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Revision of Recursive Entity Modeling Method: Notion of Sequence, Roles and "Components" and "Conception" Elements

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Abstract--- In previous work, we have developed an educational modeling method, named REMM "Recursive entity modeling method", and experienced it through educational scenarios case studies using various teaching strategies. Although the obtained results show its robustness compared to existing modeling methods, it still necessitates some rectifications in order to increase its expressive power and ensure its flexibility, and also to facilitate the design of a notation language, based on our method, interoperablewith the most used educational modelling language IMSLD.

Keywords---Recursive entity modeling method, pedagogical entity, pedagogical Sequence, Role, educational modelling

I. INTRODUCTION

With the evolution of new information and communications technology as well as pedagogical theories, teaching and learning practices have attracted great attention. So, several horizons were opened, including among other, the information sharing, online training and learning diffusion, which firstly dispense both learners to move and expensive costs to acquire information, and secondly, to pursue their learning according to their rhythms without time constraint ... But in counterpart, it requires the staff to structure and plan in more detail their courses in order to manage the distance complexity and anticipate the learning process [2]. Faced to this problem, many researches have been focused on pedagogical scenarios modeling which consists to describe them formally in order to be operationalized on a technology platform [2]. So, several educational modeling languages have been suggested such as EML [5], IMS LD [4] inspired from EML, and educational engineering method MISA [12], as well as the other ones prior to the notation such as the method of Pleiades [5] ...

By conducting a thorough study on these educational languages highlighting their strengths and weaknesses, we conceived a new method prior to the notation called recursive entity modeling method (REMM) [16]. This method was tested through case studies of scenarios adopting different teaching strategies [17] and shown, compared with existing languages, several advantages, such as, its portability on all pedagogical approaches, especially on active teaching approaches (collaborative, cooperative and interactive) since it is rich in terms of granularity levels and semantic relations and provides more precise description of the educational situation role... However, it needs some improvements before to conceive a notation language based on REMM executable on technology platforms by ensuring its interoperability with IMS LD (the most used language) in order to capitalize its efforts achieved in the educational modeling. So, the aim of this paper is to revise our method REMM by clarifying well its components, and bringing some changes to improve its quality.

In the second section, we present an overview on our recursive entity modeling method addressing briefly its principle and its particularities such as the activity concept, the educational scenarios granularity and relationships, as well as the element "Components", the roles expression and the educational situation scenario design. Then in the third section, we firstly redefine the concepts of sequence and activity, and then we propose modifications to the elements Role, Components and Conception for sequence case.

II. OVERVIEW ON REMM

A. REMM Principle

REMM is a meta-model for both the design of contextualized educational scenarios having different granularities and its indexing in the educational scenarios database. It is based on the concept of meaningful pedagogical entity which may be of different granularities (activity, sequence, block or unit). Its role is to describe formally the all components of a pedagogical situation, e.g its educational aspect, its form, its history, its working environment, its deployed educational objects and those resulting at the end of its realization, all its compositional entities in the composite entities case, the assumed role(s), the scenario of its progress,…etc.

In what follows, we present special features of REMM (concept of activity, granularities and Relationships), as well as the components that will be revised in the third section.

B. Activity notion according to REMM

1) Classification of Activities according to EML, IMSLD and MISA

The activities are defined by IMS LD as tasks that learning unit actors must perform. According to EML, they are classified into three types: learning activity, support activity and instrumental activity. Each one is characterized by a set of prerequisites and educational objectives [13], whereas IMSLD and MISA methodsdistinguish two types of activities, namely:

- Learning Activity: action taken by a learner
- Assistance Activity: action performed by a teacher or other type of software or human facilitator [8].

The IMS LD defines also a activity structure which can contain a set of learning and/or support activities carried out by the same actor.

Although an implicit correspondence is often made between the types of role and activity, nothing prohibits to associate a learner type role to a support activity and vice versa, a staff type role to a learning activity [7]. On another side, it may be that the learning activity has a teaching purpose when the assistance amongst peer serves to learning [8].

Note that according to IMS LD, the activities classification doesn't solely based on their denomination, insofar as:

- Objectives and prerequisites can be defined for a learning activity and not for a support activity;
- A support activity refers to the role (or several roles) covered by the support, while a learning activity has no attributes to reference any recipient. [7]

2) Classification of activities according to REMM

The philosophy of education has long sought to better characterize the education notion ([15], [18]). Indeed, Ericson et al. judged that teaching and learning definitions are attached from a logical and / or a causal point of view [3]. The first view expresses the fact that there can be no need to teach if there is no need to learn (in the same way that the explanation notion is linked to the concept of understanding, without being causally) [14], whereas the second view is explained by the existence of an implication relation: the teaching activity involves the learning activity, as in the classic definition "to teach is to arouse learning" [11] [14]. This explains that the educational process has double facets (teaching and learning) which aim to provide a supervised learning to the learner by considering him as the protagonist in an educational activity. What makes it very difficult to distinguish learning and teaching activities since firstly a teaching activity was always the goal of acquiring learning to learners and secondly, a learning activity is often running under the staff assistance. Therefore, REMM considers that a pedagogical activity carried out by a learner and / or a staff can include learning and teaching acts rather to consider them separately. For this reason REMM defines prerequisites and objectives for any educational activity regardless of the type of roles who carry out it; while ensuring modeling flexibility of these roles.

C. Educational scenario granularities according to REMM

REMM models pedagogical scenarios within educational entities of four different granularities according to the aimed objective (elementary or structured objective). These four granularities are:

- Activity: represents the finest teaching situation granularity. Its objective is elementary and can be accomplished by one or several persons, in a given environment, by exploiting (or not) learning resources for specified duration. There are activities with explicit objective and others with implicit goal. For the latter, the achievement of the objective is ensured by bringing together several activities; which contribute to the composition of a sequence type entity.
- Sequence: corresponds to a less fine learning situation granularity; during which several activities are combined to achieve an elementary educational objective in terms of knowledge and / or skills.
- Block: represents an average learning situation granularity whose objective is determined in terms of knowledge and / or skills for a specific public. It can be composed by other blocks and / or sequences and / or activities.
- Unit: represents the highest granularity of a teaching situation. It can be composed by other units and / or blocks and / or sequences and / or activities to treat a specific learning subject for a specific public. The unit may designate a course, a module, a learning unit, semester, license, master, a project, etc.

The entities modeling pedagogical scenarios can be presented by the following class diagram:

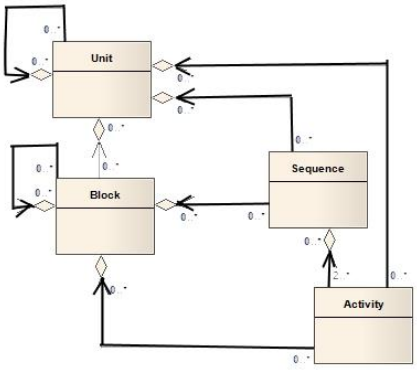

Fig 1 : Pedagogical unit conceptual diagram according to REMM

D. Relationships according to REMM

Among the strongest critics attributed to educational modeling languages based on the centered approach activity, is their inability to describe the relationship between the program (the educational scenario) and its context [9], then, in order to explain pedagogical intent of the introducing an educational entity in an educational scenario, we adopted six relations to aggregate educational entities forming the main entity modeling an education scenario, namely:

- Precedence: allows to execute sequentially the educational entities with or without respecting the conditions validation ;
- Hierarchy: expresses the case when an educational entity is detailed in another entity;
- Simultaneity: permits to trigger the implementation of several entities at the same time;
- Extension: permits to resolve the learners' profile-type diversification problem. Indeed, it allows to superimpose multiple customized pedagogical scenarios whose execution is conditional
- Accompaniment: expresses support situations and feedback situations related to the achieved assessments. It also includes effective assistance situations made during the execution of the pedagogical scenario and which are unintended a priori. These can be included in the scenario, enabling to provide assistance situations for future achievements of the same scenario;
- Choice: allows choosing the entities to be achieved regarding specific conditions related to prior learning results or specific circumstances.

The last three relationships are proposed by REMM, while the first three are borrowed from Plead method but adapted to REMM.

E. Educational situation roles expression according to REMM

Although the roles description by existing educational modeling languages (such as IMS LD, CPM [6], Plead[19] ....) has strengths, it raised several criticisms. Indeed, the most allow, other than the simple differentiation learner / tutor, to describe a hierarchy of contextualized roles for each teaching module [10]; Eg. IMS-LD envisages two main types of roles: learner and staff, for each one, it is possible to distinguish sub-roles. For example, the staff can be specified as teacher, administrator, moderator and mediator ... which helps to overcome the role stereotypical description and get a precise and contextualized role description. However, the description of the roles in IMS LD is abruptly, and their nature is not clearly identifiable: it is described for each activity in partition form (...) without the possibility to include the role in the context rather than to associate it to an activity ... [1]. For this reason, REMM considers the pedagogical situation actor can be staff and / or learner which can assume sub-roles and realize the pedagogical task within a clear and detailed organization. To do this, we have modeled the role in a component "Actor" by detailing its proprieties through the following attributes:

- Actor_Type: indicates if the entity will be run by a staff (a teacher, a tutor, a moderator ...) and/or by a learner.
- Actor_Performer: shows the organization of actor who will realize the entity. In this attribute, the actor can be either "Group" when a group of individuals working together to achieve the entity or "Individual" when each individual works alone;
- Actor_Number: Specifies the number of performers actors or simply choose one of the following values: "one" or "several";
- Actor_Framework : indicates if the entity actor works individually or in a group or if it belongs to different groups. This attribute takes one of three follow values: "Group", "DifferentGroups" or "Individual";
- Actor_Work_Type : This property shows if the actor work is common or different regarding his peers in his framework, when ActorFramework is "Group". However, if the framework is "Individual", this attribute takes the autonomous value. Thus, this attribute can takes one of three following values: "Common", "Different" or "Autonomous";
- Actor_Framework_Reference : This optional attribute allows to identify the entity actor framework. It takes the organization name (GroupX, Equipex) or actors working space (class forum).
- Role: represents the work (activity) that must be accomplished by the actor.

F. The element "Components"

This element contains references of the entities girls constituting the composite entity. It is composed by zero or more components "Entity_Girl". This later is defined by the following attributes:

- EntiyGirlReference : contains the entity girl reference in the educational scenarios database.
- Version: gives information about the version of the entity girl used in the entity. If it is not set, this attribute takes the original copy version value.
- EntityGirlKey : used to attribute second entity identifier to the entity girl. This one will be a used to addressing it in the parent entity conception (design).

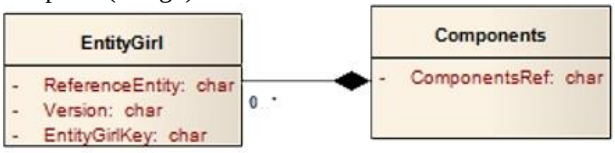

Fig 2: Element "Components" classes diagram

G. Component "Conception": Educational situation Scenario according to REMM

REMM defines the educational situation progress scenario into the component "Conception". Initially, this one can be an Entity_Unique, a Path or a Node.

1) Entity_Unique

It defines a single entity girl to be run within the parent entity, eg. a unit of course type is composed by an entity of block type which details the course content. Indeed, it is referenced by the second identifier given to the entity girl within the entity parent.

2) Path

It consists of a set of connections which aggregate the entities girls. This component is composed by the following attributes:

- "PathReference": references the path in the entity for further exploitation
- "Connection": links at least two elements (entity_unique, path or node) in the educational scenario by a specific relationship according to conditions or not. It is composed by the following three attributes :
    - "Element": defines a single item that participates in the link. The latter is either "Entity_Unique" type, "path" type or "node" type;
    - "Relation": it is the relationship that connects the elements in a component "connection". This attribute can take one of the following values: precedence, hierarchy, accompaniment or extension;
    - "Condition_Relation": describes the condition allowing the relationship execution.

3) Node

It permits either to:

- choose the element to achieve among two or more elements (choice relationship);
- carry out two or more elements simultaneously (simultaneity relation).

It is composed of the following sub-components:

- Grain: describes both a single element, and the relationship linking this element to the connected upstream node as well as the condition of its opening. To express this information, Grain is composed of :
    - Element: previously defined in "Connection";
    - Opening_Condition: the condition that allows the execution of the element;
    - Relation_Element_Upstream: specifies the relationship linking the element and other one located on node upstream. It takes one of the following values: Precedence, Hierarchy, Extension, accompaniment, or Simultaneity.
    - Relation_Node: This attribute provides information on the relationship combining the node elements. It takes as value "Choice" or "Simultaneity".

III. PROPOSED REVISIONS TO REMM

A. Scenarios with elementary goal revision

Taking into account the strong relationship (causal and / or logic) between the learning and teaching processes (in subsection 2.2.2), we find that these two processes can be completed in parallel on the same educational stage regardless the adopted teaching strategy and the learning delivery mode. This proves that within an educational entity defining an elementary goal, it may appear, other than the main activity corresponding to one of two processes (learning or teaching), other micro-activities [9] matching one of these processes in response to the main activity, or having a complementary status to achieve the educational situation goal or logistical type to insure its execution. For example, in an activity of evaluation type :

- The student recites a poem in front of the teacher.
- To complete the evaluation, the teacher listens, corrects and finally gives a point.

So, for pedagogical situations with an elementary objective, it can be only modeled into an elementary entity, i.e. activity or sequence type.

- An activity (as has already set) corresponds to the pedagogical situation modeling having an elementary objective with only one task to be performed by one or several roles (Learner or Staff);
- A sequence: it is redefined, in this work, as the pedagogical situation modeling having an elementary objective achieved with several activities execution. These activities must be described as tasks assigned to the roles of the educational situation modeled and referenced as part of the sequence; rather than modeling each task as part of an activity type independent entity. The goal of this choice is to facilitate the work to designers and to model more meaningful and expressive scenarios/entities.

  So, following the above definitions of educational entities with elementary goal, and by keeping the same definitions proposed by REMM for educational scenarios block and unit type, the educational scenarios granularity depicted in Figure1can is re-illustrated as follows:

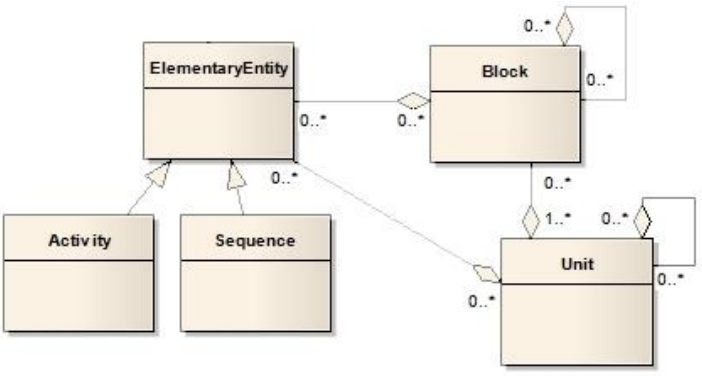

Fig 3: revised Educational unit conceptual diagram

B. Revision of the element "Components"

In the previous version of this element, we have modeled the composite entities whose components are educational entities type having a granularity less than or equal to that of the entity parent. To take into consideration the case of entities having an elementary objective (Sequence and activity), we consider that this element can have zero or more tasks. These one are designated by "Task" and composed of the following attributes:

- TaskRef: references the task as part of the educational entity.
- TaskStatut: shows if the task has a main or complementary status or if it is a logistical task type whose the purpose is to support the implementation of other tasks in the educational scenario.
- TaskDescription: describes the task to be performed by the role.

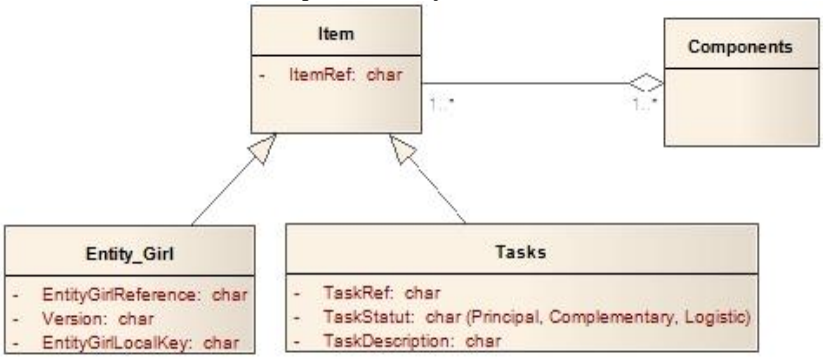

Fig 4: Element "Components" revisited

C. Revision of the roles expression

Although REMM has shown, through previous case studies [17], its great flexibility and strong ability to express various roles cases corresponding to different teaching strategies; it's need more explanation and suppleness in order to express flexibly, on the one hand, the different case roles regardless of their type (learner or staff or both), their organizations (working individually, in groups ...), the work type (common, different) and their working mode (cooperative, collaborative, ...), and on the other hand, the case of roles in the sequence considering that these can assume several different tasks to achieve elementary objective. Thus the role modeling revision can be made using the following elements:

- Individual: Sets the educational situation actors. An individual can be learner or staff, who can be arranged as part of a group, subgroup or no group (each works independently). Each individual is referenced by *IndividuRef* and has a set of attributes which identify it such as: name ... etc (these attributes will be discussed in detail in another article).
- Group: represents the organization of individual (students and/or staff assuming roles in the educational scenario). This element contains the following attributes:
  - GroupeRef: references the group with a single value.
  - GroupeTitle: it is optional; it allows assigning names to groups.
  - MembersTypeWork: it takes one of the following values: Common, different to show whether group members have the same or each has its own task.
  - MembersWorkStrategy: to show whether group members collaborate, cooperate or each work individually to realize one or set of activities in the entity
- Role: This property has the following attributes:
  - RoleRef: References the role
  - RoleTitle: designates the title assigned to the actors (learner and / or staff).
- Task: this is the work to be performed by roles; this attribute accepts as value the task reference already defined in the element "Components".

The diagram in Figure 5 illustrates, the pedagogical situation roles modeling by their assigning tasks to do, and also defines the various pedagogical scenario granularities and relationships between them according to REMM. Note that other educational scenario components are not addressed by this diagram

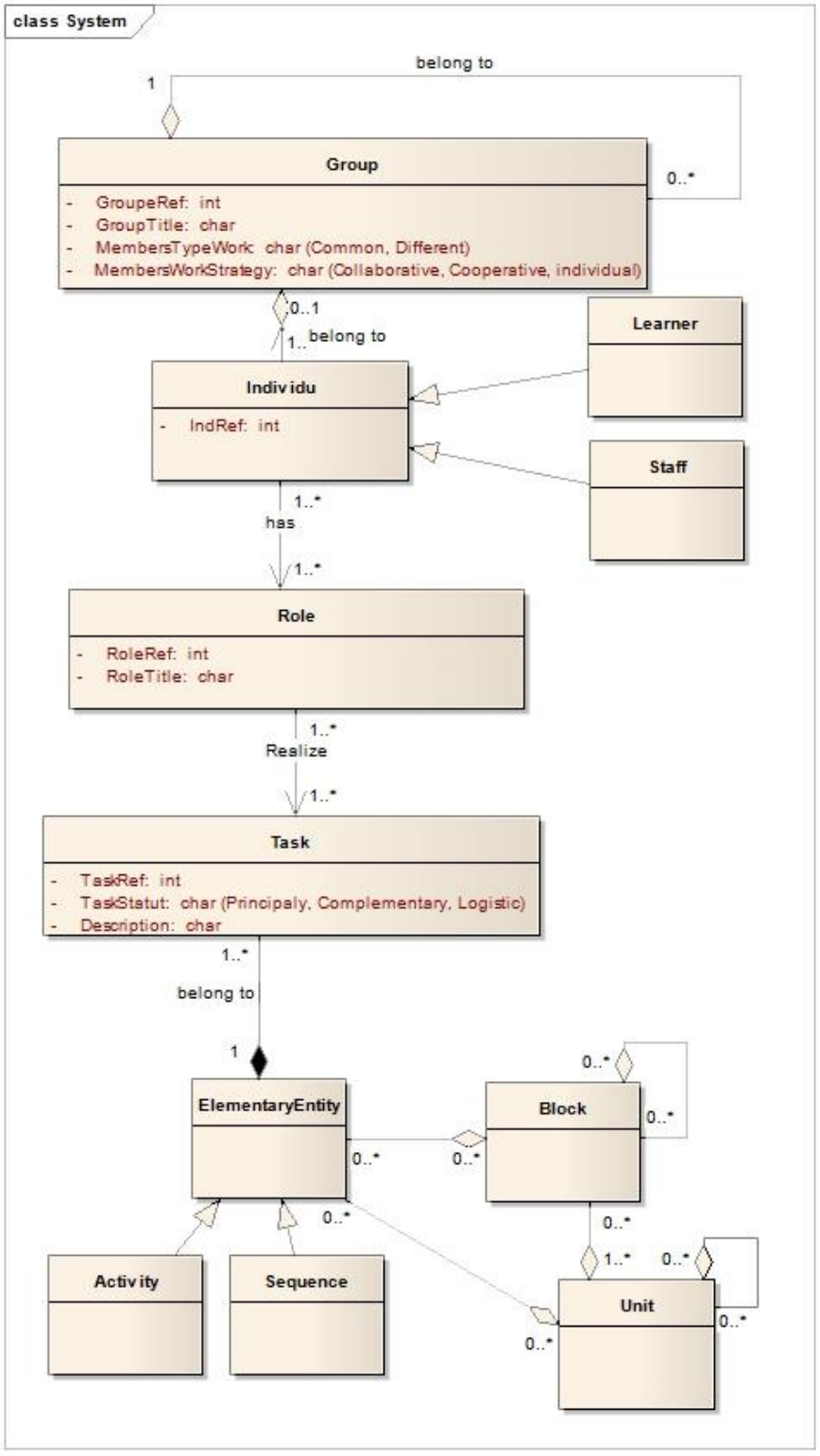

Fig 5: Conceptual diagram of revisited Roles and their tasks modeling.

D. Revision of the component "Conception": educational situation Scenario according to REMM

In a sequence, several tasks canbe performed in order to achieve an elementary educational objective. These tasks must be normally defined for the first time into the element "Components" by referencing each one with a unique identifier (TaskRef.).

As defined, the component "Conception" can be a single entity, a path or a node; but to model the elementary entity case (Activity, and Sequence), we must consider that, "Conception" can also be a task type. Furthermore, we review the component "Element" defined in the components "path" and "Grain" (subsection 2.7), by adding to its defintion the following attributes:

ElementType: can accept one of the following values: Path, Node, Entity_Unique or Task in order to aggregate the tasks defined in a sequence.

ElementRef: Receives the reference of the selected element in the attribute "ElementType". In the element task case, this one must be referenced by the same identifier (TaskRef) designed already to the component Task assigned to the educational situation roles.

Afterwards, these tasks will be linked together in the elements Path and Grain using the same relationships proposed by REMM.

IV. CONCLUSION

In this paper, after presenting an overview on the recursive entity modeling method, including its working principle, the activity concept, the educational scenarios granularity, relationships aggregating the various entities of an educational composite entity, the expression of roles as well as the elements "Components" and "Conception" which express respectively entitiesgirls composing an educational entity and progress scenario of the educational situation modeled at this entity, we have proposed some revisions on these components to support the sequence concept changes in order to ensure an expressive and meaningful scenarios design and to facilitate the conception of notation language based on our recursive entity modeling method.

REFERENCES

[1] Choquet Cristopher, 2007,Ingénierie et réingénierie des EIAH - L'approche REDiM, Ing_enierie et réingénierie des EIAH - L'approche REDiM. Human-Computer Interaction. Université du Maine, 2007. <tel-00276225>, https://tel.archives-ouvertes.fr/tel-00276225.

[2] David, J.P, Godinet, H., George, S., Villiot-Leclercq, E. (2007). Scénariser une situation d'apprentissage collectif instrumentée : réalités, méthodes et modèles, quelques pistes. Colloque Scénario'07. Montréal

[3] ERICSON D. P. & ELLETT F. S. (1987). « Teacher accountability and the causal theory of teaching ». Educational theory, vol. 37, n° 3, p. 277-293.

[4] IMSLD (2003).IMS Learning Design specification. Boston, USA: IMS Global consortium. Retrieved March 8th, 2006 [WWW document]. URL http://www.imsglobal.org

[5] Koper, R. (2001). Modeling units of study from a pedagogical perspective: the pedagogical metamodel behind EML, Educational Technology Expertise Centre, Open University of the Netherlands June, 2001 [WWW document]. URL http://eml.ou.nl/introduction/ articles.htm. Juin 2001.

[6] Laforcade, P., Nodenot, T., Sallabery, C. (2005). Un langage de modélisation pédagogique basé sur UML. STICEF, vol.12

[7] Lejeune, A., (2004), "IMS Learning Design ", Distances et savoirs 4/2004 (Volume 2), p. 409-450. URL:www.cairn.info/revue-distances-et-savoirs-2004-4-page-409.htm. DOI :10.3166/ds.2.409-450.

[8] Michel Léonard, Gilbert Paquette, 2013 : "Rapport d'étude : Modèles et métadonnées pour les scénarios pédagogiques". 2013-07-11. URL :http://www.gtn-quebec.org/rapport-detude/modeles-et-metadonnees-pour-les-scenarios-pedagogiques

[9] Nodenot, T., (2006), "Etude du potentiel du langage IMS-LD pour scénariser des situations d'apprentissage: résultats et propositions". Paperpresentedat the colloque, Scénariser l'enseignement et l'apprentissage : une nouvelle compétence pour le praticien ? , INRP, avril 2006, Lyon, France.

[10] Nodenot, T., (2005), "Contribution à l'Ingénierie dirigée par les modèles en EIAH : le cas des situations-problèmes coopératives". HDR. Université de Pau et des Pays de l'Adour

[11] NOT L. (1987). Enseigner et faire apprendre. Toulouse: Privat.

[12] Paquette G., Crenier F., Aubin C., (1997), Méthode d'ingénierie d'un système d'apprentissage (MISA), Revue Informations In Cognito, numéro 8, 1997.

[13] Pernin, J-P. (2003). Objets pédagogiques : unités d'apprentissage, activités ou ressources ? Revue "Sciences et Techniques Educatives",Hors série 2003 " Ressources numériques,XMLet éducation", pp 179-210, avril 2003, éditions Hermès.

[14] Philippe Dessus, « Qu'est-ce que l'enseignement ? Quelques conditions nécessaires et suffisantes de cette activité », Revue française de pédagogie [En ligne], 164 | juillet-septembre 2008, mis en ligne le 01 juillet 2012, consulté le 12 décembre 2014. URL : http://rfp.revues.org/2098

[15] REBOUL O. (1981). La philosophie de l'éducation. Paris : Presses universitaires de France.

[16] Rifai, A. &Messoussi, R., (2010a). "the recursive entity modelling method. Paper published in British Journal of Educational Technologies,

[17] Rifai, A. &Messoussi, R., Bakrim, M., (2010b), "Learning scenario modelling by the recursive entity modellingmethod : Case study". Internationale Conference on Models of Information and Communication Systems (MICS'10), 2-4 November 2010, Rabat, Maroc.

[18] SCHEFFLER I. (2003). Le langage de l'éducation. Paris :Klincksieck.

[19] Villiot-Leclercq, E. (2007). "Modèle de soutien à l'élaboration et à la réutilisation de scénarios pédagogiques". EIAH'07. Thèse juin 2007http://ute3.umh.ac.be/cours/scnr/partie_4.htm.

