Bricolage and Model Driven Approach to design distant course

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Abstract: In this paper we describe our current work on the BRICOLES project. We show how our project is influenced by the participatory design movement. We analyze specificity of teacher creativity and we try to propose suited tools. Two problems are addressed by our search, first concerns object to be manipulated by teacher, the other one concerns the way of treating them: it is necessary to get closer as much as possible to the educational "bricolage". We show how Model Driven approach could be apply to e-learning creation. We use RAM3, a meta-modeling tool eveloped in our laboratory. This tool is founded on MOF definition, and it uses graphical artifact. We can build metamodel with it. It offers possibility to manipulate compliant models and their instances. With RAM3, we express pedagogical scenario and study models defines on different e-learning platform metamodel. Then we export model on targeted platform with scripts. It allows to better understanding of platform functionalities and it relieves teacher from repetitive works.

Introduction

The BRICOLES [Bring off Reflexive, Intuitive and Conceptual Open LEarning System] project main objective is to suggest solutions to reintroduce teacher in e-learning courses design. We not only want to propose conceptual and technical tools to promote e-learning course design but we also want to permit teacher to define the platform functionalities. For educational community the conceptual framework is more relevant to "Bricolage" than to pedagogical engineering. For software engineering community, it is set up by rigorous methodology applied to project management. For educational engineering it is set up by instructional design and by use of Educational Modeling Languages. From studying e-learning course design, we have enlarged our problematic and have to study design process: re-introducing stakeholder (teacher) into the design process exceeds informatics' and teaching's field.

Re-introducing stakeholder into the design process

"*Technical innovation is basically social and imagination is the main component part of technical development*"(Flichy, 1995). Implemented from 70's, participatory design is based on a legislative framework witch allows workers to participate in decisions concerning their working environment. In 80's, participatory design was based on gathering of worker's knowledge. But this approach has promptly shown its limits, it establishes too different roles between actors and not really offers real equality of expression and power. Introducing users in the engineering process is a challenge since 90's (Granath, 1996). But processes are developed through a set of reification on secondary artifacts as define by Wartofsky (Wartofsky 1973), these artifacts (model, diagrams) describe process rather than real working environment. They are not shared by final users, they don't understand them, and they don't have a self appropriation of them. These artifacts don't play the role of boundary object role. Boundary objects are often constituted by prototype or report of use, but if these object are really boundaries object as Susan Star's (Star, 1989) definition, which elements do they facilitate acquisition? As they are used, it seems that such boundary objects give a place to the user in the definition of the product to be created but not in the definition of the process itself used for its realization which will lead eventually to his production. It is that raises Olav Bertelsen (Bertelsen 1997) "*the 'shared understanding' constructed during, [a rapid prototyping session] in general only exists in a form crystallized into the prototype; the prototype in turn being a boundary object tying the incommensurable praxises of designers and users together, allowing them to design together but still perceive the*

situation and the new artifact in different ways". This is the main point of our research; we will see how this limit is particularly problematic when we envisage the design of a new classes of tools for e-learning systems.

Design practices in the craft of learning situation

We will show difference between design process in learning and other creating processes. To describe the learning specificity, Huberman (Huberman 1980) underlines among other factors, the individualism of the teachers, their tendency to reinvent on their side, what the others have probably already tried out elsewhere. Philippe Perrenoud (Perrenoud, 1994) writes: *"To fight this tendency would be a misunderstanding of the nature of learning practice (…), the reinvention of activities and material is essential for the personal improving and appropriation of professional part*." To take part in the process of creating teaching materials is essential for the teachers. But the fact which this process leads to the production of a reusable finished product and storage of the result is only subsidiary. Because participation to the process involves their competency, creation and recreation of pedagogical activities is as important as to use them. Contrary to classic engineering process, creation in e-learning is an unlimited cycle of re-creation. This desire to be major actors of the process of creation is visible in the recent successes of Blogs, Wiki, and e-portefolio. Used in education, they are the proof of teacher's opportunism; they seize a technology to better hijack it. Another creation's specificity in e-learning is that design process is similar to "Bricolage". Claude Levi Strauss introduced the term in "The Savage Mind".(Strauss 1966) "*The bricoleur is adept at performing a large number of diverse tasks; but, unlike the engineer, he does not subordinate each of them to the availability of raw materials and tools conceived and procured for the purpose of the project. His universe of instruments is closed and the rules of his game are always to make do with 'whatever is at hand'.... In the continual reconstruction from the same materials, it is always earlier ends which are called upon to play the part of means.... The bricoleur may not ever complete his purpose but he always puts something of himself into it*". Philippe Perenoud (Perrenoud 1983) uses the term "Bricolage" to specify teacher works : *"it's not the economic necessity that motive practice of bricolage but it's the part of creativity that bricolage permits. It's an additionally challenge that mean we'll have to manage with what we've got […] Bricolage is not defined by its product but by its production mode: in other words, to do with what we've got, to reuse texts, situations, teaching materials outside of their main usage. Effective activity, as it takes place in classroom, is never interpretation of a play written by the teacher*." Bricolage is not only a way for teacher to create and recreate his teaching activities but it is also a way of not organizing all thing, of leaving a space for final users (the learners) participation. Thus Philippe Merrieu (Merrieu 1999) shows that an important question for teacher is to leave some space for learner, to leave them to construct their own knowledge, and it's why teacher have to use "Bricolage". Other authors have underlined this way of leaving student freedom to build their own mental representation. Reference to "Bricolage" is used by Sherry Turkle and Seymour Papert, in (Papert, 1991), to describe an exploratory approach of Logo programming. Mordechai Ben Ari (Ben Ari2001) sets his research within the framework of three related theories and methodologies: constructivism, bricolage and minimalism. He demonstrates the freedom that this practice allows, and how "Bricolage" is extensively used. Some organization like Learnativity (LEARNATIVITY) combines creativity with learning and presents learning as a continual process of creation where teacher have to implies students. The concept of "Bricolage" has been also addressed by the design sciences.

Bricolage as a way to encompass limits of Participatory Design Approach

"Bricolage" tends to closely involve users and to support collaborative way of design activities. Monica Büsher (Busher 2001) underlines how "Bricolage" "*Involves users, participatory designers and ethnographers in a continuing cycle of design and revised work practice*." She presents reflections on the use of three participatory design methods, deployed in the WorkSpace project: future laboratories, in-situ prototyping experiments and "Bricolage". Her analysis examines how the methods differ, and how they complement one another, in relation to supporting the process of grounding imagination (Busher 2004). In particular she shows how on the one hand "Bricolage" establishes prototyping action in real use, and stirs up prototype understanding and completes its usability. On the other hand, "Bricolage" stimulates communication between users. It allows, by the multiple questioning which arouses its application, to establish more frequent exchanges among "bricoleurs". The raising of communication is also noticed by Mark Hartswood (Hartswood 2002), he explains how corealisation promotes "Bricolage" and how "Bricolage" enhances communication according to " *the facilitator/bricoleur is able to show*

how to use the system while the members […] are able to envisage more fully ways to integrate it into their everyday work tasks".

The design of the Bricoles project with a Model Driven Approach

Using artifacts and "Bricolage" are two natural ways to help teacher to design distant courses. Our project to provide a tool for such design to teachers (and not to pedagogical engineers) needed to build on these concept and method. We chose to adopt ideas from model driven engineering to "materialize" such concept/method. This recent area of software engineering promotes heavy use of structured models and transformations between them in order to have a better reusability (sharing, maintenance, platforms evolution …). Broadly speaking, using model driven tools begins by defining a logical model, without technical/implementation details, and ends by automatic generation of corresponding application (after selecting the implementation platform). We do not keep such life cycle because it is not "bricolage": we have to do with what we got, it means with existing e-learning platforms. What we keep of model driven engineering? It's modeling process and models transformation.

Modeling process: In order to play a scenario, an e-learning platform (as usual computer software) has to be fed by structural data. These data are generally in a database. Platform presents these ones to users with GUI objects which may be considered as the artifacts. These objects are not always significant for teachers. More, they are attached to a particular platform: this fact represents a barrier in sharing/community context. One aspect of our proposition is to make teachers working on models, composed by boxes, circles, arrows, pictures, to bring more significant objects. We think that models are graphical artifacts which are more intuitive because they are less technical and more natural (everyone has made at least one schema in his/her life). Further, they provide a better overview of underlying scenarios.

Models transformation: We cannot find or define a universal modeling formalism which meets needs to every aspect of pedagogical modeling and suits to everyone. If we want to allow teachers to reuse experience of others, our tool has to support different modeling formalisms (called also metamodels). Models transformation is the mechanism which provides us such support: it will allow teacher A, who uses to model with formalism FA, to use a model (or a part of it) from teacher B expressed in formalism FB. This mechanism is particularly relevant for deployment of models in e-learning platforms. In the needed deployment process, we insert an intermediary step which consists in showing the deployment under a modeled form. Once teacher has defined a pedagogical model and selected a platform to deploy it, his/her model is transforming in a graphical model expressed with platform concepts. This last model may be refined in order to adapt the first model to the selected platform.

Models provide better boundary objects and models transformation allows "Bricolage" by reusing experience of others and by adapting scenario to target platform. Supporting different modeling formalisms is complex to implement and models transformation generally needs to define transformation rules which are not easy (in our context, fortunately not defined by teachers). As described in the next part, we use standards of model driven engineering and their progresses and adapt them to our pedagogical context: MOF (Meta-Object Facility) for "meta-modeling"(MOF), UML 2.0 for its graphical artifacts variety (UML), QVT (Query View Transformation) for models transformations (QVT). For example, we define the corresponding metamodel for each e-learning platform and implement deployment facility which will be fed by instances of previous metamodels.

Finally, we put IMS-LD (Koper 2001) forward for modeling because this pedagogical metamodel represents a standardization effort from the educational community. Despite the fact that IMS-LD refers to an industrial view of education (Sallabery 2005) and is useful in industrial (taylorist) e-learning design process, course models described using IMS-LD metamodel, it allows teachers to express easily dependencies between teacher pedagogical intention, platform functionality he/she wants to use and different roles he/she needs to define.

Life cycle

More than a tool, our proposition consists in a design environment which is composed by two tools: RAM3 - to support different modeling formalisms; GenDep - to deploy model on e-learning platform. RAM3 (Le Pallec 2003) RApid Manipulation of MOF Metadata - comes from previous works and has been improved for the Bricoles project. It allows defining metamodels (and their graphical formalism) and creating models from these ones. GenDep - Generic Deployer – has been developed for this project. For a given model, it communicates with the e-

learning platform (selected through its web address) in order to create corresponding elements. This section presents what type of users may use this environment and what they do with.

Principle

Here are roles of each hypothetical user of our environment. Computer scientists and pedagogical engineers define with RAM3 modeling formalisms like IMS-LD or Ganesha associated metamodel (GANESHA). Teachers or pedagogical engineers define with RAM3 models of pedagogical scenarios according to metamodels defined before. With GenDep the teacher deploys an instance of a course (play the scenario) in a e-learning platform (like Ganesha).

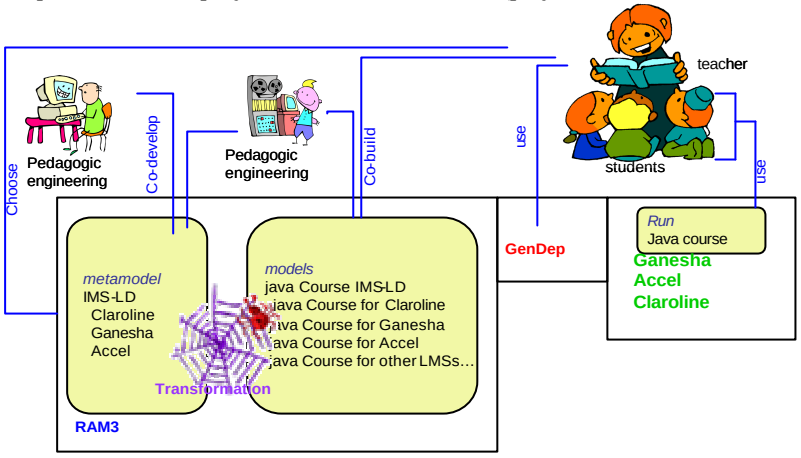
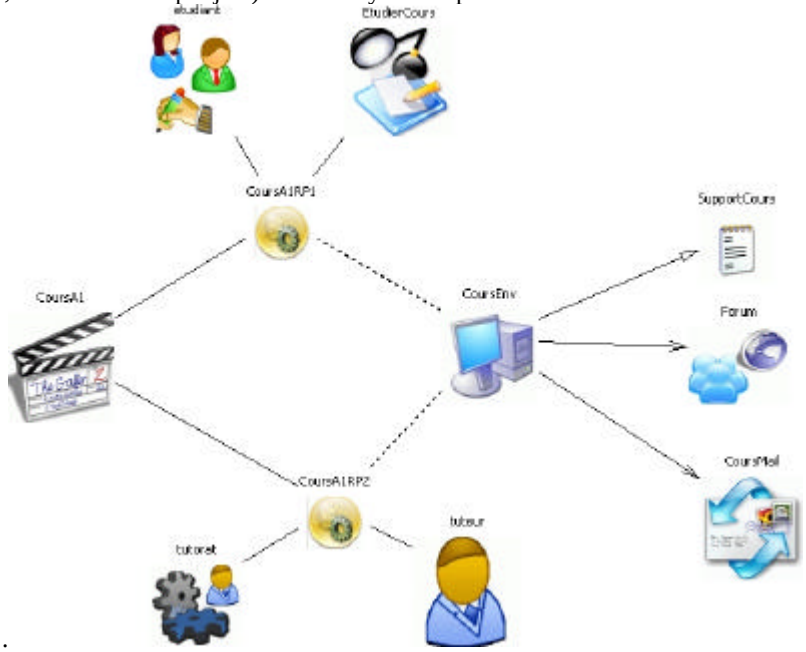


Fig 1 life cycle

One e xample

We illustrate here the use of Bricoles for a teacher. The person in charge of a master in computer sciences wants to propose a distant version of the diploma. The responsible has chosen the Ganesha e-learning platform to realize this version. The Java course is a small one including only the main principles of Java programming (like a remainder). This simple course may illustrate the life cycle of Bricoles.

First, the Java teacher defines the scenario. As he/she prefers to use IMS-LD, he/she begins to load IMS-LD in RAM3. Then, he/she may define the IMS-LD model corresponding to the Java course (Fig 2). He/she describes the different roles (students, author, and teacher) and the different phases (to study documents, to do exercises, to realize small p roject) which may run in parallel



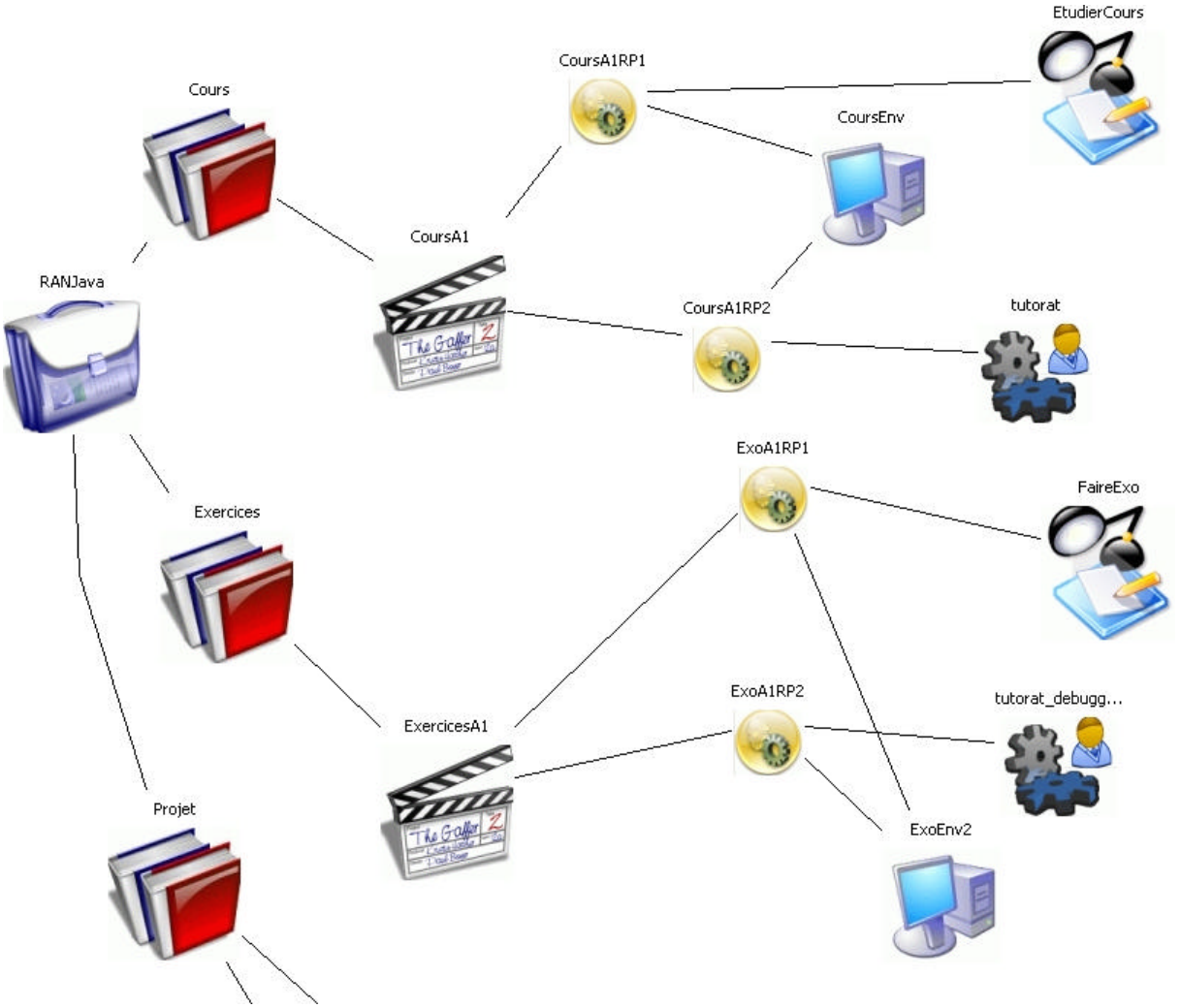


Fig 2 Two different views for course java

Next, he/she chooses to project his model to the Ganesha platform (he/she can do this because transformation rules has been defined before). The transformation engine creates the Ganesha model corresponding to the previous IMS-LD model. The teacher may use RAM3 to edit the resulting Ganesha model with RAM3 (see Fig 3) in order to improve it. This transformation/exportation shows fundamental differences between the IMS-LD scenario and the Ganesha one. Inside the Ganesha model framework it is not possible to attach support activities to learning activities, as is it possible with IMS-LD (tools are group dependant). Messages, commentaries and files are not contextualized. It makes sense that teacher has to refine the model resulting from transformation. Note that the simple/rapid exportation helps teacher to easily understand platform functionalities (if he/she does not know it), and how they influence his pedagogical scenario.

Finally, teacher uses GenDep to deploy his Ganesha model on the (Ganesha) platform where it has to do his course. After GenDep asks him/her web address of the platform, it simulates a web user filling web forms, which are presented by the platform, in order to deploy corresponding group, to assign students to group, to allocate resources to students…. Simulation is done by sending HTTP requests (protocol used on Internet)

We are studying same process to export our scenario on Claroline (CLAROLINE), Moodle (MOODLE) and PostNuke (POSTNUKE) platforms.

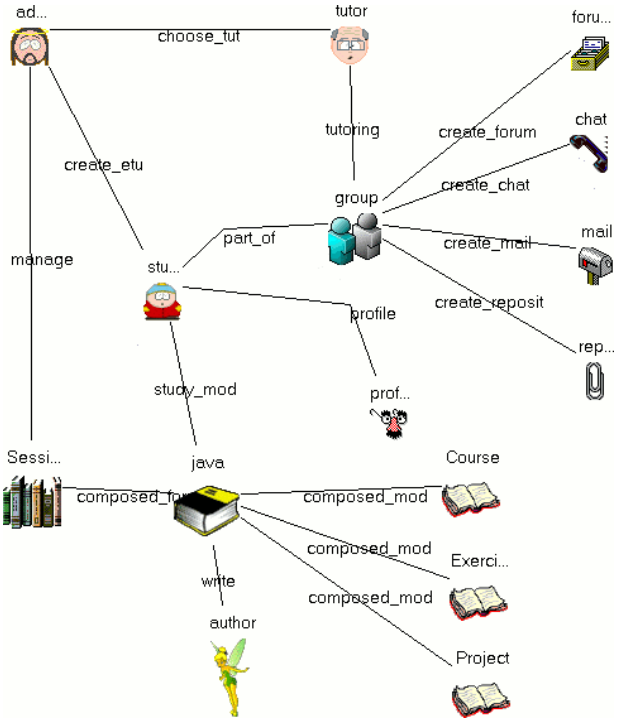


Fig 3 Course model on Ganesha

Conclusion

Modeling is the main principle of our proposition. It softens the transition between needed pedagogical bricolage and needed computer structural data. It is a suitable solution for teacher “courses designer”. Modeling a pedagogical scenario introduces secondary artifacts in the design process. These ones and the process we want to set up are adapted to teaching public because they allow “Bricolage” and prototypal manipulation throw different artifacts. When we define new boundary object for teacher community we expect to enhance reuse of path on different platforms and knowledge sharing. We think that if courses adaptation on different platforms is a sterile and chronophagous activity, design and quick redesign of courses on different platform throw intuitive artifacts make senses for teacher. This process is not far from “Bricolage”. This is the process we want to address when we suggest to deploy pedagogical scenario throw different e-learning platforms. Our solution is inspired by Model Driven Development philosophy, and Educational Modeling Languages. We hope that to define process to design pedagogical scenario will have influence on student learning as pedagogical “Bricolage” have. For different projects (like European Kaleidoscope (KAL) we have written several scenarios and modeled them. It remains several tasks to do. Firstly we want to specify metamodel of other platforms (other that Accel, Ganesha, Claroline) and their associated “deployment protocol”. Secondly we develop a graphical editor to define transformation rules because currently such rules are defined in XML files and we hope to make rules definition accessble to pedagogical engineers. Last, we are studying other artifacts than class diagram to model cooperation and elements that promote it (incomplete data…).

We will test our prototype with other specialists during the summer school for e-learning French community that will take place in July at Autrans (France).

Reference

Flichy, Patrice. L'innovation technique: récents développements en sciences sociales. Vers une nouvelle théorie de l'innovation. Paris : La Découverte, 1995

Granath J A., Lindah G.A., Rehal S., From Empowerment to Enablement. An evolution of new dimensions in participatory design. Logistik und Arbeit n°8 1996.

Wartofsky, Marx W (1973), Perception, representation, and the forms of action: toward an historical epistemology, in Wartofsky, M. W., Models, Dordrecht: D. Reidel Publishing Company, 1979.

Star, Susan Leigh (1989), The Structure of Ill-Structured Solutions:Boundary Objects and Heterogeneous Distributed Problem Solving, in Gasser, Les and Michael N. Huhns Distributed Artificial Intelligence, volume II, London: Pitman Publishers, pp. 37-54.

Bertelsen Olav, Understanding objects in use-oriented design, Proceedings of the 20th Information systems, Research seminar In Scandinavia, Oslo, 1997.

Huberman, M.(1980) Recipes for Busy Kitchens: A Situational Analysis of Routine Knowledge Use in Schools. Washington, D.C., National Institute of Education, Program on Research and Educational Practice

Perrenoud Philippe,La formation des enseignants entre théorie et pratique, Paris, L'Harmattan, 1994, chapitre I.

Levi-Strauss, C., (1966). The Savage Mind. (2nd. ed.) Chicago: University of Chicago Press.p 17

Perrenoud Philippe, La pratique pédagogique entre l'improvisation réglée et le bricolage http://www.unige.ch/fapse/SSE/teachers/perrenoud/php_main/php_1983/1983_01.html

Merrieu Philippe, Un nouvel art d'apprendre, Intervention aux Entretiens de la Villette, 1999 http://www.unige.ch/fapse/SSE/groups/life/textes/Meirieu_A2001_02.html

Papert and Turkle in "Constructionism" Ablex Publishing Corporation, 1991 Chapter 9

Ben Ari Mordechai, Constructivism in computer science education. Journal of Computers in Mathematics and Science Teaching, 20(1):45–73, 2001.

LEARNATIVITY: http://www.learnativity.com

Büscher M, S Gill, P Mogensen & D Shapiro (2001) 'Landscapes of Practice: Bricolage as a Method for Situated Design', Computer-Supported Cooperative Work: The Journal of Collaborative Computing, Vol. 10, No 1, pp. 1-28. Pdf

Büscher, M.; Mogensen, P. Agger Eriksen, M.; Friis Kristensen, J. (2004). Ways of grounding Imagination. Proceedings PDC (Participatory Design Conference) 2004

Hartswood, M., Procter, R., Slack, R., Voß, A., Büscher, M., Rouncefield, M., & Rouchy, P. (2002). Co-realisation: Towards a principled synthesis of ethnomethodology and participatory design. Scandinavian Journal of Information Systems, 14, 2 9-30. http://www.daimi.au.dk/workspace/site/content/heading_07/papers/sjis_2002.pdf

MOF: www.omg.org/mof/

UML: www.omg/uml/

QVT: http://modfact.lip6.fr/ModFactWeb/qvtP.jsp

Koper, R. Modeling Units of Study from a Pedagogical Perspective – The Pedagogical Meta-Model behind EML. Open University of the Netherlands. First Draft, Version 2, 2001. Latest version available at: http://eml.ou.nl/introduction/articles.htm

Sallaberry Christian, Nodenot Thierry, Laforcade Pierre, Marquesuzaa Christophe, Model driven development of cooperative Problem-Based Learning Situations, Implementing tools for teachers and learners from pedagogical models Proceedings of the 38th Hawaii International Conference on System Sciences – 2005 http://csdl.computer.org/comp/proceedings/hicss/2005/2268/01/22680040c.pdf

Le Pallec Xavier, Derycke Alain, RAM3: towards a more intuitive MOF meta-modelling process, SCI 2003, Systemics, Cybernetics and Informatics.

GANESHA: http://www.anemalab.org/ganesha/

CLAROLINE: http://www.claroline.net/

MOODLE: http://moodle.org/

POSTNUKE: http://www.postnuke.com

Kal: http://www.noe-kaleidoscope.org/