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SCORM specifications for an emerging world:

The linguistic diversity at work

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Abstract—The world wide spreading of e-Learning models, techniques and solutions is imposing new challenges to emerging countries in order to face the digital divide by subscribing to this inevitable global educational process. Many projects, collaborations and initiatives are striving to find out the appropriate solutions to reduce and bridge the e-gaps in education through standards definition and implementation. Among the major initiatives that the Agency of French speaking Universities (AUF) has undertaken in this respect, is the assistance forwarded to its French speaking partners to produce standardized educational resources on basis of their own linguistic and cultural specifications. This paper illustrates the procedures, outcomes and perspectives of such an initiative with regards to AUF experience with SCORM specifications as a leading model in the realm of international e-Learning standards.

e-Learning Standards, Linguistic diversity, cultural diversity, governance, AUF, SCORM

I. GENERAL OVERVIEW

It is obvious, nowadays, that e-Learning standards gained a very large universal interest among all categories of actors working within educational, learning and training contexts. The pioneers' era when instances like AICC[1], ARIADNE[2], IMS[3] etc. were acting in closed clusters of e-Learning elite is somehow obsolete. After two decades of progressive improvements, the e-Learning standardization issue is becoming a strategic component of e-Learning governance and a guarantee of integration within the world wide dynamics of access to knowledge and education for all.

This generalized concern about e-Learning mechanisms and, in a second step, about its standardization procedures, induced a wider concern about the cultural and linguistic diversities in which international potential users and actors could find an obstacle to access and share educational resources and services. International programmes like Unesco project "Education for all"[4] or IUT WSIS summits[5] treating the digital divide, attribute to this linguistic and cultural considerations a key role in solving problems inherent to unequal ICT access and unbalanced STI resources between "haves" and "have nots".

The Agency of French Speaking Universities (AUF)[6], an international network composed of around 635 universities and research institutions having French as one of their working

languages, is one of the stakeholders that strived to deal with these gaps through education, training and research on basis of equal chances, bilateral cooperation and mutual recognition of each partner's cultural and linguistic peculiarities.

II. AUF E-LEARNING FRAMEWORK

One of AUF concerns is to put forward an ICT competencies reference model for the definition of professional profiles and the appropriate trainings associated to them. Since few years ago, AUF has been developing a reference framework of ICT trainings capacities that fit with its French-speaking and multilingual partnerships policies.

The competencies reference framework is built upon 4 priority trends:

- ICT for basic use of Internet (an axis treating digital documents editing, collaborative working tools and communities of learning) ;
- Interconnection of systems and networks ;
- Information systems ;
- Educational technologies.

Among the expected objectives of AUF, while implementing this reference frame of competencies, we can mention:

- The tracking of learners' progression in their respective educational processes and their appropriation of the mechanisms that help them acquire competencies ;
- The use of a common vocabulary in the field of ICT between the trainers and learners using the collaborative environments.

These two issues synthesize the wide spectrum of AUF involvements in e-Learning resources and services in connection with its French speaking academic and research partnerships. This also justifies its current strategy to be aligned on the practices and the recommendations of e-Learning through international standards.

Two core activities are conducted by AUF to reinforce its commitment in this educational choice.

- On the one hand, the implementation of a centralized educational learning system (Transfer LMS)[7] to provide a set of free educational materials and services around its ICT competency reference model [8].
- On the other hand, AUF is sponsoring decentralized series of specialized workshops (Transfer workshops)[9] about education, e-Learning and standardization in developing French speaking countries.

Although starting as limited and free initiatives, without strong standards conformity, these both experiences are nowadays submitted to a large effort of synchronization with up-to-date standards and specifications.

III. TRANSFER LMS GETTING STANDARDIZED

The Transfer platform, an AUF open source GNU licensed LMS, is designed to provide a framework of integrated training services and resources in which the educational standardization requirements of e-Learning cope with those of the most relevant world specifications like AICC and IMS. The objective is to reach on the long term, a level of compatibility with the current standards largely inspired from IMS specifications: Accessibility (Accommodation), Competency definition (RDCEO)[10], Content packaging (IMS-CP)[11], Digital repositories (OAI model), Enterprise, Enterprise services, Learner information (IMS-LIP)[12], Learning Design (IMS-LD)[13], Metadata (IEEE LOM), Question and test interoperability, Simple sequencing (IMS-SS)[14], Vocabulary exchange definition (VDEX)[15].

A. Planning standardization priorities

In this respect, and in order to achieve advanced standardization stages of its reference frame of competencies, AUF established a set of priority levels dealing with the different components of its information and educational supporting systems, on basis of a logic ordering of fundamentals dictated by the nature of the on-line educational processes and the stakes that AUF has to deal with. These priorities can be summarized as follow:

1) Ongoing achievements:

- Drafting and structuring Transfer Workshops contents on basis of structured learning objects granularity (IMS organization compliant),
- Their referencing and indexing by standardized metadata (IEEE-LOM compliant),
- Their use on basis of standardized adaptive sequencing (Scorm-SN/IMS-SS compliant)
- Their delivery in the forms of content aggregation packages (IMS-CP compliant),
- Their interoperability between various LMS (AICC/IMS compliant).

2) Short terms objectives:

- Design of standardized educational contents (IMS-LD compliant),

- Definition of competencies, particularly those of Tutors (RDCEO compliant),
- Creation of standardized educational resources repositories (OAI and Cordra compliant),

3) Long terms objectives:

- User information: “Passeport TIC” (IMS-LIP compliant),
- Common multilingual vocabulary definition (VDEX compliant).

Success of such objectives is intended to be the result of an international dynamics that implies contribution to international standardization activities and e-Learning worldwide governance initiatives. It also implies implication of worldwide French speaking partners in developed and developing countries to reinforce the cultural and linguistic diversities to which AUF devotes a large activity programme in its educational strategy.

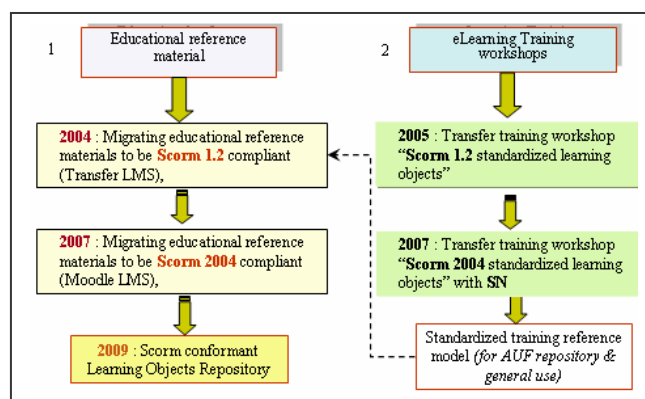


Figure 1. AUF standardization strategy

B. Choosing SCORM as a reference model:

Once the development of educational contents for the 4 training above-mentioned topics of the competencies reference frame has been completed (10 workshops, 71 sessions between 2005 and 2006, 1006 learners, 22 French-speaking countries), AUF undertook a standardization process of these training resources putting as a fundamental goal to make them “RAID” qualified (Reusable, Accessible, Interoperable, Durable) among and by all its French speaking partners. The Scorm reference model was selected to be the solution for this initiative.

A SCORM 1.2 compliant upgrading has been applied to the Transfer LMS to make concrete the above mentioned category of ongoing objectives: using a Scorm contents aggregation model (CAM) with Scorm Sequencing and Navigation (Scorm SN), applying a Scorm Runtime Environment (RTE) and using a Scorm derived metadata model. A minimal application profile has been defined using Scorm compliant metadata elements to which few personalized data elements have been appended to respond to particular system needs (Responsible, execution type). When choosing this reduced metadata model, the guidelines were to provide easy to use metadata categories in comprehensive taxonomy for the large educational French

speaking communities, still unprepared to these new trend of contents tagging forms.

Nowadays, the entire Transfer competencies educational reference is standardized on this basis. The next steps, as stated in short terms objectives, are standardization of learning design processes and creation of standardized educational resources repositories conform to OAI protocols and Cordra system architecture [16].

Figure 2. SCO Metadata template

However, when implementing such upgrading and introducing an innovative standardized layer to its educational and training mission, AUF is aiming at a higher objective: to endorse local governance and stewardship of these new standardized issues in French speaking countries and partners communities. Thus, it would play its intermediary role, which defines its core educational mission as a consortium of hundreds of French speaking universities in the world. This explains its commitment to set up the second solution of training national trainers in order to put forward its policy of technology transfer between North and South.

IV. TRANSFER TRAINING WORKSHOP ON AND BY E-LEARNING STANDARDS

Within the series of its 10 Transfer workshops covering various aspects of ICT and education, AUF has defined a Transfer workshop specific to the “standardized design of interoperable learning objects”[17] targeting a development of competencies around essential skills like use of metadata,

handling the general Scorm environment, producing IMS aggregation packages, handling interoperability functions of Scorm/Aicc/Ims compliant LMS, and validation of contents and Scorm certification.

A. Transfer workshop about e-Learning standards: the basics of Scorm

The workshop is constructed around 5 topics combining theoretical basics and practical productions of learning objects:

- General introduction to standardized metadata models and XML documents,
- General overview about e-Learning standards and their implementation,
- Presentation of SCORM environment :
 - a) Content Aggregation Model (CAM)
 - b) Run Time Environment (RTE)
 - c) Test Suite,
 - d) Certification
- Scorm Sequencing and navigation
- Interoperable Content Packages between LMS : Ganesha, Moodle, Transfer

As a first training experience with learners arriving with classical assumptions of linear and monolithic one-bloc learning resources, the objectives of this first basic version of the Scorm workshop is to:

- Sensitise with the advantages of the standardization of learning resources,
- Encourage use of educational metadata when creating educational resources,
- Draw attention on the benefits of interoperability obtained through standards,
- Train on handling authoring tools for tagging Assets, SCOs and producing organizations of XML based e-Learning standardized contents (Reload),
- Train on using SCORM compliant learning resources and environments (LMS) on basis of RAID criterions.
- Train on validation of Scorm contents using ADL Test Suite.

Three sessions of Transfer 2.3 workshop have been already organized during 2006, two of them were in Tunisia and one was in Madagascar, registering totally 36 participants from 07 African countries.

B. Learner-oriented evaluation of Scorm applications

Transfer workshops are characterized by a final evaluation process performed by the learners themselves about their appreciations, difficulties and ways of considering the upgrading of any workshop they attend. Evaluation criteria are fixed through a common template concerning the agenda, the resources distributed, the pedagogical objectives and methods,

the trainers' qualifications and the added value they may acquire following the training session.

Transfer workshop 2.3 about Scorm standards has consequently been submitted to this evaluation in order to consider the extents at which a second versioning is required to reach better performances.

Remarks have been generally formulated around the two following issues:

1) *Metadata complexity:*

Being rarely used to deal with metadata in electronic documents editing, learners find some redundancy in using so long application profiles and metadata forms to fulfil. The role of metadata for indexing and searching in an e-Learning system remains confusing to them. Taxonomies of some metadata categories and elements: When using LOM standards, some of them remain barely apprehended by learners. Some of these are, for instance, the recurrent data element "Catalog" appearing with 1.1.1 and 3.1.1 then 7.2.1.1 items, the "entry" data element 3.1.2 and the data element 9.2 "Taxon path".

In short, we can summarize the learners' difficulties handling metadata as follows:

- Superfluous taxonomy (e.g. 1.1.1 "Catalog", 2.3.2 "Entry", 9.2 "Taxon path"),
- Subjective (unqualifiedly) data elements (e.g. 4.7 "Duration", 2.2 "Status")
- Accessibility to controlled lists of vocabulary data types (e.g. 3.1.1 "Catalog", 3.1.2 "Entry")
- Complex data elements (e.g. 3.2.2 "Entity", 4.1 "Format", 9.2.2 "Taxon,")

2) *Granularity:*

Beginners with Scorm standards generally face the challenge of migrating from a classical cognitive schema of linear learning contents structuring to a Scorm-compliant learning model. Largely used to one bloc and linear data contents, learners find it relatively difficult to understand the real scope of Scorm learning items like Assets, SCOs and Learning Objects. Three issues are usually discussed in this respect:

- First, the ambiguous conditions when an Asset could be considered as a SCO or a SCO could be taken as an Asset in a content aggregation is sometimes confusing for learners.
- Second, the high level semantic autonomy of a SCO, that makes it reusable in different learning contexts, goes beyond the linearity constraints that classical course contents impose on the intrinsic sequential and semantic ordering between all their components. The fact that an asset is taken as a semantically neutral component in an IMS organization, contradicts the thematic dependency that it inherits in a classical course construction.
- Third, the prohibition of any physical links (hyperlinks) or logical ties (cross-references) between

SCOs (prohibition necessary for SCOs reusability), constitutes another crucial change for learners by comparison to the deeply rooted cognitive schemas they inherited about course contents structuring.

3) *Using authoring tool:*

Transfer workshop 2.3 is mainly based on Reload authoring tools to produce and test Scorm compliant learning packages. Although originating a large world consensus as a reliable authoring tool, Reload Editor offers a relatively complicated interface for Scorm grass root users mainly those who did not follow any ICT previous trainings. Yet, the Java software solution of Reload tools constitutes a draw back problem for implementing the editing environment on some users' machines. An XML web based solution would have been of better impact for larger dissemination and use.

4) *LMS Interoperability:*

Interoperability of Scorm content aggregations is demonstrated and tested through three different Learning Management Systems: AUF Transfer LMS, Moodle LMS and Ganesha LMS. The strategy is to create a Scorm compliant aggregation package using Reload editor and to export it in-between the three of them. One of the recurrent problems in these experiments is the reproducing of IMS sub-manifest nodes in a large package when migrating from one LMS to another. This puts forward the interoperability problem between LMS that should be better addressed by LMS developers. This is one of the forthcoming upgrading features that AUF is planning for its LMS environment. Upgrading to Scorm 2004 is also another quality criteria among all those related to IMS compliant specifications.

C. *4.3 Evolution towards a Learning Design approach*

AUF strategy today is to encourage local duplication of this first version of the SCORM workshop by national trainers who attended one of the three mentioned sessions, and work on a second version where Scorm advanced functions and specifications would be introduced.

AUF is working today to restructure this workshop so it could be merged with a previously designed workshop exclusively dedicated to Web based educational contents development without strong emphasis on standards. The issue will be that two complementary standardization workshops will be tied consequently to each other, the first one (Workshop 3.3) will be about Scorm compliant Web based XML learning objects and repositories, and the second one (Workshop 2.3) will cover IMS-LD compliant learning design using IMS Sequencing and Navigation specifications.

The result would be a quality upgrading of the impact that standardization workshops would have on the local final users involving them to further disseminate standardized e-Learning resources and services.

This delocalization process of e-Learning standards towards emerging countries has been planned by AUF to reach a second quality level by affording validated educational and training materials and developing local competencies in order to strengthen local expertise and appropriation of standardization issues. This will certainly encourage wide spreading of

standards implementation, local governance and adaptive stewardship of e-Learning standards to local cultural and linguistic needs.

V. SCORM & I18N: THE LINGUISTIC AND CULTURAL DIVERSITY AT WORK

Digital linguistic diversity is yet a worldwide concrete matter of fact. Internationalization (I18N) and Localization (L10n) of resources, applications and services are nowadays of common use owing to multi-byte characters coding sets like Unicode and its derived UTF-8 coding format. Starting from the core definition of its mission and partnerships policy, AUF has adopted the principles of I18n to reinforce and help partner languages to integrate rapidly the information age and the ICT revolution. One of its initiatives in this respect is to upgrade its working spaces and resources to a multilingual framework where partner languages could find their own linguistic and cultural requirements for a balanced multilingual partnership. Experimental multilingual versioning of its LMS working space is on the way to become the official solution with integrated IMS compliant multilingual resources and services.

Yet, some experiments have been conducted to test the extents at which existing IMS resources and Scorm specifications could comply with multilingual course content aggregations. Experimental e-Learning workspaces, similar to AUF Transfer LMS, have been tested to produce multilingual IMS compliant aggregation packages and to run them within multilingual Scorm based learning environments. What is relevant in these experiments is that the multilingual coding is no more limited to content materials, but the whole LMS is compliant with internationalization and localization global specifications regarding automated language detection for interface adaptation (i.e. directionality swapping), appropriate characters' glyphs rendering and adapted linguistic command based menus and instructions. Arabic language has been chosen as an experimental language considering its both complexity levels of character glyphs rendering and right to left directionality. The result has been outstanding at level of Content Aggregation Model (CAM) and metadata editing, Sequencing and Navigation (S/N) and Run Time Environment (RTE) Application Programming Interfaces (APIs).

Another relevant outcome of AUF Transfer standards workshop has been the initiative of a Tunisian team of computer science students [18] to localize Reload authoring tools.

This experience, supervised by one of AUF standards workshop authors, is at its beginning with the localization process. Its objective is to achieve full linguistic and cultural upgrading of the Reload authoring and delivery tool regarding its window interfaces bi-directionality, menu based commands, editing templates, localized calendar and currency use. This will certainly help duplicate localization and translation of this kind of applications and reinforce awareness about standardized learning resources in linguistic environments using other than Latin based languages.



Figure 3. Reload localization to Arabic language

VI. CONCLUSION

No more doubt that standards constitute a worldwide challenge for the future educational systems and policies. The linguistic and cultural diversities, being one of the world's most emphasized issues to deal with the digital divide, they have to be considered with as much care as possible not only to disseminate content resources and technical solutions for emerging countries, but also to train local skills in order to produce appropriate resources and tools based on their proper needs and requirements. This requires much more implication of indigenous human resources in software engineering, computerized applications development, educational contents modelling and definition and local expertise training and education.

ADL initiative to forward the Scorm development to an international stewardship and to convert it into a *Core Scorm* reference model is a valuable initiative for an international governance of e-Learning standards [19]. Being largely disseminated as an e-Learning reference model, Scorm would certainly enhance the universal dynamics for more concrete e-Learning systems interoperability. The foundation of the LETSI international non-profit federation in March 2007 will certainly help promoting e-Learning and enabling innovation in learning technologies [20].

Some recommendations are however compulsory for the forthcoming evolution of e-Learning standards:

- End-user oriented solutions: the old questioning of adapting technologies to users or vice versa should be settled definitely to be user based solutions. It is recommended that in using standards, users are not evidently concerned by standards script coding or complicated set-up interfaces. Intelligent systems should replace users adapting their inputs to the required output standardized formats. Back office layers and routines are to be implemented to take over this function.

- XML Web-based solutions: for some users, sophisticated plug-ins (i.e. Java) could constitute problems of computer systems set-up requirements. Web based XML resources are today a more easy solution to handle.
- Free software solutions: any e-Learning solution should be open source and put free for the large world community. Appropriate and commercial solutions have demonstrated restrictive dissemination among low income communities and have induced large gaps of mutual conformity which is very critical for worldwide e-Learning systems interoperability.

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