Bottom-up and Top-down: An alternate classification of LD authoring approaches

Tim Sodhi*, Yongwu Miao, Francis Brouns, Rob Koper

Educational Technology Expertise Center, Open University of the Netherlands, 6419 AT, Heerlen, The Netherlands

E-mail: (tso*, ymi, fbr, rkp) @ ou.nl

*Corresponding author

Abstract: This paper presents an alternate classification of the approaches in the design of Units of Learning based on how the authors can approach the design task and the support afforded to the non-expert authors with the application of learning design rules to capture the authors' knowledge. Based on the classifications, the paper proposes a set of features based on which today's crop of IMS LD tools can be classified, and a new generation of tools to support the non-expert authors can be modelled.

Keywords: IMS LD, UoLs, bottom-up approach, top-down approach

1 INTRODUCTION

The existing classification of IMS LD (IMSLD, 2003) authoring tools on the basis of their purpose and proximity to the specification (Griffiths, Blat, Garcia, Vogten, & Kwong, 2005; Tattersall, Sodhi, Burgos, & Koper, in press) is incomplete. The classifications view the design and creation of Units of Learning (UoLs) as a single process, when in fact the process of modelling education using learning design rules, is indeed a conglomeration of sub-processes, modelling of which can start from specifying the lower-level details or from the elicitation of the educational scenario. In addition, learning design rules (Koper, 2005), used to capture the author's knowledge and assist the author in developing the best suited learning design, form the cornerstone of effective modelling of knowledge into UoLs. In spite of this, there have been limited concerted efforts to classify today's IMS LD authoring tools on the basis of the provision and support these tools offer for the application of these rules to help capture the author's knowledge.

Nearly all of today's IMS LD authoring tools are geared towards experts in the specification, not addressing the needs of non-experts and practitioners who are unable to relate to the technical formalisms of the specification (Burgos & Griffiths, 2005; Dodero, Tattersall, Burgos, & Koper, 2006; Griffiths & Blat, 2005; Hernández-Leo, Harrer, Dodero, Asension-Pérez, & Burgos, 2006). The latter possesses the domain-specific knowledge of their chosen fields (Christiaans & Venselaar, 2005), but needs support with the modelling of their knowledge into pedagogically sound UoLs.

In the face of the gamut of IMS LD authoring tools that conform to one or more of the existing approaches, a reclassification is sorely required to actualize a clear demarcation of the tools and inform the development of a new generation of IMS LD tools that actively support the non-experts in the specification with the application of learning design rules to efficiently model their knowledge into pedagogically sound, quality UoLs.

2 EXISTING CLASSIFICATIONS

Initiatives in the past have classified IMS LD tools as *General purpose* vs. *Specific purpose* tools and those used for use by *Experts* in the specification vs. those targeted at *Novice* authors (Griffiths et al., 2005). Depending on the functionality demanded of the tool, IMS LD tooling can be classified according to the purpose it serves. Tools for specific purposes are focused and don't require the author to be exposed to all of IMS LD, instead present authors with only the functionality they would need for the specific scenario. On the other hand, pedagogy specialists need a wider focus, due to the complexity and range of learning situations they model, and in that, would want full access to IMS LD, which would be mirrored in a tool aimed at this group.

In the second classification, tools aimed at IMS LD experts put the onus of knowing the specification and the technical formalisms on the author. The authors are expected to know the structure and the metaphors inherent to the specification. On the other hand, higher-level editors cater to novice authors, who find the terminologies of IMS LD cumbersome, and cannot relate to the specification metaphors (Dodero et al., 2006; Griffiths & Blat, 2005; Hernández-Leo et al., 2006; Tattersall et al., in press).

3 AN ALTERNATE CLASSIFICATION

An alternative view on the classification illustrates how authors approach the design task, and what kind of guidance the authoring environment affords to them. The authors can start either from defining the lower process level details and refining the details up, till a learning design emerges (bottom-up), or commencing from selecting the type of education to be modelled and working down to the process level details, aided and guided in the application of learning design rules to capture their knowledge into effective, pedagogically sound UoLs (top-down). Traditionally, strategies for processing information and knowledge ordering, these approaches can also be used to characterize educational process modelling techniques.

Bottom-up Approach

The bottom-up approach to the design of UoLs emphasizes upon the emergence of a learning design from the lower level details of the educational modelling process, without an underlying emphasis on the type of learning to be designed forming the basis of the modelling process. In bottom-up design with regard to IMS LD (Botturi, 2006; Morrison, Kemp, & Ross, 2004), the design is aggregated from the individual processes by first specifying the individual parts of the design like activities, roles, environments, resources, etc. These parts are then linked together to form larger components like activity structures etc, which are in turn linked until a complete UoL is formed. The learning design eventually emerges from the piecing together of the individual processes. The approach relies on either the authors being fully cognizant of the type of learning to be modelled, or on the authors tweaking worked out examples, to create a working design. The design activity is thus relegated to a mere editing of the UoLs in situ, and cannot in itself foster a higher-level of involvement from the author in the design process.

Since the learning design is a consequence of the process linkage, rather than a result of the type of educational scenario to be modelled, the system provides at the most limited guidance in the application of learning design rules appropriate for the design task at hand. Guidance offered to the authors at the time of modelling can therefore only be restricted at most to the support with the specification, allowing the authors to visualize the modelling process using metaphors and concepts close to their design vocabulary. Consequently, the bottom-up approach can be envisioned to find its appeal with authors who have a clear idea at the inception of the process of how the design would pan out, as well as with authors who rely on worked out examples (with encapsulated pedagogies, which may or may not be relevant to the design task at hand) to adapt their courses. The approach does not however make any provisions for keeping the author informed about the relevant design choices through the modelling process. Fischer & Giaccardi (2006) advocate that a successful implementation of this approach however, finds its implementation best with authors who have considerable prior design experience.

Top-down approach

The top-down or the *holistic* approach to the design of UoLs emphasizes upon first the elicitation and selection of the type of educational scenario to be modelled, and based on that, provides relevant guidance throughout the design process. Systems based on this approach ideally provide for underlying learning design rules, used to model the author's knowledge into effective, quality UoLs. Here the authoring of the UoLs can either begin from the creation of the overview of the learning design, before the lower level process details can be chalked out, or from piecing together of lower-level processes.

The top-down approach is significantly different from the bottom-up approach in the starting point of the design process and the guidance and support afforded to the author at critical junctures of the design process. Here, the author defines the learning objective or the scenario at a higher level by selecting from amongst sample educational scenarios encapsulating sound pedagogical principles and learning theories. Support and guidance is then provided to the author using learning design rules (templates of worked out examples, patterns in best practices) to model the author's knowledge into pedagogically sound UoLs.

The process modelling in the top-down approach is flexible. It can be envisioned as first selecting the approach based on learning theories, creating the overall working learning design, and subsequently elaborating at each step, creating, for instance, an activity structure and populating the same with activities and learning resources relevant for the particular scenario. Alternatively, the modelling could begin by elucidating the approach as before and then piecing together processes (activities, resources) to build up to a working UoL, aided at critical steps by targeted support.

Allowing the design to proceed from the top-down aids the author to view problems and the related features as interconnected from the main overview, rather than compartmentalized (Spector, 2001). This is particularly

true of non-experts, who may need to start with an overview of the learning scenario to be able to understand the connection between the elements (ADAPT-IT, 2000; Botturi, 2006; Jenlink, 2004). This approach can find its appeal in the support of authors who are necessarily experts in their own domains, however are not quite experienced with the modelling of knowledge into UoLs, and thereby need support and guidance in the effective translation of their knowledge into pedagogically sound UoLs.

4 FEATURES OF THE APPROACHES

From the background of the current approaches to IMS LD tool design and our classification of the top-down and the bottom-up approaches discussed, we can glean a set of characteristics and features on the basis of which we can evaluate and classify today's IMS LD authoring tools.

Scenario-based modelling – does the authoring tool take into consideration the underlying learning design theories and rules, providing support for the elicitation and selection of the type of educational scenario to be modelled, basis and structure of which are determined by underlying educational theories and best practice recommendations.

Inception of the design activity – does the tool allow the author to commence the design activity from a *Tabula Rosa*, or rather, to build upon real world case studies, templates and exemplars of existing learning designs, etc. Furthermore, does the tool lend itself to the easy review and reuse of existing learning designs allowing the author to browse through, modify and reuse relevant parts?

Support and guidance – does the tool offer support and guidance by providing and aiding with the application of learning design rules to effectively model the authors' knowledge into UoLs? Does the tool offer guidance with the technical formalisms of the specification, or is the guidance offered more rounded, with in-time, context sensitive support with the critical decision making steps in the design process, starting from and based upon the educational scenario being modelled.

Proximity to specification – does the IMS LD aware authoring tool base itself on the use of metaphors, notations etc, that are close to the author's vocabulary, or are the specification constructs laid bare, placing the onus on the author to be conversant with the specification before any modelling activity can begin.

Authoring approach – what authoring approach does the tool impose upon the author with respect to the design activity? Can the modelling begin by specifying the overall learning design and then progressing with the process level details, or vice versa? Or does the tool impose a strict authoring approach implementing a certain order in the modelling of UoLs?

Target group – who are the intended users of these tools? Are the tools designed keeping the needs of non-expert authors at mind, or do these tools cater to expert instructional designers who have a clear idea at the inception of design activity, about the underlying pedagogies and the educational scenario to be modelled?

5 CONCLUSION

This paper presented an alternate classification of IMS LD authoring approaches, viewing the creation of UoLs as a conglomeration of processes rather than a single process. The classification, characterized as bottom-up and top-down with regard to the way the authors can approach the design task and the support and guidance afforded to them with the application of design rules, is an attempt to clearly demarcate today's IMS LD authoring tools, and to inform the development of a new generation of tools in the support of non-experts in the specification. The salient features of the classification, as presented, can form the underpinnings of the identification of gaps in today's IMS LD authoring tools in the support for non-expert authors.

6 REFERENCES

ADAPT-IT. (2000). *Deliverable 2.2: Training Designers' Needs.*

Botturi, L. (2006). E2ML. A Visual Language for the Design of Instruction. *Educational Technologies Research & Development, 54*(3), 265-293.

Burgos, D., & Griffiths, D. (2005). *The UNFOLD Project. Understanding and Using Learning Design.* Heerlen: Open University of The Netherlands.

Christiaans, H., & Venselaar, K. (2005). Creativity in Design Engineering and the Role of Knowledge: Modeling the Expert. *International Journal of Technology and Design Education, 2005*(15), 217-236.

Dodero, J. M., Tattersall, C., Burgos, D., & Koper, E. J. R. (2006). Non representational authoring of learning designs: from idioms to model-driven development. *Software-Practice and Experience, 00*, 1-7.

Fischer, G., & Giaccardi, E. (2006). Meta-Design: A Framework for the Future of End User Development. In H. Lieberman, F. Paternò & V. Wulf (Eds.), *End User Development — Empowering people to flexibly employ advanced information and communication technology* (pp. 427-457). Dordrecht, The Netherlands: Kluwer Academic Publishers.

Griffiths, D., & Blat, J. (2005). The role of teachers in editing and authoring units of learning using IMS

Learning Design. *Advanced Technology for Learning, 2005*(4).

Griffiths, D., Blat, J., Garcia, R., Vogten, H., & Kwong, K. L. (2005). Learning Design Tools. In E. J. R. Koper & C. Tattersall (Eds.), *Learning Design - A Handbook on Modeling and Delivering Networked Education and Training* (pp. 114-116). Berlin: Springer-Verlag

Hernández-Leo, D., Harrer, A., Dodero, J. M., Asension-Pérez, J., & Burgos, D. (2006). *Creating by reusing Learning Design solutions.* Paper presented at the Proceedings of the 8th Simposo Internacional de Informática Educativa, León, Spain: IEEE Technical Committee on Learning Technology.

IMS LD. (2003). IMS Learning Design Specification. Retrieved February 27th, 2007, from http://www.imsglobal.org/learningdesign/index.cfm

Jenlink, P. M. (2004). The pragmatics of educational systems design: a critical examination. *Systemic Practice and Action Research, 17*(4), 323-339.

Koper, E. J. R. (2005). An Introduction to Learning Design. In E. J. R. Koper & C. Tattersall (Eds.), *Learning Design - A Handbook on Modelling and Delivering Networked Education and Training* (pp. 3-20). Heidelberg: Springer Verlag.

Morrison, G. R., Kemp, J. E., & Ross, S. M. (2004). *Designing effective instruction* (4th ed.). New York: Wiley & Sons.

Spector, J. M. (2001). Philosophical implications for the design of instruction. *Instructional Science, 29*(4-5), 381-402.

Tattersall, C., Sodhi, T., Burgos, D., & Koper, E. J. R. (in press). Using the IMS Learning Design notation for the modelling and delivery of education. In L. Botturi (Ed.), *Handbook of Visual Languages for Instructional Design: Theories and Practices*.