Learning design: models for computers, for engineers or for teachers?

Jean-Philippe Pernin (*, **),
Anne Lejeune (**),

(*) Institut national de recherche pédagogique - ERTé e-Praxis
19 Mail de Fontenay, B.P. 17424, France-69347, Lyon Cedex 07
(**) Laboratoire CLIPS-IMAG

Contact Author's: Jean-Philippe Pernin

Institut national de recherche pédagogique

19 Mail de Fontenay, B.P. 17424, France-69347 Lyon Cedex 07

Jean-Philippe.Pernin@inrp.fr

Learning design: models for computers, for engineers or for teachers?

Jean-Philippe Pernin (*, **),
Anne Lejeune (**),

(*) Institut national de recherche pédagogique - ERTé e-Praxis
19 Mail de Fontenay, B.P. 17424, France-69347, Lyon Cedex 07
(**) Laboratoire CLIPS-IMAG

Abstract:

In this paper, we focus our attention on the authoring approach applied on learning scenario's management. We present the challenges raised by this issue by proposing a precise definition of the concept of learning scenario and its lifecycle. Then, we present current works aiming to capture and analyze the practitioners' needs and usages and to co-build models and tools matching with their specific context and environment. To conclude, we wonder about the possibility of considering a federative meta-model whereas at least three different targets must be considered: models for computation, models for design specialists and models for practitioners such as teachers.

Keywords: learning scenarios, educational modelling language, authoring approach, communities of practice.

1. Introduction

Since several years, an important domain of research concerns modelling of learning situations. Initiated by different works in the field of EML (Educational Modelling Languages) [12], researches have first concerned the definition of a consensual specification. IMS Learning Design, directly issued from the EML language developed at OUNL, seems to be today an unavoidable proposition and constitutes the base of a large consensus and research activities at international level (UNFOLD and Tencompetence projects].

In a recent article, Koper [7] has underlined the major challenges to raise in the field of learning design modelling: (a) the use of ontologies and semantic web principles & tools related to learning design; (b) the use of learning design patterns; (c) the development of learning design authoring and content management systems; and (d) the development of learning design players, including the issues how to use the integrated set of learning design tools in a variety of settings.

In this paper, we focus our attention on the third issue: an adapted authoring approach must allow practitioners usually deprived of technological skills: to create adapt, exploit and evaluate their learning scenarios. According to us, the precise analysis of this topic has important consequences for the used meta-models and ontologies discussed in the first issue of Koper's proposition.

This paper is organized as follows (in a possible further full paper, each topic will be more developed).

In a first section, we precise the specific problem we want to solve: making available creation, adaptation, exploitation and reuse of learning scenarios by the main concerned actors (teachers, trainers, tutors and learners) in the context of hybrid learning situations. We particularly point out the difficulties of the authoring approach we have previously studied in the context of creation of learning simulations.

In a second part, we detail the previous works we have carried out, particularly by defining the concept of "learning scenario" that we consider as a living object that continuously evolutes. We present also a summary of the scenario lifecycle we have proposed in 2004. We detail the different steps in the lifecycle and we precise the different intermediary forms of a learning scenario. We also insist on the variety of roles that can be hold at different steps by different persons or by a single one.

In a third part, we discuss about the concept of "bricoleur teacher" recently proposed in the context of learning design [1]. We think that it is not realistic to formulate strong hypotheses about needs and mental representations by this

specific kinds of audience without having first lead a rigorous analysis. Consequently, we present a new project whose the goals are to capture and analyze the practitioners needs and usages and to co-build with teachers models and tools matching with their specific context and environment.

In the last part, we propose from the previous analysis to refine the concepts of models, languages and tools in learning design process. We assert that a model represents a conceptual support to a certain activity to be performed by a human being or a computational system. Thus, it seems impossible to define one meta-model that will be consistent all along the above defined process. In function of characteristics of each situation (actors, goals, resulting waited objects, etc.), it is necessary to provide some formal support to allow the expression of specific needs. So we propose three levels of meta-models respectively dedicated to computer, to instructional engineers and to practitioners.

2. Learning design and authoring approach

In recent contributions, several authors underlined the necessity of extending the scope of EMLs so that they can be directly manipulated by teachers: *"the overarching presumption we hold is that any learning design process must be intuitive and empowering for teachers, and not intended solely as the professional realm of instructional designers"* [1]. These needs have been summarized by Koper [7] by the following topics to study:

• *the development of learning design specific tools to support teachers in a specific context;*

• *the question how learning designers should be supported with tools and how teachers should be supported with tools (the teacher as a designer);*

Some environments have been developed in order to reduce the gap between complex formalisms inherent to a formal specification and the practitioner's needs, goals and capabilities. Two main approaches can be adopted.

The first approach consists in building high-level tools upon existing specifications in order to get their more accessible. This approach has been used with IMS LD with tools such as Reload Ask-LDT [6]. According to us, this strategy is not really realistic because it just offers a better way (for example, a graphical way) to manipulate complex underlying concepts. Final users have always to master those complex concepts if they want to create, adapt, exploit or evaluate relevant learning scenarios.

The second approach consists in providing tools based on other formalisms, more adapted to the user's capabilities or requirements. Such approach has been for example used by LAMS [2] which proposes graphical tools adapted to teachers capabilities. MOT+ [9] proposes to adapt an existing knowledge-oriented modelling tool in order to provide a coherent package for designers accustomed to use a certain class of graphical languages. In this second approach, the problem is to insure the transformation from the concepts manipulated by the authoring tool towards a "standardized" language able to insure operationalization and interoperability (for example IMS-LD). Such works have been recently carried out by LAMS and MOT+.

We retrieve here the basics of authoring approach that has been popularized in the eighties and the nineties, when an important goal was to provide the teacher with tools aiming to develop multimedia or interactive learning contents. We had previously studied that topic in the specific context of development of learning digital simulations [11] [4]. In a first step, we had defined a formal meta-model (MARS) dedicated to structure the design of a learning simulation. Then, we have proposed a generic authoring tool for instructional designers, in the context of a technical training center. The first experiments have shown that, even with important efforts to propose convivial GUI, it was practically impossible for a trainer to model in terms of the proposed meta-model the behavior of a device he daily manipulated..

From this experience, we decided to develop specific tools resulting from a precise analysis of the concepts of the specific targeted domain. The main question for us was to provide software mechanism able to perform the matching between the domain-specific concepts with the

underlying conceptual meta-model of our system base on MARS meta-model.

The second approach really gave best results, mainly because the provided tools were developed upon ontologies built in partnership with final users.

It seems to be relevant to adopt the same strategy on the domain of learning design. For that, we have before to define precisely the concepts, process, roles and objects that we want to manipulate.

3. Learning scenario's definition and lifecycle

In previous papers [8], we have proposed to base our approach upon the concept of learning scenario for which we give today the following definition: *a learning scenario represents the description, carried out a priori, dynamically or a posteriori, of the organization of a learning situation aimed at the acquisition of a precise body of knowledge. This organization is made in terms of roles, activities as well as in terms of knowledge resources, tools, services and results associated with the implementation of the activities.*

The main idea we defend is that a learning scenario is a living object, continuously modified by the activity of each actor, all along the steps of its lifecycle. Those adaptations are unavoidable, because the learning process is the result of human interactions in moving environments.

To describe this lifecycle and the different degrees of adaptation, we identify four main steps:

• *Initial conception*: this phase allows for a general definition of the structure of an *abstract scenario* without accounting for the conditions needed for implementation. This can be performed either by a specialist (an instructional designer) or by a practitioner (teacher or trainer).

• *Contextualization*: this phase allows for the determination of conditions of use of an abstract scenario in a specific audience and context. We can identify two kinds of contextualization tasks.

Pedagogical contextualization concerns mainly the roles affectation to physical persons, the dated planning of activities and the choice of the more relevant resources, tools and services. It can also concern the possible refinement of the abstract scenario in order to insure the best adaptation for the targeted situation. We can underline that, at this point, this phase may concern learning situation based or not on the use of digital artifacts. Pedagogical contextualization asks mainly competencies in pedagogy and organization.

Technical contextualization concerns the implementation of the scenario in a precise digital system: this topic asks questions about the localization and the availability of the different resources, tools and services. This is typically the kind of problem addressed by the use of a LMS such as Moodle detailed in [1], where the choice of a technical solution may strongly influence the pedagogical purpose.

• *Use and dynamic adaptation*: this phase corresponds to the use of contextualized scenarios. The resulting *adapted scenario* is made of gradual dynamic modifications carried out by different types of actor (tutor/facilitator as well as learners) during the actual playing out of the learning situation.

• *Validation and reuse*: this phase focuses on the evaluation of results obtained during the previous phase with a view to setting conditions for subsequent reuse in other contexts. A scenario pattern, one of the possible results of the reuse stage, is obtained from the analysis of the actual run and from the comparison with other pre-made or adapted scenarios. De-contextualization enables the abstraction of information that is too specific and which could constitute an obstacle to their reuse in other contexts.

This lifecycle refines other propositions [9], [13] mainly by specifying contextualization phase and by defining intermediary status of the scenario.

4. Capturing practitioners needs

In a recent paper Berggren & al. [1] had introduced the concept of "bricoleur teacher" coming from previous works of S. Papert. We think that it is not realistic to formulate strong hypotheses about needs and mental

representations of learning design by this specific kinds of audience without have first lead a rigorous analysis. In that context, we have launched in latest 2005 the CAUSA project (in French, stands for Collecting and Analyzing Uses of Scenarization of learning Activities). The first goals of this project are to collect (a) current uses of scenario concept all along the process and (b) the formal ways that practitioners adopt to represent those scenarios. Contrary to a relatively common belief, a not negligible part of teachers or trainers adopts today an activity-centered point of view and shares practices within specific communities. In France this case is relatively frequent at primary school (with the widespread concept of pedagogical sequence), at secondary school or at university level (in domains which require problem-based or collaborative approaches). In order to collect those data, we have developed a questionnaire that we propose to a large set of practitioners (teachers, trainers, instructional designers, etc.). From the obtained results, we want to (a) detect the reality and the variety of current uses of scenarization, (b) analyze the main criteria that allow distinguishing between the different collected representations. For instance, we want to know if the following variables strongly determine the way of creating, contextualizing, adapting, using or evaluating learning scenarios: domain and discipline, education level, degree of hybridization of learning situations, importance of socio-professional environment, existence of constituted communities of practice, etc.

In parallel with this analysis, we organize workshops with different kind of practitioners in order to co-define conceptual models the more related to their practice and experience. We have for example define a model and graphical tool dedicated to a precise learning context in secondary school [3].

5. Meta-models, languages and tools

From the previous analysis, we propose to refine the concepts of meta-models, languages and tools in learning design process. We assert that a meta-model represents a conceptual support to express a certain activity that will be performed by a human being or a computational system. Thus, it seems impossible to define one meta-model or one language that will be consistent all along the above defined process. In function of characteristics of each situation (actors, goals, waited resulting objects, etc.), it is necessary to provide some formal support to allow the expression of specific needs.

So we propose to classify the different meta-models (or ontologies) in three classes:

- meta-models for expressing completely and consistently a learning situation interpretable and executable by computer systems (like LMS);
- meta-models targeting specialized instructional designers who may design any kind of learning situations;
- meta-models dedicated to specific communities of practice (typically teachers, trainers but also learners) who share a common culture, goals, environmental and socio-professional constraints.

While general metaphors like IMS LD's theatrical metaphor may be used for meta-models belonging to the first or the second class, we think that they can be more disturbing than relevant for the third class. According to Berggren & al [1], we also raise the problems introduced by the vocabulary employed. Even if solutions may hide the complexity or the too broad concepts of a meta-model, they are not really based on a specific meta-model (e.g. the COLLAGE solution [5] proposes patterns of collaborative learning situations that can be adapted by teachers via a graphical editor).

Nevertheless, this distinction between the meta-models requires mechanisms of translation of the ones towards the others. The translation can be partially automated, but it may be necessary that human beings intervene during the process to ensure a minimum of loss of expression (e.g. teachers that use a specific meta-model would work with IMS LD specialists to better translate constraints and requirements of a particular learning situation).

6. References

[1] Berggren A., Burgos D., Fontana J.M., Hinkelman D., Vu Hung, Hursh A. and Tielemans G. (2005). Practical and Pedagogical Issues for Teacher Adoption of IMS Learning Design Standards in Moodle LMS. Journal of Interactive Media in Education, 2005(02)

[2] Dalziel, J. (2003). Implementing Learning Design: The Learning Activity Management System (LAMS), http://www.lamsinternational.com/documents/ASCILITE2003.Dalziel.Final.pdf.

[3] Faure D., Lejeune A., GenScen, Un éditeur graphique pour l'enseignant scénariste, colloque EIAH 2005, Montpellier, mai 2005,France, p. 431-436

[4] Guéraud V., Pernin J-P., Developing pedagogical simulations: generic and specific authoring approaches, Artificial Intelligence and Education (AIED'99), Le Mans, France, July 1999, pp 699-701

[5] Hernández-Leo, D., Villasclaras-Fernández, E.D., Acensio-Pérez, J.I., Dimitriadis, Y. (2006). COLLAGE:A collaborative Learning Design editor based on patterns. Educational Technology & Society, 9 (1), 58-71.

[6] Karampiperis, P., & Sampson, D. (2005). Designing learning services for open learning systems utilizing Learning Design. In Uskov, V. (Ed.) Proceedings of the 4th IASTED International Conference on Web-based Education, Grindelwald, Switzerland: ACTA Press, 279-284

[7] Koper, R. (2006). Current Research in Learning Design. Educational Technology & Society, 9 (1), 13-22.

[8] Lejeune A., Pernin J-P., A taxonomy for scenario-based engineering, Cognition and Exploratory Learning in Digital Age (CELDA 2004) Proceedings, p.249-256, Lisboa, Portugal, dec. 2004

[9] Paquette, G., Léonard, M., Lundgren-Cayrol, K., Mihaila, S., & Gareau, D. (2006). Learning Design based on Graphical Knowledge-Modelling. Educational Technology & Society, 9 (1), 97-112.

[10] Pernin J-P, Lejeune A., Models for the re-use of learning scenarios, "Imagining the future for ICT and Education", IFIP conference Proceedings, Ålesund, Norway, June 2006 (to be published)

[11] Pernin, J-P, Comparing two authoring approaches of instructional simulations: an industrial experimentation, International Conference on Computer Aided Learning and Instruction in Science and Engineering (CALISCE'98). Göteborg, Sweden

[12] Rawlings, A., van Rosmalen, P., Koper, E.J.R., Rodríguez-Artacho, M.R. and Lefrere, P. (2002), Survey of Educational Modelling Languages (EMLs), Publication CEN/ISSS WS/Learning Technologies. http://www.cenorm.be/cenorm/businessdomains/businessdomains/informationsocietystandardizationsystem/elearning/learning+technologies+workshop/emlsurveyv1.pdf

[13] Van Rosmalen, P., Vogten, H., Van Es, R., Passier, H., Poelmans, P., & Koper, R. (2006). Authoring a full life cycle model in standards-based, adaptive e-learning. Educational Technology & Society, 9 (1), 72-83.