TEACHER TRAINING ON THE JOB

A generic metadata modeling approach for personalised learning and learner support

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Abstract: Since mid 2000 in the Netherlands full teacher qualification can be obtained in real life training trajectories 'on the job', by means of a tri-partite contract between a teacher (trainee), the school where the teacher/trainee will be working/learning and a teacher training institute. The Ruud de Moor Centre (RdMC, Open University of the Netherlands) was established to support these trajectories on the job, especially by means of ICT based distance learning and support. Like all real life learners these teacher trainees form a heterogeneous group, which requires a highly tailored approach for learning and support. Such a tailored approach not only has to take into account personal characteristics of the trainees, but also the working/learning contexts that differ from school to school. Tailoring includes (but is not limited to) personalisation and contextualisation of content delivery, adapting presentation modes and individualising user support. This imposes severe constraints on the organisation and management of the learning materials and on delivery modes. Adequate metadata, conceptual structures for organisation and processing of knowledge, proper search tools and engines for information retrieval are requested. The RdMC is developing a flexible and modular system architecture as well as a data model, with emphasis on didactic potency, enabling design and delivery of tailored learning and learner support on the job.

Key words: Personalisation, teacher training, in service training, knowledge databases, user perspectives

1 INTRODUCTION

The Ruud de Moor Centre (RdMC) of the Open University of the Netherlands (OUNL) is supporting a typical category of real life learners: career switchers who enter a teaching job in a school (in this paper we will address these learners as "new teachers"). While working as a teacher they have to acquire their formal qualification in one or two years, for which the new teacher, the school and the teacher training institute enter a tri-partite contract. This on the job training, i.e. in the school, is becoming increasingly important in the solution of the problems caused by the shortage of teachers, especially in primary and secondary education.

In general the actual knowledge and the experience of these new teachers do not fit too well with respect to the subject to teach and/or with respect to pedagogic and didactic competences.

Like all real life learners these teacher trainees form a heterogeneous group, differing in characteristics such as prior knowledge, competencies or cognitive style. Also working/learning circumstances, contexts and facilities differ from school to school. Schools, mentors and training institutes work with different didactic models, are confronted with cultural differences, differ from school type, …

Most often the schools lack the expertise in training trajectories on the job. Support by the school, by new colleagues or by mentors on site is not developed to its full extent yet. This requires new organisation processes from the schools where these new teachers learn while working, as well as from the supporting organisations (e.g., teacher training institutes).

For new teachers this situation means coping with the challenges of learning and working in a rapidly changing context from an organisation that in its turn is also learning while doing. These developments and the needs (expressed by all parties) were the guiding principle for the Open University of the Netherlands in the establishment of the Ruud de Moor Centre. The Centre is now developing a "toolbox" of learning materials, tools and services to support the new teachers, their schools and the teacher training institutes involved as well as the interactions within the tripartite. End-users of the products are not only the new teachers but also trainers, mentors and institutes. The elements of the toolbox are chosen and constructed in an ongoing process of supply and demand. All users could have the role of content provider, adding their input to that provided by experts at the RdMC and external authors.

In these conditions a highly tailored (multipurpose, multi-actor and flexible) approach is a conditio sine qua non. Personal differences (prior knowledge and expertise, learning or teaching style) are taken into account,

delivery systems memorise user settings, learning tracks, address the user in a personal way (personalisation).

Learning takes place in contexts, and preferably, these contexts fit the learning objectives. Contextualisation varies the contexts to the particular target group, even if the basic information remains the same for all target groups. For new teachers the most important context will be the school in which they are learning while working. For their trainers this might be the teaching institute. Adequate tailoring will take these differences into account.

Tailoring requires a flexible, multi-purpose environment for learning and learner support, accessible by all actors according to their needs, preferences and contexts, from the workplace as well as from the distance (i.e. by IT-tools and/or consultancy). Developing such an environment is about creating an open, complex working environment, embodied by three major functionalities: authoring, repository and delivery.

This working paper focuses on one of the key factors to create, maintain and use well structured, interrelated repositories: an accurate metadata model. It elaborates the discussion of tailoring an environment to support the multiple and heterogeneous groups of real life learners, their schools and their trainers, and then proposes a generic metadata model. Finally the preliminary test results of two pilot studies are presented and discussed.

2 CONSTRAINTS FOR METADATA MODELLING

Tailoring is conditional to offer adequate products, provide requested information, limit or reduce the amount of information to what is really relevant for the user. It is alleviating the risk of the "lost in hyperspace syndrome" (Foss, 1989), it offers timesaving benefits by pointing immediately to the information that is specifically needed, opens opportunities to consult related information in order to explore a subject as deeply as needed, etcetera.

For example a teacher at the eve of his first class activity in a new school does not expect an overwhelming amount of eventually interesting information but might prefer an immediate, relevant and limited range of information. In a later stage the same teacher might be willing to go deeper into a specific theoretical topic, a good practice, new didactic method… In the first situation the new teacher will appreciate a restricted (or filtered) version of the learning and materials, while in the later version he might be willing to browse through additional materials, to search specific topics …

The situation of a highly tailored approach imposes demanding conditions to an adequate Virtual Working and Learning (VWL)

environment. This VWL environment should function as an extension of the real working environment of real life learners, as a working process aid. It should function as an open, modular architecture that allows for different authoring systems, a flexible repository (cf. a number of interrelated repositories) and delivery to a variety of learning/working environments by a wide range of media (web, dvd/cd-rom, paper, mobile devices).

Creating and maintaining a multi-functional and flexible repository especially puts severe constraints on the metadata model. Metadata are key elements in tailoring mechanisms such as information retrieval, sorting, filtering, presenting the same content in a different mode, in different didactic approaches, combine content units fit for all with tailored content, … Content entities have to be isolated from their presentation mode or medium, from the didactic and instructional meanings of these entities, and from the information on the relations between content is of absolute importance, in order to be able to reassemble the same content with other content entities, present it in different modes, in different didactic settings. From a logistic point of view, tailoring is based on a "Assemble to order system" (ATO) in which units of content are assembled according to needs and demands. ATO systems are based on accurate labelling by means of parameters and classes of parameters (metadata). Robust metadata models are key factors for ATO systems (Hegge, 1990).

Theoretically a lot of the problems might be solved rather easily if all elements of the system architecture were compliant to international standards as described for Dublin Core, SCORM, LOM, IMS Learning Design etcetera. However, in practice it appears to be very difficult to develop an all-inclusive holistic metadata model that covers all functional dimensions (domain, user, instruction/didactics, authoring) of storage, retrieval, reusing and sharing of learning material. Even when such a model might be created, it is hardly possible to get it accepted by all actors. In many cases different terminology is used for the same types of metadata. The VWL environment needs to support different metadata "dialects" and different sets of metadata types. And even if a common model might be accepted, it should be able to face frequent revisions, in reaction to the rapidly changing reality.

3 A GENERIC APPROACH FOR METADATA MODELLING

Therefore we propose a generic approach for functional metadata modelling of (learning) material that can lead to many metadata profiles. This generic model consists of a set of sub-models for separated dimensions and sets of rules to define the relations between them. We propose four (sub)

models with their own organising principles: the content domain model, the authoring model, the instructional and the user model. The model contains metadata and metadata-types, values of metadata, and relations between metadata (or their specific values). These models reflect the different perspectives or dimensions of the generic model. The models should be orthogonal: metadata should apply for one model only. 'Combined' metadata will be generated by the management and authoring tools.

3.1 Critical characteristics of the model

- Metadata are descriptors of content units: content fragments (or assets, information objects), content objects, learning objects, …
- Allow labelling of content elements with metadata on all levels of aggregation - even the smallest resource types (i.e. content fragments) when useful
- Units of content can be related to many meta-data
- The metadata model allows usage of dialects for different actors (different actors use different terminology to find or use equal information objects; Metadata used to support the development of the content are different from those used by the end-users)
- The model is robust enough to withstand changing situations and conditions, changing user groups and user needs
- Changes in one subset of the model does not lead to changes in other subsets: they are orthogonal
- The model supports maintainability: content objects are unique in the repository, even if it is delivered many times in different didactic situations, for different user groups, used by many authors
- Discern "what" from "how". i.e. discern domain metadata from didactic metadata: (in order to allow reusability of content in several didactic setting or to allow that equal didactic settings can contain different content for different user groups.)

3.2 The four basic orthogonal dimensions

3.2.1 Domain model

Knowledge, skills, attitudes and meta-cognition relevant in this domain

- Structuring and organisational metadata: content entity or aggregation level (asset, paragraph, document, chapter, module, …) and domain structure (reflected in concept maps, tables of content - hierarchical tree model or network model). (A lot of this meta-information will be

generated automatically by the system and will be supported by the metaphoric structure of the authoring and management tool "create a paragraph, a document, a chapter,..." Other information will be author-generated, e.g. titles, document names, ...)

- Semantic metadata (domain classification): descriptions of the knowledge, skills, attitudes and meta-cognition for the content domain (e.g. economics, mathematics, communication, ...)

3.2.2 Authoring model

- Managerial and lifecycle metadata (date, author, version, status, rights, roles...)
- Collective authoring metadata (to allow exchange)

3.2.3 Instructional model

- Didactic metadata
  - type of didactic material component with values such as: learning goal, assignment, source, illustration, case, advance organiser...),
  - didactic method (case-based, competency based, problem-oriented, thematic, question-based,...),
  - support device (tip, feedback, cognitive stimulus,)
- Navigational model: sequence, relations ("is conditional for", "requests prior knowledge of "),
- Target group metadata

3.2.4 User model

- New teachers:
  - prior knowledge and expertise
  - cognitive style
  - ambitions
  - social interactions skills and style
  - deficiencies
  - preferred didactic method
- School
  - type
  - didactic method used
  - size
  - culture
  - organisation type
  - organisational expertise in teacher training on the job

- Training institute:
  - didactic methods
  - Level of experience with mentoring new teachers
  - Learning environment
  - Preferred delivery mode (Word, pdf, Scorm package, interactive reader, Bb-course content, …)

3.3 Sets of rules

A second essential part of the model is the set of relations between the values of the metadata, which form the basis for pre-tailoring while authoring. This leads to sets of rules such as:

- If the value of user type Training Institute is "No experience with mentoring new teachers" than the module "Supporting new teachers on the job" will be presented.
- If the value of user characteristic "Deficiency" for user type "new teacher" is "No experience with eventual misconceptions of pupils in sciences" than the didactic support device "Eventual misconceptions" is added to all science concepts.
- If the "preferred didactic method" of the new teacher is case-based then the module will start with case description and assignment.

These types of rules are a helpful mechanism to tailor the learning and support to the characteristics and/or the context of the user.

The definition of accurate right sets of rules is based on thorough knowledge of the user, gathered by the RdMC in in-depth interviews with representatives of the field.

4 TESTING OF THE MODEL IN THE PROJECTS OF THE RDMC

The model was tested in two ways during the period of August-September 2004. In these tests two sets of interrelated repositories were built, by means of an open authoring tool and Learning Content management system "Content-e" and delivered in common delivery environments (several-browser based web-players, Blackboard) and media channels such as internet, Pdf, Word and Zip-file.

The model was discussed in a national and international expert group during the period of October-November.

In the pilot project "Palet: the Crash course for new teachers and their mentors" an instantiation of the generic model was tested against the criteria

of consistency and practical value for the developers (and will be tested for the added value of tailoring for multiple user groups). The generic capacities of the model are tested. One of the major issues is to observe whether (or at what cost) existing models fit into the generic model. Another concern of the pilot is to confirm the assumed added value of tailored approach for multiple user groups with rapidly changing needs and contexts. A basic assumption of the tailored learning principle is that in a tailored environment the questions of users are answered quickly, easy and accurate, and that the user does not get lost in unwanted, superfluous information (objective benefit). A second and related assumption is that users also appreciate these benefits (subjective benefit).

In a mock-up prototype the model is used to create a multifunctional and tailored repository "The Bach therapy knowledge base", created to reflect in a nutshell the complexity of the conditions of real life learners. In the mock-up prototype the model is tested against the criteria internal consistency, robustness in changing situations and practical value for developers and authors.

In both test situations the following aspects are investigated: "How intuitive or contra-intuitive is it for authors to respect the orthogonality of the dimension and to express relations between metadata in sets of rules?"

"Are the four dimensions sufficient or would it be necessary to add one or more extra dimensions?"

5 INTERMEDIATE RESULTS

Results available at the moment for both tests are mainly based on evaluation of the value of the model for *developers and authors,* and some intermediate results from *end-users*. The data are mainly written or verbal feedback, spontaneous reactions, formal evaluation results and reports from in depth discussions.

Using the model to create the mock-up prototype confirms the consistency and robustness of the generic model for *developing and maintaining* a multipurpose knowledge database, learning environment, support environment and course for multiple heterogeneous target groups,.

In both test groups developers report finding it rather hard to respect the orthogonality, especially when it comes to unravel instructional and authoring issues from the domain structure. Initial concept maps, concepts of tables of content, project plans show mixed models containing instructional and even authoring or user information unsystematically interwoven in the domain model. Separation of content, presentation, instruction, and didactics

appears to be conflicting with teacher's tradition of developing integrated learning materials.

However, for the Mock-up group, which is starting from scratch with the model, it seems to be easier to get used to this systematic way of developing materials. In both groups the developers report that the process goes much easier, quicker, and that the results are more flexible and reusable, once they get familiar with the orthogonality and with its authoring consequences.

The pilot test reveals that the generic metadata-model does allow using metadata-dialects for different groups of authors/developers as well as for different user groups. The generic metadata model proves to be generic enough indeed to incorporate the original metadata-model of the pilot project group.

Developers report that the development process might be supported by intuitive metadata management tools, such as automation of application of metadata (where possible), generating reports and overviews of the metadata (values) and how they are interrelated.

Intermediate results of *user evaluation* within the threefold user group confirm the appreciation of tailored materials. (Exclamations as: "This is exactly what I was looking for!" express a user's feeling that the information he received was not more and not less than what he needed. The tailoring seemed to be successful…)

6 DISCUSSION

Although the evaluation process is still ongoing, the results of working with the generic model are promising. Using the generic model requires a shift in development procedures, a demanding process for authors and developers. The question remains whether the model will be able to correspond well enough with the procedural aspects of content development and behaviour of authors and developers, whether it will prove to be facilitating the content development process rather than hindering it. Further analysis as well as testing will show whether these four dimensions will be sufficient for this complex and changing situation or whether more dimensions should be added.

7 REFERENCES

Brusilovsky P. (2003) Developing adaptive educational hypermedia systems: From design models to authoring tools. In: T. Murray, S. Blessing and S. Ainsworth (eds.): Authoring

Tools for Advanced Technology Learning Environment, Dordrecht: Kluwer Academic Publishers.

Dekeyser, H.M. (2003) Surf Meeting on LCMS 2003, LCMS and Educational Quality: the conditions (June 25, 2003). Surf. [http://elearning.surf.nl/docs/e-learning/dekeyser.pdf]

Foss, Carolyn L. (1989), Tools for Reading and Browsing Hypertext. Information Processing and Management, Volume 25, Number 4, 1989, pp. 407-418.

Goldiamond, J. (2003), Aspects, Challenges and Repositioning of Distance Learning, EADL Conference 2003: Annual conference of the European Association for Distance Learning, 2003, Hamburg, 14-16 May.

Hegge, H., (1009), Intelligent Product Family Descriptions For Business Applications. PhD-thesis. Eindhoven University of Technology.

Open Universiteit Nederland (2002), Plan van aanpak Project lerarenopleiding, http://www.ou.nl/rdmc

Straub, R. (2003), The Learning Society on its way, EADL Conference 2003: Annual conference of the European Association.