extended metadata, for instance LOM-based metadata, then it is possible to make resources available the way the scenario outlines.

Barriers and possible incentive:
It is to some extent a question of the quality of the data: metadata are very often not good enough to allow a highly targeted search. But it is also a question of the extent to which metadata reflect the way users think (mental models) – and very often the metadata do not reflect how the users think and search.

Important next steps / focus areas
We need better tools and interfaces for creating and searching educational metadata. Initiatives on national repositories and federated searches may solve parts of the problem, but we need to discuss and develop models that reflect user needs when designing repositories and international services.

Teacher story 6: exporting resources available from LMS

I want to be able to export the materials I have authored within a specific platform using the tools found in that platform, so that I can continue to develop my work, share it with other teachers or upload to another repository – or even move to another platform.

Current status:
It is a serious problem in connection with institutions that want to change from one VLE/LMS to another. In most cases, however, it is not easy to do it.

Barriers and possible incentives:
Learning platforms often use their own non-standard ways of storing information. If they support standards such as SCORM, they often have a more or less individual implementation of the standard. The result is that learning resources exported from one platform look quite different, and perhaps also lose functionality, when imported to another platform.

Important next steps / focus areas
One simple solution is to cry for more standards compliance. This, however, is what some have been doing for a number of years, without getting the problem solved, perhaps due to the complexity of the standards etc. Another solution would be to design a common export/import format specification.

A third approach might be to discuss whether a better solution consists in using 'external tools' and integrating them into platforms by means of interoperability specifications such as the IMS Tools Interoperability Framework.

Teacher story 7: integrating on-line tools and services

I want to be able to set up a learning scenario where I integrate on-line, Web 2.0 services/tools as part of the school VLE. I want the VLE to be a personalized, central point of access to all tools and services provided on the web.

Current status:
Scenarios of this kind are currently wishful thinking.

Barriers and possible incentives:
It is possible to set up collaborative spaces, though not within the framework of VLEs or LMS systems. The technical and organizational requirements of setting up closed collaborative spaces are prohibitive for most teachers as no VLEs or LMSs currently support cross-platform/system communication.

Important next steps / focus areas
With the IMS tools interoperability initiative this may in time become possible. It is important to raise awareness among platform providers regarding the interoperability framework and other standards that allow systems to interact. We need an open, cross-system framework of communicating and collaborating.

Teacher story 8: integrating elements

I want to be able to use elements from a commercial product where we have a licence. I want to put some of it into a PowerPoint presentation and upload that to our LMS in order to bring in high quality and reliable materials into my teaching.

Current status:
Scenarios of this kind are mainstream practice.

Barriers and possible incentives:
Depending on the packaging standard used it may be very difficult to integrate and reuse elements from a commercial product in one's own presentations. Apart from the technical aspect there is also a question of rights and licences.

Important next steps / focus areas
It is important to have a general discussion of the needs of the educational community as far as the use of educational resources is concerned. This involves both the technical issues of disaggregation, and the rights and copyrights issues involved.

Teacher story 9: change/control the structure of packaged content

I want to be able to take a packaged resource, unpack it and add or remove items or perhaps just change the order of the items in the package so that it suits my purposes and the needs of the particular group of students that I have.

In some cases I just want to be able to disable sequencing in a specific SCORM package to allow my students to skip certain elements of the package.

Current status:
Currently, this scenario is probably more wishful thinking than mainstream practice.

Barriers and possible incentives:
The major barrier is no doubt technical. Depending on the packaging format, it is impossible just to change the order of the content.

Teacher story 10: reuse learning scenarios

I want to be able to copy a complete learning scenario that I have developed in my LMS/VLE, so that I can easily reuse a specific content and setup with another class.

Current status:
Currently, this scenario is probably more wishful thinking than mainstream practice. It is supported by some VLEs/LMS platforms.

Barriers and possible incentives:
The major barrier is no doubt technical.

Schools/HE institutions as content users

Institution story 1: migrating resources

Our institution has decided to change our LMS so we need to be able to move all our educational resources from our old platform to the new. The resources include commercial resources as well as resources created by faculty.

Comments
Many institutions, particularly in HE, use more than one platform. Different departments of a university may use different VLEs/LMSs. Over time they may migrate from one platform to another and need to move all their resources from the old system into the new – preferably without too much work.

Current status:
Scenarios of this kind are mainstream practice.

Barriers and possible incentive:
In the absence of a common format for distributing course content, many systems have their developed own proprietary formats, thus leaving the content of the institutions tied to a particular platform. Particularly smaller or locally-developed systems typically have no means of exporting or converting content.

The need to be able to migrate from one system to another constitutes an important incentive for institutions (as customers) to demand standardization of packaging formats. Ideally content should be able to load and run on all leading LMS platforms.

Important next steps / focus areas
It is important to raise awareness among institutional customers/users that standards are one way in which they can secure their investments in digital learning resources.

Institution story 2: mixing resources

Our institution does not want to be restricted to buying learning resources from one specific content provider. We want to be able to buy the best resources and mix them in our courses.

Current status:
Scenarios of this kind are mainstream practice.

Barriers and possible incentive:
The need to be able to mix resources from different provider constitutes another important incentive for institutions (as customers) to demand standardization of packaging formats.

Important next steps / focus areas
It is important to raise awareness among institutional customers/users that standards are one way in which they can secure their investments in digital learning resources.

Content suppliers

Commercial publisher

Commercial publisher story 1: producing quality resources

I want to create high quality resources and content that all teachers and pupils use and value so that I can grow and sustain a profitable business.

Current status:
This is mainstream practice and probably what most commercial content providers see as their main objective.

Barriers and possible incentives:
Producing quality resources is on the whole a rather expensive undertaking – in particular if one is thinking of innovative resources that use technology in new and exciting ways. Incentives to address this particular barrier could be better and more flexible tools, but it could also be a question of pooling development resources and create libraries of illustrations, animations for use in learning resources.

In order to be used extensively or just regularly by teachers and pupils, quality resources also need to match national curriculum requirements as well as the teaching context of schools. Resources need to fit into the classroom not just in terms of content, but also in terms of the pedagogical and organizational context they presuppose.

Last but not least, the resources need to match the technological platforms of schools, so that teachers and pupils can actually integrate and use the resources in their daily work. In order to minimize this particular barrier, content producers need to produce resources that adhere to particular technical standards and thus can be run in most environments – at schools or from home.

Important next steps / focus areas
One important step is the discussion of quality: what is quality in educational resources? Can we agree on certain general principles, e.g. flexibility, adaptability, and openness, learner-centred. Another important discussion could focus on the relationship between existing content packaging standards, such as SCORM and Common Cartridge, and quality.

Commercial publisher story 2: standards-based products

I want to produce state-of-the-art products complying with relevant new standards for a well defined area of education, so that I can penetrate into the established market and make a long-term profit.

Current status:
This is probably wishful thinking in that most commercial content providers do not see adherence to standards as an end in itself. Few probably care much about standards as long as they can market and sell their products without doing so.

The story seems to be based on the implicit assumption that new standards equal state-of-the-art products, which again equals quality.

Barriers and possible incentives:
The main barriers to using standards are probably that the standards are complex and difficult to understand and just as difficult to use – and that there is no clear market incentive for commercial producers to adhere to standards.

The equation seen from the point of view of the commercial producer is simple: anything that adds to the costs of producing the product without giving other benefits that will make up for the added costs should be avoided. Unless using standards will lead to a bigger market share, decreased development costs, or a higher quality product, there is no commercial incentive to use standards.

If the use of standards puts restrictions on, for instance, (innovative) learning design and thus the quality of the product, even a decrease in development costs will not be a valid commercial argument in favour of standards adherence, unless of course the market looks for cheap products rather than expensive high quality products.

Important next steps / focus areas
One important step is the discussion of the relationship between existing content packaging standards, such as SCORM and Common Cartridge, and quality.

Commercial publisher story 3: simplify production and technical support

I want to simplify the production of digital learning resources and at the same time reduce support costs so that we can reduce costs, sell our products cheaper and make more money.

Current status:
This is mainstream practice and probably what most commercial content providers see as their main objective.

Barriers and possible incentives:
The lack of a common format for distributing digital course content poses a number of problems for content providers. If they want to deliver course content for LMS platforms, they often have to build, test and distribute their content specifically for each platform.

This parallel development, test and distribution require extra resources, adds to the production time and ultimately, to the costs of the product. Different versions of the same product also increase the costs of support.

Important next steps / focus areas
One important step is to convince both content providers and tool providers that it is in everyone's best interest to support the same basic standards.

General discussion of status, barriers and incentives

In England the use of standards aren't mandatory so, it doesn't matter (yet) if you don't comply. From a marketing point of view there is no incentive either, since it won't hurt your reach to the market.

Cut and paste drag and drop are the actual standards that matter for publisher. That is standards that are so obvious and aimed at visible functionality.

There is no central repository at the moment, so there isn't a real standard in England. Although the national curriculum and curriculum online has (was) been pushed.

If you already own a controlling share of the market you're not willing to change to a standard unless the government or users demands you to.

When a supplier is in a dominant position and uses a defacto standard it's hard to convince them to change.

When buyers say it works, the suppliers won't change it.

You have to make a decision: do you want to be found in a repository or not. The decision made depends on the size (or stage) of the publisher or on the national strategy (mandatory or not).

Espresso, a dominant content provider to schools, is not interested at all in standards. They sell content directly into school, and don't rely on being on every learning repository.

For content authoring systems the current standards are Microsoft Office, Adobe Acrobat and Flash (although many schools still do not have Flash player installed). All of these standards were developed without central government initiatives, and originated as proprietary standards.

Barriers to entry
A push and pull strategy is needed to get standards adopted. Central government needs to push a standard, and customers need to demand the standard off the publishers. If schools do not want to adopt standards, then they will never get adopted.

Kennisnet provides schools with the specifications they should demand of their suppliers. Schools make their own decision, but are influenced by examples of good, standard-based products that have been used elsewhere.

In the UK, there are no good examples of content suppliers who have succeeded through adopting standards. SCORM appeared to be a marketing advantage at one point, by allowing publishers to export into LMS, but has been too complex for both customers and publishers to adopt. RM (owner of Kaleidos, an LMS) requires publishers to conform to SCORM 1.4, but have recently changed the standards. This has resulted in many publishers being put off standards completely.

Publishers that do not have their proprietary rights have more of interest common standards, to boost their market share. It is easier to encourage smaller publishers to adopt standards, but it will probably need a major publisher (possibly with their own proprietary standards) to change the situation.

Important next steps
It is considered possible that large educational publishers may pull out of the current standards, so that they have a marketing advantage by selling the content directly through their own repositories.

Relatively competitive educational markets, such as UK and Denmark, will let the market dictate the metadata standards, whereas in other more controlled education systems (such as Korea) the standards will continue to be set by governments. This opens up the market for smaller publishers, encourages innovation within a standard and keeps prices down.

Public/non-commercial content supplier

Public content provider story 1: sharing best practice examples

Being employed in a teacher training centre, I want to produce educational resources as part of a teacher training program so that teachers acquire ICT awareness, and the training centres promote the resources created during the training session (the brand of the course).

Current status:
This is mainstream practice – but at the same time is to some extent wishful thinking because teachers are not all that happy about and willing to share their own resources with other teachers.

Barriers and possible incentives:
There are some potential barriers. One is the reluctance of teachers to publish and share resources they have produced themselves. Another is the rights problem that typically comes up in connection with teacher-produced materials, because they often have to rely on resources (illustrations, animations etc.) found on the web.

Another potential barrier is technological: the teacher training centre needs to have access to a repository. And if they do, there is the question of metadata and packaging to take into account as well as the rights issues. If the resources are published on a simple web site, the resources will only be found by the rather few people who know where to look.

There are a number of examples where this is done:

Radiowaves: showcasing podcasts produced by teachers during their training in this technology http://www.radiowaves.co.uk/infoR21.

IWB materials produced during training - highly used (at least in the sense that teachers using IWB know this site): http://r21.ccems.pt/

Austrian example math teachers: Seminar "Mathematik 2.0" at the The Private University College of Education of the Diocese of Linz. You find the examples developed in the Seminar under "Beispiele des Monats" on the right side: http://www.ph-linz.at/mm-team/math2000/index_2.php.

Important next steps / focus areas
One important step is to discuss how to create awareness among teachers and teacher training institutions of the importance of building up ‘best-practice’ repositories.

Public content provider story 2: making resources available

As part of a publicly funded project I want to make existing content more widely available and reusable so that teachers have access to – and actually use the content – in their teaching.

Current status:
This is mainstream practice in the sense that many projects attempt to do this.

Barriers and possible incentives:
Again there are (at least) two different problems in this story: one is making content accessible technically; another is making teachers use the content.

Quite a number of countries have or are in the process of setting national repositories that can solve the first problem of accessibility; and there are international initiatives like EUN's Learning Resource Exchange, which is trying to do the same on an international/European level. The technical solutions are, on the whole, in place, so the barrier, if it is there, is one of funding.

The problem of use is a different problem: the incentive here has to be one of quality and thus benefits to the teachers and students. If the resources are there, and they solve problems and provide benefits to teachers, the main task is one of 'marketing' the repositories in the right places so that teachers become aware of their existence.

If, however, teachers do not feel that they benefit from using the repositories and the resources found there – either because the quality is not ok, or because the resources are not sufficiently adaptable to the needs of the teacher, then creating technically brilliant repositories with all the right metadata and content packaging standards and marketing them to teachers will have little or no effect on the use.

Important next steps / focus areas
One important step is the discussion of quality: what is quality in educational resources? Can we agree on certain general principles, e.g. flexibility, adaptability, and openness, learner-centred. Another is the discussion of teacher and learner needs and possibilities: if resources provide solutions to actual needs, and do not require technical or organizational solutions beyond the scope of ordinary teachers, they will use the resources.

Examples (illustrating a very wide set of approaches and the complexity of what is intended to be shared)
The Learning Resource Exchange: http://lreforschools.eun.org/

Learning about learning: an example of making existing knowledge / not content / more available, http://www.ltscotland.org.uk/learningaboutlearning/index.asp

EduRep: http://edurep.kennisnet.nl/

PrimTICE: http://primtice.education.fr/

AEIOU: Project to digitalize information on Austria, http://aeiou.iicm.tugraz.at/

Bildungspool: Austrian Project of the Ministry of Education, http://bildungspool.bildung.at/

Materialeplatformen: http://materialeplatform.emu.dk/materialer/index.jsp

Public content provider story 3: making cultural assets available

Our institution (museums, archives, cultural heritage institutions) wants to digitize its physical collections and make the digital resources available as assets to the public. Being a publicly-funded cultural heritage institution we are of course eager to showcase our particular institution as innovative and to provide the

public, and the educational system in particular, with access to our resources so that the funding agencies feel that society gets as much as possible out of the funding.

Current status:
This is mainstream practice.

Barriers and possible incentives:
Digitizing everything in a museum and adding relevant metadata is an expensive and time-consuming process, and requires both manpower and, in the case a large museums, a complex technical system to handle both digital resources and metadata about the resources.

Important next steps / focus areas
It is extremely important to discuss how to present the assets and resources of museums so that teachers and students will actually use them and benefit from using them. It is important to exchange experiences regarding best practice in providing cultural heritage assets and resources to schools. Digitization has become an end in itself. However, simply having the assets in digital format will not make teachers and students use or even get anything out of the assets. Simply sending teachers or students into the 'digital storeroom' of a museum will not provide a good learning experience.

It is also worthwhile discussing what sort of metadata we actually need, whether Dublin Core metadata are enough or even relevant for the purpose described here. Perhaps even more important is that a sufficiently open licensing policy is adopted to in fact allow teachers and students to use such assets when producing actual learning resources/content.

Examples
Albertina: Bilddatenbank, http://gallery.albertina.at/eMuseum/code/emuseum.asp
Kunsthistorisches museum: http://bilddatenbank.khm.at/
SCRAN (Scottish example): http://www.scran.ac.uk/

Public content provider story 4: producing online learning activities

Our institution (museums, archives, cultural heritage institutions) wants to produce online learning activities, and use ICT to provide more interaction and engagement in physical exhibitions so that we fulfil the institution's obligation of education in two ways: by treating every visitor as a lifelong learner, and by making it possible for teachers and learners to integrate our online learning activities in their work at school.

By doing this we also hope to increase 'market reach' by giving people who live far away from our museum access to our resources.

Current status:
This is done by some museums, but is still far from mainstream practice.

Barriers and possible incentives:
Creating and maintaining an online bank of learning resources is a time-consuming task. It also requires people with the skills in instructional design, and people with the right technical skills to put it all together

and to manage websites and repositories. Last but not least, it requires people who understand the context (curriculum and classroom) in which the learning resources will be used.

Important next steps / focus areas
It is extremely important to discuss how to create learning resources based on the assets and resources of museums so that teachers and students will actually use them and benefit from using them. It is important to exchange experiences regarding best practice in providing cultural heritage assets and resources to schools.

It is also worthwhile discussing what sort of metadata we actually need, whether Dublin Core metadata are enough or even relevant for the purpose described here.

Examples
Gallica: National Digital Library (http://gallica.bnf.fr/)
Technical Museum Vienna: http://www.tmw.at/default.asp?id=62&cid=23&al=Deutsch

Public content provider [university] story 5: provide access to content

Our institution wants to provide easy access to the content of our teaching and research activities, so that we will be more widely known for our quality teaching and research.

Current status:
This is mainstream practice.

Barriers and possible incentives:
The potential barriers are the same as those mentioned in connection with some of the other stories on public content providers: the technology is there; so are the standards covering almost any relevant aspect from storage over search and retrieval to packaging and use. The costs are, however, a significant barrier if any institution wants to set up a repository that is based on all relevant standards and specifications.

Important next steps / focus areas
Increasing the reach of these resources to the intended audience.

Examples
MIT OpenCourseWare, Connexions

Public content provider [library] story 6: provide access to content

Our library wants to make available our collections of educational digital resources so that people (teachers, pupils, students, parents) interested in education or searching for educational materials can find useful resources for their specific needs.

Current status:
Currently this is relevant only to few.

Barriers and possible incentives:
The potential barriers are the same as those mentioned in connection with some of the other stories on public content providers: the technology is there; so are the standards covering almost any relevant aspect

from storage over search and retrieval to packaging and use – metadata, harvesting, search and retrieve web services, controlled vocabularies etc.

The costs and complexity are, however, a significant barrier if any institution wants to set up a repository that is based on all relevant standards and specifications.

Important next steps / focus areas
We need to provide the community with best practice examples and free or inexpensive technical solutions to the problem of setting up a repository.

General comments on public content providers

Publicly funded projects

Current status
Many projects are currently funded for making existing content more widely available and reusable or to produce digital content for different areas.

The projects are funded by different institutions (regional, national, Europe wide) and their results are many different types of content for many different thematic areas and in many different formats. In the last years many project outcomes focused on fulfilling some standards to support cooperation with different providers and the implementation of the content into different VLEs and to raise the chance of being funded.

Museums

Cultural heritage, museums, archives

The big challenge is to be able to show a wider public the collections which they hold, be them books, paintings, statues, etc, by creating web-based appealing ways of introducing both students and teachers to these resources. This involves the development of interactive digital educational materials.

There is thus a growing pressure for every cultural institution to have a significant presence online. The most widely used metadata standard seems to be Dublin Core. This is deemed to be perfectly suited to the work undertaken for analogue resources, but when these institutions go on to produce educational digital resources the adoption of this standard may not be enough.

Barriers and possible incentives:
Even though these institutions have specialized staff in the creation of metadata, they may lack the necessary knowledge to be able to adopt the most appropriate and widely accepted standards and specifications when it comes to digital educational resources.

Therefore, incentive schemes are important, but as important is the possibility to get the necessary knowledge and skills to understand and then implement the most “useful” standards and specifications.

Important next steps/focus areas
It seems of paramount importance to: (a) be able to easily collect the necessary information on these standards and specifications; (b) to create a network of cultural heritage institutions in Europe and elsewhere so that information can be imparted and exchanged; (c) gather together experts in the field of

standards and specifications and those who run and work in museums, archives, etc.; (d) never lose sight of the end user, students and teachers in this case. This means adopting those standards and specifications which are useful for the institutions but also for those who actually have access to and use the digital learning resources that are being produced; (e) be able to establish a proficuous communication with schools.

Focus areas would then be as follows: (1) metadata standards and specifications, (2) packaging solutions, (3) vocabulary banks and exchange solutions.

Libraries

I want to make available educational digital resources collections

So that people interested in education can find useful resources for their specific needs

Relevant standards: LOM, Dublin Core, OAI/PMH, SRU/SRW

Current status

Public libraries have a good experience working with content description standards and interoperability. This experience comes from the cataloguing world where the MARC and UNIMARC (MAchine-Readable Cataloguing) family formats let libraries to exchange, use and interpret bibliographic records avoiding the duplication of the cataloguing work. The cataloguing also involves the creation and use of controlled vocabularies (thesaurus, classifications, taxonomies).

Some libraries also have experience on managing digital content subscriptions.

These mean that libraries have knowledge and people able to work following different kind of standards.

Libraries are not yet very familiar with educational technologies standards. Some libraries have manifested an interest about the LOM standard and there are some works dealing with LOM to UNIMARC mappings. Libraries who have implemented digital services are aware about Dublin Core standard and the OAI/PMH protocol.

Barriers and possible incentives:

For libraries it should be necessary that educational technologies standards be widely adopted and stable.

The adoption of standards is not only a matter of awareness. Libraries need to have personnel trained to develop, implement and maintain new computing technologies.

Important next steps / focus areas

The main focus areas for libraries are metadata, harvesting and search and retrieve web services standards.

Some libraries can also be identified to set up and maintain the educational vocabularies registries.

The libraries can be identified as educational resource distributors.

It would be useful for educational stakeholders to get closer to digital library providers, because they are using tools and techniques similar from those of education

Tool and service providers

Repository owners

Repository owner story 1: improve discovery

We want to provide discovery features so that teachers and pupils can easily find appropriate material.

Current status:
This is mainstream practice.

Barriers and possible incentives:
The technical standards and specifications for advanced search features are in place: these include metadata standards such as the LOM or Dublin Core metadata specifications, and various vocabulary and thesaurus specifications such XVD, VDEX, SKOS, ZTHES, and CEF.

Important next steps / focus areas
We need to agree on best practice standards and specifications for repositories – and to provide the community with best practice examples and free or inexpensive technical solutions to the problems of setting up a repository.

Repository owner story 2: connecting repositories

We want to connect several repositories so that users will be able to find resources from all over the world from within their own, familiar environments.

Current status:
Currently, this is relevant only to few repositories

Barriers and possible incentives:
The technical standards and specifications for connecting repositories are in place: these include mechanisms for harvesting, for federated searches, automatic translation of metadata and keywords etc. The standards and specifications include e.g. query languages such as CQL, PLQL, LRE-QL; protocols such as SQI, SPI, SRU, SRW, OAI-PMH, and SWORD; and registries like CORDRA, ADL.

Important next steps / focus areas
We need to agree on best practice standards and specifications for repositories – and to provide the community with best practice examples and free or inexpensive technical solutions to the problems of setting up a repository.

Repository owner story 3: usability / improving discovery

We want to provide a service with high usability so that teachers and students will be able to find and retrieve material with least effort (ease of use, ease of learning and ease of recall)

Current status:
This is wishful thinking.

Barriers and possible incentives:
The technical standards and specifications for advanced search features are in place. Specific metadata profiles are available that are targeted at educational resources, for instance IEEE LOM.

Important next steps / focus areas
What we probably still need is a thorough understanding of how users search our repositories, what metadata they require in order to be able to locate resources easily etc. But we also need to discuss strategies for providing our resources with all the relevant metadata, which is typically a labour-intensive and complex process. In addition to this, much of this is more related to general UI design issues and not specific to educational repositories.

Additional comments

The following is a list of key areas that are also relevant to consider when setting up an educational repository. These key areas have not been described as actual use cases, and not all of these considerations relate to standards and interoperability:

- Content strategy (Different strategy to what kind of content the repository should the repository have.)
    - Only learning resource or other content like library resources
    - Only digital content or physical resources as well
    - Repository VS referatory
    - User generated VS “professional” content
- Service / feature strategy
- Gatherer strategy
    - Barriers:
    - Quality variations
        - Selecting content and sources
    - Quality assurance, Quality criteria
    - Popularity, travel well
    - Reusability and modification of resources
        - The use of Creative commons to inform the user
- Discovery services (search, tag cloud e.g.)
        - Usability

        - Barriers: The users feel that advanced search features are complicated
        - Vocabularies:
    - Search relevance and problem that users often find either too much or too little content
    - Curriculum relevance as a retrieval mechanism.
    - Evaluations and recommendation of content
    - The retinal mechanism is still not mature and focusing too much on search.
        - Rating, popularity, context,
        - Exchange of popularity end user comment data between repository
    - Widget as a discovery service
- Delivery of content strategy
    - Rights management
        - The business model is complex and difficult to implement in the repository. The publisher business model is not that mature yet. Should the Content authorization be done by the repository, VLE or the publisher? Several specifications: CC, DRM,
        - Trend: Publisher does the authorization and the repositories expose the rights information.
- Marketing of the repository
- Community strategy
    - The repository is often focusing on the content and not so much on the users and the community
- Federations
    - Connecting the repository to federated network to have more content
    - Centralized VS distributed search model
    - Speed and usability VS having data that is updated

Tool providers

Tool providers story 1: improve search, retrieval and use

We want users to be able to search, retrieve, deposit and use learning resources from many repositories so that users need only focus on their work, not on how to make things work in different systems.

Current status:
This is wishful thinking

Barriers and possible incentives:
For this to work, the LMS will have to make use of standards to interoperate with any repository – and the repositories as well as the resources need to comply with a specific set of standards.

Important next steps / focus areas
We need to agree on best practice standards and specifications for repositories and resources – and to provide the community with best practice examples and free or inexpensive technical solutions to the problems of applying these standards to both repositories and resources.

Tool providers story 2: support the creation of resources

We want to provide people with easy-to-use tools so that they can make their own learning resources.

Current status:
This is mainstream practice.

Barriers and possible incentives:
Creating high-quality resources is a complex and time-consuming process. What we need are tools that are easy to use; tools that make the reuse of resources and assets simple and hide away much of the complexity involved in creating and handling digital resources. Such tools may provide an incentive for some users to start developing content.

Important next steps / focus areas
Tools providers need to develop GUI-based tools that support teachers with limited ICT skills in the processes involved in creating standards compliant content. They also need to discuss with teachers what sort of 'templates' they consider useful and would actually want to use in class.

Tool providers story 3: support sharing of resources

We want to support people in sharing and using their learning resources so that more people benefit from the resources and will actually consider it worthwhile spending time on the development. In order to do this, the authoring tools need to support import/export to the formats of different LMS/LCMS – or both tools and platforms need to support existing formats such as IMS-CP, SCORM, IMS-QTI, IMS-CC, IMS-LD, interactive whiteboard common file format specification etc.

Current status:
Currently this is relevant only to few.

Barriers and possible incentives:
The technical standards are in place. The question is whether they actually give teachers and learners what they want and need.

Important next steps / focus areas
A discussion on packaging standards, templates, tools and user needs could be an important next step in developing tools that reflect what the educational market needs.

Examples of tools
Xerte, Exe

Tool providers story 4: enable collaboration on authoring

We want to support people in collaborating with each other to produce learning resources.

Current status:
Currently this is relevant only to few.

Barriers and possible incentives:
It is possible to collaborate on the production of resources although only few authoring tools handle all the aspects of the workflow such as different roles, working areas, multi user editing, versioning etc.

Important next steps / focus areas

Tool providers story 5: improve quality through validation

We want to validate our product according to learning standards so that learning resources created with our product complies with accepted standards.

Current status:
Currently this is relevant only to few.

Barriers and possible incentives:
There are some validators available, for instance the SCORM Conformance Test Suite, the Kennisnet eValidator (http://contentketen.kennisnet.nl/validatie). It is probably difficult, however, to get ordinary teachers to search for validator applications, and they will most likely assume that if their learning resource works in the editor and in their own LMS, then that is validation enough seen from their point of view.

If someone would create a simple, one-stop web-based validation service that the tools could use without the user having to be involved, then that could make the validation process work.

Important next steps / focus areas
Discuss whether the e-learning standardization community could be involved in developing such a validation service.

Tool providers story 7: develop systems integration

We want to support the schools in easy student learning management, so that they minimize extra administrative work. The LMS should interface with administrative systems for the synchronization of data.

The synchronization should work both ways, so that we can get information on students, classes, and teachers etc. from the administrative system into the LMS, and move administratively relevant data from the LMS back into the administrative system.

Current status:
This is mainstream practice (from administrative system to LMS at least)

Barriers and possible incentives:
In order for this to work we need a high degree of standardization with configurable, web service or simple XML-based, import/export specifications. IMS-LTI v. 2 and the IMS-LIS are steps in this direction.

Tool providers story 8: improve discovery

We want to provide the learners with tools that support collaborative activities so that the learners can engage in learning activities based on collaboration and communication. The LMS systems should provide not only traditional asynchronous communications, but also 'web 2.0' technologies such as widgets for chatting, voting, rating as well as collaborative workspace.

Current status:
Currently this is relevant only to few.

Barriers and possible incentives:
Implementing all tools in the LMS is not the best solution due to the amount of work that will go into developing additional functionality. In most cases it is probably a better solution to integrate external tools, for instance by means of the IMS Tools Interoperability Framework – or other similar, fairly standardized approaches, for instance the W3C standard for widget description.

Important next steps / focus areas

Tool providers story 9: support for tagging

We want to provide the users with tools that support the tagging learning resources so that the resources they create comply with metadata specifications. The tool should be able to handle different metadata standard schemas, for instance IEEE-LOM and Dublin Core.

Current status:
Currently, this is wishful thinking.

Tool providers story 10: support for automatic tagging

We want to provide the users with tools that support automatic tagging of learning resources so that the resources they create not merely comply with metadata specifications, but also have quality metadata.

The tagging tool should be able to handle different metadata standard schemas, for instance IEEE-LOM and Dublin Core.

Current status:
Currently, this is wishful thinking.

Comments on tools and tool providers

The following paragraphs consist of unedited notes from the discussions of different types of tools. Some of these notes are reflected in the above use cases, whereas many other points simply reflect status and observations from the current market situation – often not strictly related to standards and interoperability.

LMS/VLE

In Holland no real VLE in the primary sector. Vocational school: Sharepoint, Netschool, Fronter

Secondary school: Teletop, it's learning

- Issue: Interfacing with school admin systems (manual, xls, no interface)
- Strong: VLEs are the starting point for students and teachers
- Functionality – interoperability of SCORM objects
- Publishers make their own VLE/LMS around the content and these systems can not interface with the school admin systems
- In Denmark VLEs are very widespread in the primary sector (non standard product).

Barriers:

- Use of the SCORM object should play correctly within the VLEs
- Also communication of the results between the VLEs and ex the teacher.
- Search and find part within the VLE. We feel we are moving towards a learning plan central-approach: starting with the curriculum, teachers can choose to change certain parts wt other material
- VLEs lack of supporting IMS-LD. There are tools (LAMS, SLeD, ,…) but they are not usable enough. Atlas Rubiconis a tools for building learning plans
- Lack of consolidation in the market. Many VLEs but
- Standards are very complex to implement

Focus areas:

- To solve the barrier between the VLEs and also to the administrative systems.
- More content that uses standards. In this way it pushes VLEs to implement the standards. And also to innovate the standards.
- Encourage to use digital learning material in VLE:
- Stimulate publishers to offer more content in SCORM etc via VLE
- Stimulate schools to make won content in SCORM and let it work in VLE
- Work with VLE's as a guide to help them to implement;
- Stimulate teachers to understand the advantages and possibilities of SCORM – digital objecs – and let them stimulate the VLE. They are the demanding community,
- ENIS and eTwinning network
- How to integrate social network into the VLEs

Validation tools

Status:

- In NL we develop SCORM-validate tool, to use for authoring tools, teacher (but only the ICT savy) who just made an object. We provide that tool, including testing objects. This helps the smart buyer

- Not only SCORM-validation, but as well eportfolio validator. To help the chain get things work. www.kennisnet.nl (contact Jos)
- Valid. Tools are not integrated in the applications themselves. Moreover you need some kind of independent testing mechanism. We do not judgement, only show what is possible or not.

Barriers:

- Technical too complex, errors easily get too complicated
- Standards are always evolving
- Validation is as well complex (you can not find all errors)
- Money is a problem, because resources are needed

What to focus on:

- Use use use use !!!
- Provide easy to use tools for different target groups like teachers, publishers, VLE,s ahtoring tools, etc
- Develop make aware make smart THE BUYERS: that they have to be aware of all these aspects and functionality
- Winners will the tool provider willing to work with customers. Not always chosse for the rapid change or fast development, but feel the rhythm of customers, standards, technical possibilities, etc
- European level validation tools: make local applications, but use a European base to use the available money and knowledge as efficient as possible

Interactive whiteboards

Schools are complaining that there are no content.

Some publishers in Denmark and Holland has already produced content.

Some whiteboard vendors have collected links to learning resources from their users.

Lack for standards (Will Ellis talk)

Authoring tools

Current status

Exe is faced out in Holland. They support LOM, but they don't support application profiles.

Communities around the tools: organized from the schools management (ex edutude lessenbuilder, contentcorner, learn exact)

Tools need math editor

Development between countries is not coordinated.

Wikimedia is supported by the ministries of education in new initiative.

Wikimedia has no SCORM no metadata.

We see in NL that school management – communities choose for pragmatic approach and worth with semi-commercial tools as well as in vocational, also community. On the middle long term there will be issues on

continuity, licensing, costs, etc being not an open source tool. Standards to be able to switch tooling should be very welcome.

Barriers and possible incentives:
Users are asking for better sequencing possibilities, but standards needs 1-2 years to mature.

Barriers are interoperability between authoring tools; information exchange in de standards between the learning use and VLE-s¸ flexibility to arrange lessons. Current standards are not ready yet, or even worse, current standards might not be good enough so on the long term we have to change rigorously to other standards.

Math editor: add on to different authoring tools. Open source? European universal functionality, as math teacher in Spain asks for same functionality as math teacher in Sweden (we suppose)