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# Specification of a multilevel model for an individualized didactic planning: case of learning to read

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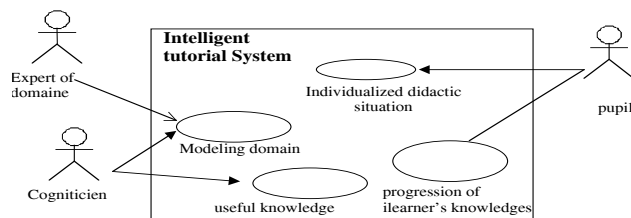
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**Abstract:** The basic idea of this paper is to follow a modeling by level, which has a progressive degree of smoothness, according to three approaches (Macroscopic, Mesoscopic and microscopic), to arrive at an individualized didactic planning. We follow in the first level a macroscopic approach. It is related to the individualization of the goal of working session; the second level is concerned by the calculation of sequence of didactic situations types. We will base our selves on an approach called mesoscopic; the third level requires a microscopic approach, which is related to each didactic situation. This level has the highest degree of smoothness, it covers all aspects of didactic situations: the contents, the interface and the scenario of unfolding.

## Introduction

Our research project proceeds in language Research Laboratory (LRL) within the framework of the project, AMICAL<sup>1</sup>. This project aims at the realization of intelligent tools media likely to a contribution to individualize teaching reading. It concern a particular training that to learn how to read mother tongue (French) with children in normal schooling at the beginning of there training. AMICAL is composed of three types of functional modules: the resource module, the exploration module and the tutorial module. Our research sticks on this last module, which has a multi-agents architecture, so we wish to integrate agents, which ensure an individual didactic planning by specifying their intervention in various levels of individualization. The tutorial module, must lead, in a controlled way, to the acquisition of knowledge by the student. It aims at proposing the student to realize learning sessions of reading, dynamically elaborated and adapted to a particular student at a specific moment of his learning. The sessions are the result of a process, “ didactic planing”, in which the system determines first an objective constructed from the knowledge it has about the student and the knowledge about the domain. This objective corresponds to a reading lesson in class. This session represents a quite short theoretical time with the student. Then, the system determines a sequence of didactic activities with corresponds to this objective. A sequence of didactic activities represents a whole combination of activities, which are proposed by the system to the student for a particular objective. The aim of this paper is to specify the model of didactic planning individualized by level, which has a progressive degree of smoothness according to three approaches (macroscopic, mesoscopic and microscopic).

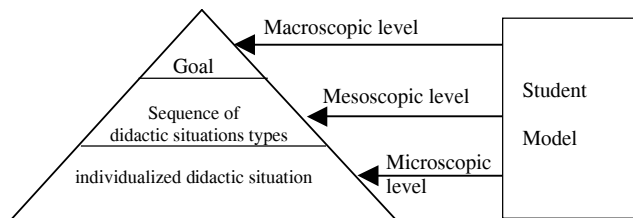


**Figure1:** Use Case UML Diagrams

<sup>1</sup> Architecture Multi-agents Interactive Compagnon pour l'Apprentissage de la Lecture (an interactive learning-to-read environment with a multi-agent architecture)

## 2. Levels of individualization in didactic planning

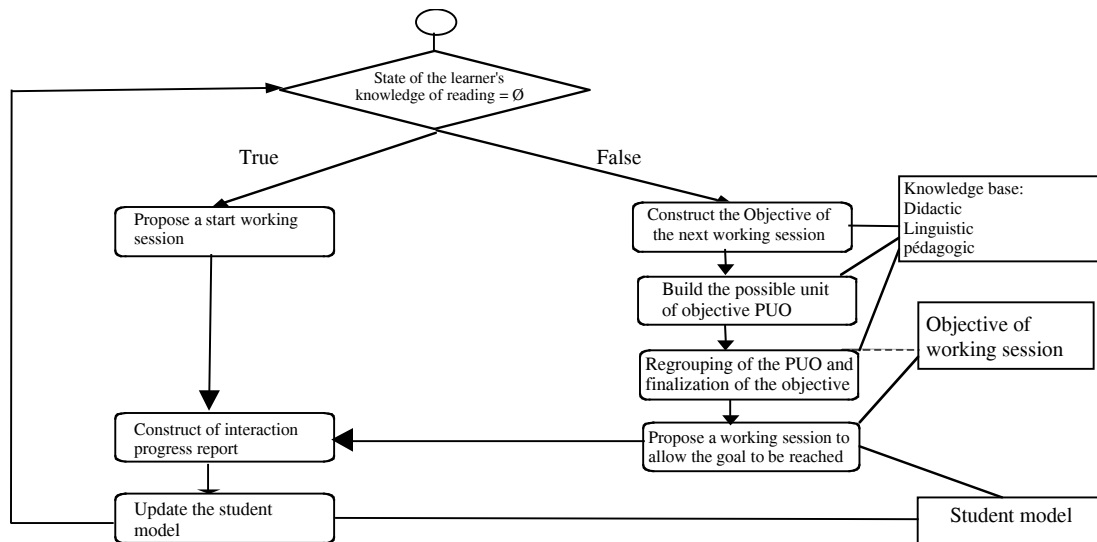
It is considered that didactic planning passes by three stages: - plan the objective of the next session of training which is in the highest level called “macroscopic level”, - plan the sequence of didactic situations types, while following a mesoscopic approach to determine the sequence and finally, - individualize each didactic situation, which requires the highest degree of smoothness. We follow in this level a microscopic approach, so that we can reveal all specificities of the didactic situation to be able to present as an individualized multi-media activity. This present work contains the way of integrating the process of individualization in these various phases while basing ourselves on a modeling by level.



**Figure 2:** Levels of individualization according to three approaches

### 2.1. The macroscopic level "Individualization of the Goal of working session":

The aim of an Intelligent Tutorial System is to individualize the learning and propose individualized didactic activities and be able to explore the progressiveness of learner’s knowledge. Then we must start by the first level of individualization to determine the objective of the next session, starting a student model, that one uses to collect all useful knowledge concerning it’s learning. This knowledge is represented under a particular format containing warp details of learning knowledge on various objects from reading (Letter, word) (figure 7). we call this knowledge “State of the learner’s knowledge of reading”. The objective is a whole of units of objective represented in the form of entities < Action; Knowledge unit > and <Action; statute-of-learner’s-knowledge; knowledge unit>. The construction of the objective is done dynamically in two stages: - the construction of the possible units of objective PUO and the construction of the objective starting from these PUO. Cleder C. (2002).



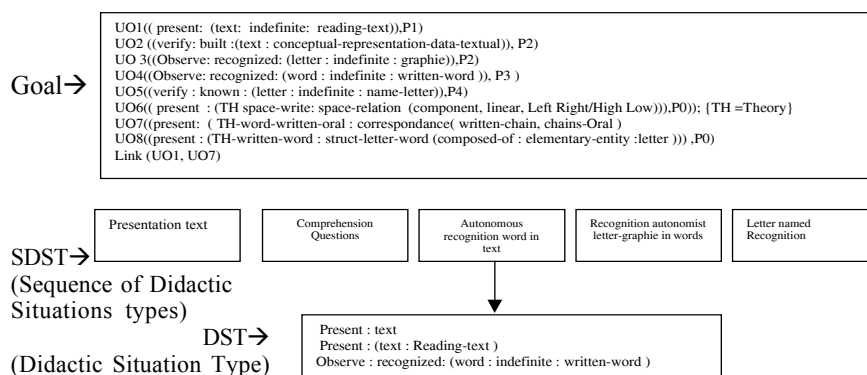
**Figure 3:** UML Activity diagrams: The macroscopic level "Individualization of the Goal of working session"

In the first stage, one determines the whole of the PUO starting from the state of the learner's knowledge of reading and organizing knowledge from the linguistic, didactic and teaching domains. Linguistic knowledge is related to the French language which one calls knowledge of languages (the description of the writing example: High - Low, Left right ; entities of the reading: letter, word, sentence...); didactic knowledge relates to the rules which determine the objective according to the state of the learner's knowledge, permitted to acquire a new knowledge through learning; or to modify the statute of knowledge. Pedagogical knowledge relates to all didactic knowledge which is not related to the field of the reading. The tools which one can use in this level: are the formalism of representation of knowledge dedicated to the system of training (MOT, MISA) Paquette G. (2002). The second stage includes two phases: the regrouping of the UO and the finalization. It acts in a first phase, to gather the possible units of objective PUO according to didactic, pedagogical and teaching principles, then affect priorities for each one. In the second phase, we build units of relevant and coherent objectives in terms of training. The individualization of the objective is a dynamic process which is done by using two types of rules: rules of selection of the UOP to integrate them into the unit constituting the objective in the course of construction and of the rules to assign priorities to the units of objectives Cleder C. (2002).

## 2.2 The mesoscopic level "sequence of didactic situations types"

From a theoretical point of view, if we consider the goal of a didactic session as an objective to be attained, the purpose of the sequence of this didactic situations types corresponds to the planning of a sequence of actions likely, to make it possible to achieve the goal fixed. We distinguish in AMICAL systems: the didactic situation types and the individualized didactic situations, didactic situation type "unit of action" corresponds to the smallest action that can be both isolated and meaningful in relation to the goal to be attained and with a relation to the student. It is meaningful because the student contribution to the action can be evaluated in relation to the goal of the session. It is the smallest possible action that can be isolated because it constitutes a whole that cannot be broken down into sequences of other didactic situations (themselves able to be isolated and meaningful). This elementary action is a configuration of couples < action, knowledge unite > or triple < action, statute, knowledge unite>. The individualization of the sequence concedes certain kinds of knowledge in particular about the student, the organization of the learning domain in its relation to the learning process involved, the chosen teaching methodology and the available didactic situations. In our case, the system calculates plans while being based on a library of didactic situations types and not on pre-set complete levels as in Blackboard Instructional Planner (Bb-IP) of Murray (1990). Here the system carries out the dynamic selection of a continuation of the didactic situations types which are regarded as building blocks used for the construction of a plan. However a situation can be grasped, if it satisfy all the conditions of adequacy compared to the state of learning knowledge and the compatibility of the constraints. In this level, we pass through three stages for the construction of a sequence:

- 1) Marking didactic situations containing couples or triplets present in the objective.
- 2) Assignment of weights to didactic situations types according to priorities calculated by the responsible agent (style of learning training, and especially its history).
- 3) The filtering of these didactic situations types to have a sequence of didactic situation likely to achieve the goal built, always by using a student model.



**Figure 4 :** The mesoscopic level " the sequence of Didactic Situations Types"

## 2.3 The microscopic level ( didactic situation)

The didactic situation is an entity complex multi-faces Bussapapach (2000). According to one of these faces, a didactic situation is a unit of action (it corresponds to the smallest one and at the same time to the isolable and the significant action which the system carries on for the objective fixed and attained by the student), the didactic situations constitute sequence training situations associated with an objective, is individualized by using the parameters of individualization. These parameters can be related to various aspects of the training situation, related on the contents, the interface and the teaching scenario. We introduce here a new approach of representation of the didactic situation under a Learning Object format which is the subject of many works, aiming to the standardization of their indexing. Paquette G (2004), Pernin, J.P.(2003), Dufresne A., Henri F & Hotte R. (2002).

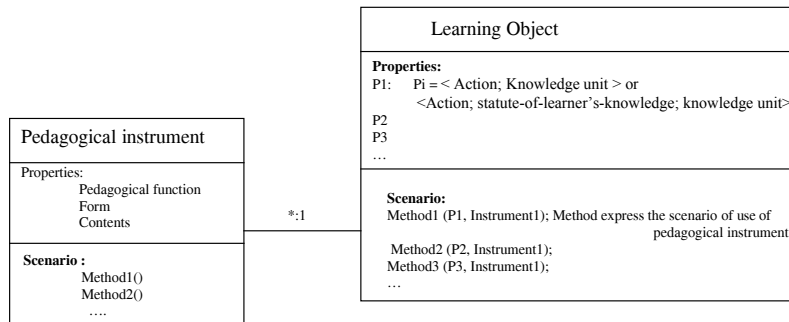


Figure 5: Meta model of Object learning according to the formalism of UML Class diagrams

### 2.3.1. Individualization of the contents:

It acts, in this stage, we instantiate knowledge illustrated in couples and triplet of the object learning properties all being based on the student model. For example the individualization of a didactic situation of recognition of word, in a text, will be particularized by elements such as: the text chosen, the number of words to be recognized, the nature of these words, knowledge present in the text, according to their compatibility with the objective and knowledge of learning. If we wants, for example, to instantiate the triplet < verify; Known; word-current >; we must replace the variable ' Word-Courant' by a word ' M1 ' while basing our selves on learned word s already known in the student model. (Figure 7)

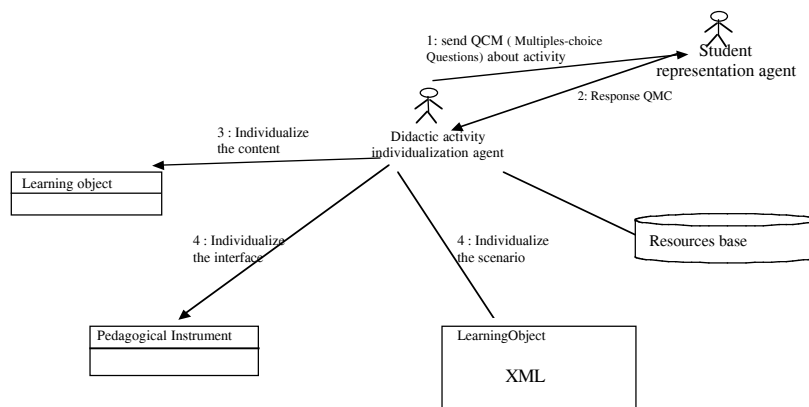


Figure 6: The UML Collaboration diagrams: Microscopic level (didactic situation)

### 2.3.2 Individualization of the interface:

The individualization of the interface is related to the adaptation of this latter to learner. The proposals concerning the characterization of the training situation seems don't correspond perfectly to all the pedagogic needs, for that, we aims at concretizing the pedagogical aspect while following our current design of the training situation by pedagogical instruments based on interfaces. A pedagogical instrument is defined as being an adequate entity, suited to turn on an action of the system. This entity can be used, re-used or consulted during a didactic situation to carry out a task behind a pedagogical intention. The pedagogical instruments, is characterized by four criteria:

- Pedagogical Function: who can answer a pedagogical intention of type  $\langle$  action, knowledge unit  $\rangle$  or  $\langle$ Action; statute-of-learner's-knowledge; knowledge unit $\rangle$ .
- Scenario of use: the duration of use, numbers tests, proposal of the assistance...
- Form: the shape of the instrument (Button defines; Fields of text; Word; letter, an image), colors, dimensions space...
- Contents Make: it is the contents (the text, the word, the button...)

### 2.3.2. Individualization of the pedagogical scenario:

The object learning scenario describes the way of use of each learning instrument, described by methods which are regarded as scripts behind each learning instrument. The parameters of individualization of the pedagogical scenario can be related to a number of tests given to learning for each word, the assistances suggests or imposes, the form, the nature and the formulation of instruments, ..., these parameters are included implicitly in the methods illustrated in the Learning Object.

#### Example :

One takes again the example quoted in the preceding level. Supposing that the student model contains the known words: [Jeanne, banane, noyau, poupée, un]

Student model contain:

Instance : Jeanne  
Written-word: Know-recognized  
Statute : Known-as-known  
Assumption context: SDT3 : session : 04-01-05  
....

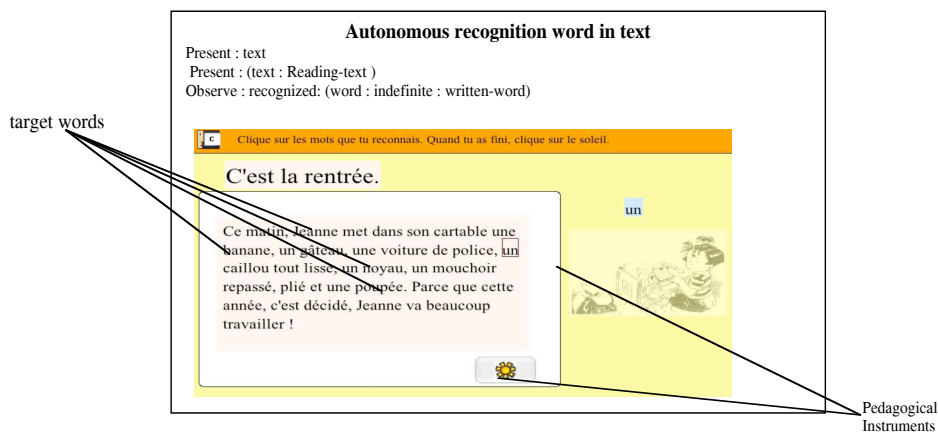


Figure 7: Example of individualized multimedia activity

### 3. Conclusion and perspective:

We presented in this work a new way of modeling per level according to three approaches (macroscopic, mesoscopic and microscopic) allowing to see the problem on the various levels of abstraction which start with highest or the goal of session to go on a less abstract level which is related to the sequence of didactic situations types and finishes by a low level which concentrates on the didactic activity itself. This way enables us to see well the various zooms, which increase on each level in order to show the various parts hidden in the preceding level. However a certain number of problems remain outstanding concerning the choice of the best strategy to be followed to return the planning system didactic individualized more effective. How we can go further in the degree of smoothness of last level? and what is the relation between degree of smoothness and didactic activity individualization agent? In fact, two policies can be brought into play concerning the definition of the individualization agent; one uses only one general agent to individualize any standard activity; or one which puts behind each activity an agent to individualize it by using the strategy Agent-Object Mahmoud A. (1996). Then, knowledge of the agent relates to one only standard activity and that can go further concerning the use of this knowledge what will make it possible to have a microscopic level of higher degree of smoothness which is exactly the subject of our future research.

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