

Ontologies and Context for Educational Process Modeling in IMS Learning Design

Colin Knight¹ and Dragan Gašević² and Griff Richards³

Abstract. This paper discusses the role of context and ontologies in educational process modeling. Educational process modeling seeks to represent the complex interactions that take place in multi-actor learning environments, with the view that the sequence and types of interactions can be equally as important as the sequence and types of content. The IMS Learning Design specification provides the semantics to represent multi-actor interactions within an educational process, and the IDLD project has resulted in a substantial catalogue of Learning Design models from a variety of contexts. To facilitate reuse of these models in different contexts, ontologies have been developed based on the IMS Learning Design specification and we propose to use context to determine the relevance of Learning Design models when used in new situations to guide the learning process.

1 INTRODUCTION

Learning design has emerged at the forefront of research into the modeling of dynamic, learner-centered eLearning experiences. The IMS Learning Design (LD) Specification [1] provides a way to represent complex multi-actor interactions in an educational environment. This specification has been widely integrated into a number of learning management systems and authoring tools, and several ontologies have been developed around the specification [2],[3],[4]. The recently-completed IDLD [5] project effort involved modeling the educational processes of dozens of actual on-line and face-to-face courses being delivered at universities across Canada according to the IMS LD specification. Effective reuse of Learning Design models remains a challenge because each model is gathered from a diverse learning situation, meaning that some of elements of the model become irrelevant when applied to new situations. Since it is a time-consuming task to model the educational process in a learning

design, a mechanism is needed to guide the transfer of models for use in new situations. We propose the use of contexts as a solution to this problem.

Previous work on development of ontologies for eLearning has focused on the authoring process [6],[7] and sequencing of content [8],[9] with relatively little emphasis on expressing the role of multi-actor interactions in the learning process. However, these efforts have provided a useful framework for us to work within.

An exploration of contextual variables for learning environments has been completed in [2]. Since the variability of these environments is almost as great as the variability of the designs themselves, it is necessary to simplify to include the context elements that had the greatest influence on the structure and sequence of the course structure. This simplification usually occurs after consultation with the course author or instructor.

2 LOCO - an ontology compatible with IMS-LD

The IMS-LD Information Model and XML binding is the specification for Learning Design [1]. The LOCO ontology [2] is a light-weight ontology in the OWL language, based on the IMS-LD Information Model. The ontology is able to represent complex series and parallel interactions of actors. Each actor is assigned one or many *Roles*, which are associated with *Activities* according to the *Role-part* that each actor engages in and in *Environment* (resources, services) in which the activities take place.

¹ Simon Fraser University, Canada. Email: cjk2@sfu.ca

² Simon Fraser University, Canada. Email: dgasevic@sfu.ca

³ Simon Fraser University, Canada. Email: griff@sfu.ca

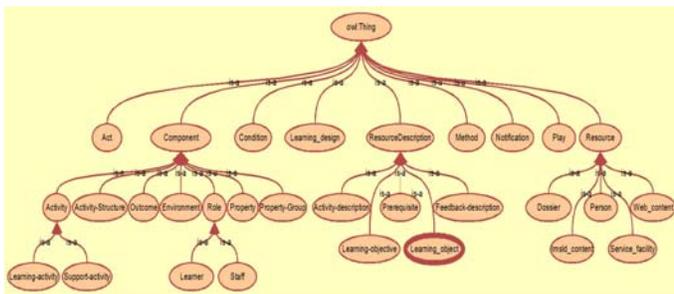


Figure 1. The class hierarchy of the LOCO ontology

To create the LOCO, some changes were made to the Information Model [1] in order to conform to established best-practice recommendations for ontology design [11], and to resolve some ambiguities and inconsistencies in the information model. These changes are described in detail in [2]. To date the LOCO only addresses IMS-LD Level A.

3 CONCLUSIONS

Treatment of context information stands as a barrier to the reusability of Learning Design. Existing solutions for the use of context and ontologies in learning applications could be enhanced by incorporating educational process modeling into the semantic representation of the learning space. A method of using context to effectively transfer these processes to new settings would greatly benefit learners by enabling pedagogical methods such as collaborative learning to become more of reality in eLearning. Also, reusability would enhance the cost-effectiveness of modeling learning designs. Future research will involve determining suitable methods for using context effectively to transfer learning designs to new learning situations with minimal redesign effort.

REFERENCES

- [1] IMS Global Learning Consortium (2003). IMS Learning Design Information Model. Version 1.0 Final Specification, revision 20. Retrieved March 25, 2005, from http://www.imsglobal.org/learningdesign/ldv1p0/imsld_infv1p0.html.
- [2] Knight, C. Gasevic, D. & Richards, G. (2005). Ontologies to integrate learning design and learning content. *Journal of Interactive Media in Education*. Special Issue on Advances in Learning Design, 2005 (7).
- [3] Psyche, V., Bourdeau, J., Nkambou, R., Mizoguchi, R. (2005). Making Learning Design Standards Work with an Ontology of Educational Theories. In proceedings of the 12th Annual Conference on Artificial Intelligence in Education, Amsterdam, NL.
- [4] Amorim, R., Lama, M., Sanchez, E., Riera, A., Vila, X. (2006). A Learning Design Ontology Based on IMS-LD. *Journal of Education, Technology, and Society*, 9 (1), 38-57.
- [5] Paquette, G., Marino, O., Lundgren-Cayrol, K., Léonard, M., I de la Teja, I. (2006) The IDLD Repository – Classification and Repurposing of Learning Designs. .TENCompetence Workshop, Sofia, Bulgaria, March 20.
- [6] Mizoguchi, R., and Bourdeau, J. (2000). Using Ontological Engineering to Overcome Common AI-ED Problems. *International Journal of Artificial Intelligence in Education*, 11, 107-121.
- [7] Inaba, A., & Mizoguchi, R. (2004). Learning design palette: An ontology-aware authoring system for learning design. In proceedings of the International conference on computers in education, Melbourne, Australia.
- [8] Jovanović, J., Gašević, D., Verbert, K., Duval, D. (2005). Ontology of learning object content structure. In *Proceedings of the 12th International Conference on Artificial Intelligence in Education*, Amsterdam, The Netherlands, 322-329.
- [9] Dichev, C., & Dicheva, D. (2005). Contexts as Abstractions of Grouping. In proceedings of the Context & Ontologies Workshop 2005, Pittsburg, Pennsylvania, USA.
- [10] Mizoguchi, R., Vanwelkenhuysen, J., and Ikeda, M. (1995). Task Ontology for Reuse of Problem Solving Knowledge. Towards Very Large Knowledge Bases. Mars, N.J.I (eds), IOS Press.
- [11] Noy, F. N. & McGuinness, D.L. (2001). *Ontology Development 101: A Guide to Creating Your First Ontology*, Technical Report SMI-2001-0880, Stanford Medical Informatics, Stanford University, Stanford, CA, USA.