Modelling the "Planet Game" Case Study with LDL and Implementing it with LDI

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Abstract: LDL (Learning Design Language) is an educational modelling language which was designed to model collaborative activities. This paper details the solution proposed to address, with LDL and the associated infrastructure LDI, the two steps presented in the workshop "Comparing Educational Modelling Languages on a case study". The modelling of the case study is described in detail. Its "operationalisation" and execution are illustrated with videos. The second step is addressed in conclusion.

Keywords: e-Learning, Learning Design Language (LDL), Modelling Learning Activity, Pedagogical Scenarios, IMS LD.

Interactive Demonstration: Embedded in this article are QuickTime movies of the demonstration of the operationalization and execution of the case study (see section 3). To view them, you will require Apple's QuickTime plug-in for your browser, or the player.

1 Introduction

The main objective of the Learning Design field is to give teachers and instructional designers the conceptual and the technological means to create and manage learning activities. Modelling an educational activity is a matter of building a scenario. A scenario is an abstract and general formal description of what a future activity will be. It generally describes the learning flow in details but not the specific context in which the activity will take place. Indeed participants are not identified in scenarios: they are just represented by means of roles. Neither are the ressources. In order to transform such a formal description in an on-line activity integrated in an existing LMS (such as Plone or Moodle), an "operationalization" process is required. After this operationalization, the activity could be executed. Thus, three steps can be distinguished in the life-cycle of a scenario: the design, the operationalization and the execution as shown in Figure 1.

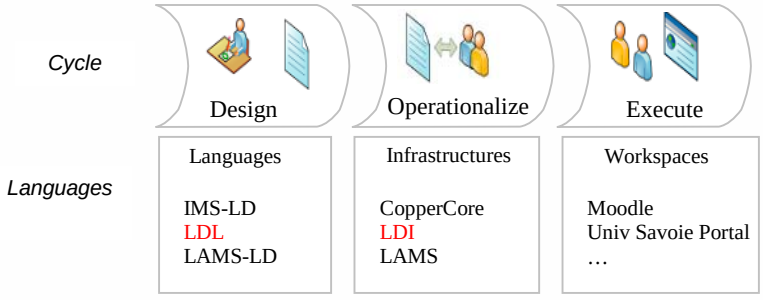

Figure 1: The life cycle of the model of the activity

LDL (Learning Design Language) is one of the EML (Educational Modelling Language) for modelling educational activities in order to produce executable activities in existing digital environments. It relies on a powerful meta-model which allows the representation of various situations, particularly collaborative ones, with few concepts. It is briefly described in the second section of this paper, and detailed in Martel, Vignollet, Ferraris and Durand (2006).

Considering LDL, a complete framework, from design to execution of the scenarios, is now available, associated with a methodology.

To help the teachers and the instructional designers in charge of the design of collaborative learning activities using LDL, the authors of LDL propose a graphical notation of each concept defined in the meta-model. They also make recommendations for the design stage in an associated methodology. Finally, they propose a design tool called model editor (Martel et al. 2008) which produces the LDL-XML binding of the model.

The Learning Design Infrastructure (LDI) associated to LDL will assume the operationalization of the scenario: first the participants are chosen, the roles are distributed, the services and the contents selected ; then, a corresponding activity is created in the targeted digital environment (such as Plone or Moodle) for the chosen participants. When operationalized, the activity can be performed: LDI manages its execution. It also provides the means to observe the progression of the activity.

The LDL team was one of the challengers during the workshop at ICALT'2006. This paper describes how they cover all the steps proposed for the specified case study. The first step is covered in section 2 for the modelling of the case study and in section 3 for the operationalization and execution of the model built. Finally, the way the second step is covered is described in section 4.

2 LDL to design the case study

LDL has been conceived to model collaborative activities. It is grounded on social theories which explain what is an activity and what is inherent in these activities. We consider an activity as a "unit of observation", in reference to Leontiev's works related to activity theory (Leontev 1978): the activity is what is going on at a given moment, which can be observed and analysed by an observer. LDL provides means to build models of activities, called scenarios. It integrates concepts which enable to take some inherent features of an activity into account, mainly its unforeseeable (Vygostky 1930) (Leontev 1978), situated (Suchman, 1987) (Fitzpatrick et al., 1995) (Garfinkel et Sacks, 1972) and interactional nature. Indeed, drawing a parallel with conversation (Austin 55) (Roulet et al., 1995), we consider an activity as a set of interactions between the participants involved.

A scenario is codified and formal description of a future activity. It is simply an arbitrary notation with which to describe a future activity planned by the author, independently of the context of its execution. Its production is based on an abstract model of a learning activity which is in turn constructed using a meta-model that defines all the concepts and their relationships that are useful for the description and modelling of the activity.

2.1 LDL meta-model

A scenario can be considered as a specification of the activity. Designing a scenario with LDL consists in describing the activity using the concepts of the associated meta-model (see Figure 2).

The concepts are succinctly defined as follows:

- **Interaction**: It is the main concept of the model. The interactions specify the exchanges the participants will have during the learning activity.
- **Structure**: A structure specifies the order in which the interactions will be played out, i.e. the learning flow. Several types of structure exist, to specify whether the order is sequential or parallel.
- **Role**: Held by the participants, a role is defined by the list of the interactions in which a participant having this role is involved.
- **Arena**: Where (and with whom) interactions are performed.

- **Rules**: Give the start-up and stopping conditions of the interactions or structures. Used to regulate the activity.
- **Positions**: Stated by participants/agents to make choices or to evaluate an activity.
- **Observables**: Every concept of LDL is observable. An observable requires an observer. An observed position is associated to each observable. Sensors are used to determine the value of an observable. Observed positions are also useful in producing structured traces of activities.

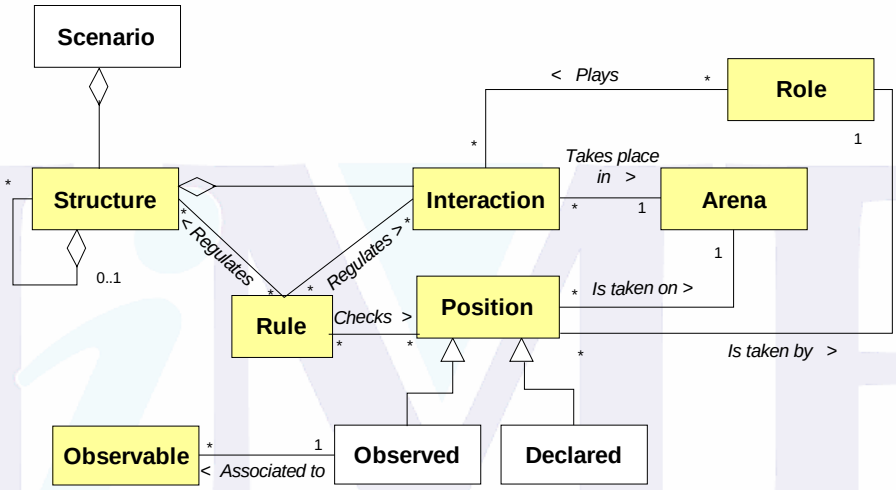

Figure 2: Simplified version of LDL's metamodel

The LDL meta-model is "Interaction centred". The modelling is guided by the spatial metaphor: participants' activity is situated, in the context of a service or content. So are their interactions in the corresponding arenas. In its simple form, an interaction is an action from one participant to another in a specific place. The initiator is called "the addresser", the other "the addressee".

LDL includes an original concept, that of position, which allows one to specify these reactions or actions and thus to adapt the activity according to them. Two types of position exist, depending on how the value of the position is obtained. A «declared» position means that its value is given explicitly by the participant involved. The value of an « observed » position is assigned by the system which deduces it from observation data on the activity's progression. The instructional designer will have to define aspects which are to be observed. These aspects are called the observables.

The value of a position is tested in the conditional part of a rule.

For a more complete description, see (Martel et al., 2006) and see also the description of the experimentations done with LDL in the Kaleidoscope project in Michelet, Adam, Luengo (2007) and in Lejeune David, Martel, Michelet, Vezian (2007).

2.2 LDL's associated methodology

A methodology has been defined to facilitate the modelling of learning activities. It is described in detail in Ferraris, Martel, Vignollet (2008).

To summarize, this methodology helps to formalize an informal version of a scenario, usually based on teachers' description of the activity they want to carry out with learners.

The LDL authors consider that the slightest educational activity is complex, and that it conceals several interwoven activities. First, they propose to distinguish four types of activity: learning, observation, assessment, organization. Then, they recommend following the steps of the formalization process set out below:

- The first step is to identify the activities which constitute the overall one, determining the type of each of them.

- The second step is to define the relationships between the activities, that is to say the learning flow and what the activities share with each other.
- The third step is modelling each activity, following the steps mentioned below:
    - Identify the interactions by naming them and define the learning flow;
    - Specify each interaction using the LDL concepts *roles* and *arenas*;
    - Specify the start-up and stopping conditions of each interaction;

2.3 Modelling the case study

2.3.1 Identification of the activities

This corresponds to the first step of the methodology. When analysing the informal scenario given in the case study description, we can easily identify the four kinds of activity (organization, learning, observation, assessment), which are usually described implicitly.

When analysing the informal scenario, it may be observed that the four kinds of activity we have mentioned in the methodology section actually exist in the planet game. For the learning activity, it is obvious. The informal scenario explicitly includes a lot of information about this activity. The learning objectives are listed, together with the way to reach these objectives (analysis of the clues, discussion in the chat room, negotiation with the other team, etc.). The aim is clearly for learners to acquire (build) knowledge about the organisation of the solar system.

The informal scenario also mentions the interventions of the teacher in relation to the learning activity. Indeed, the teacher has to observe the teams whilst the learning activity is proceeding. S/he may observe the team members' exchanges, their productions, the way they use the clues, etc. This is an activity *per se* during which the teacher may identify the difficulties encountered by the learners, may put new clues at their disposal, etc. This is the observation activity.

The assessment activity is also clearly mentioned. It consists of a summative assessment which occurs at the end of the learning period. It aims at checking the level and the solidity of their knowledge.

Finally, there are some elements which are related to organisation. They are mentioned in a less explicit way. The most obvious one is to set up the two teams. To be carried out, the planet game requires this step. It also requires the teacher to prepare some instructions intended for the learners, to put them at the learners' disposal, together with the useful resources (interviews, clues, shared whiteboard, chat room, …), to organise the course of the activities over time, etc.

These activities are represented graphically in Figure 3 , together with the learning flow between them (the schedule and the synchronisation points). Note that the learning activity appears twice, once for each team: the two activities correspond to the same scenario.

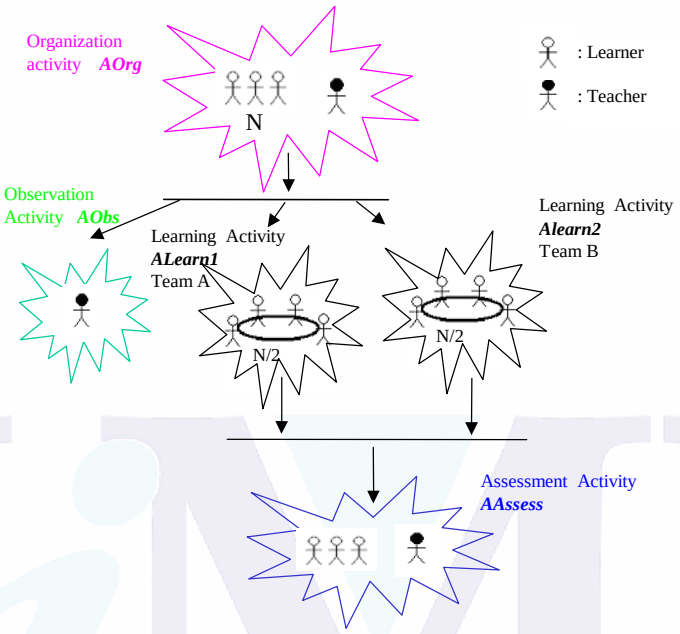

Figure 3: The four types of activities identified for the case study

2.3.2 *The activities' relationships*

The description of the relationships between activities has to be supplemented by the definition of the shared objects: arenas and position. The ALearn1 and ALearn2 learning activities share the forum which supports the negotiation of the exchange of clues. This arena is also shared with the AObs observation activity, as the teacher involved in the observation activity has to be able to at least observe what happens in it (see Figure 4).

Furthermore, the two learning activities, the observation one and the assessment one share the "end of the learning activities" position. This position is a decision by the teacher to be made explicitly in the AObs activity. Indeed, s/he observes the two ongoing learning activities and chooses the time at which to stop them, when s/he considers that the learners have worked sufficiently and have acquired enough clues and knowledge. Thus the AObs activity has to share this position with the two learning ones. As a consequence, these two activities will be aware of it and will be able to end. Note that it is also shared with the AAssess activity, as the end of Alearn1 and Alearn2 coincides with the beginning of AAssess.

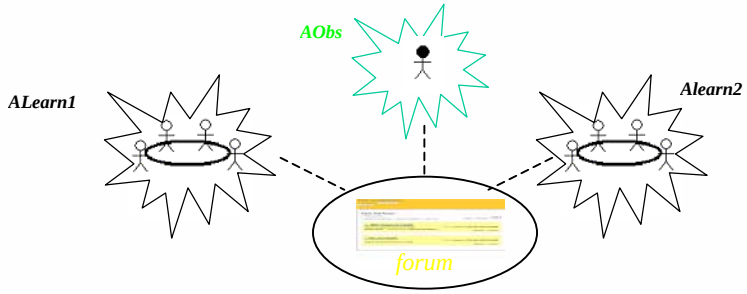

Figure 4: The forum is shared by the two learning activities and the observation one

2.3.3 *Modelling of each activity*

This section gives the specification of the activities, following the flow given in Figure 3.

2.3.3.1 The organization activity

When one analyses the informal scenario, the organization activity would seem to be dedicated to the choice of the group by the learners. Moreover, the organization activity allows one to prepare the learning activity. This means being able to operationalize and start the observation activity and the two learning activities. This leads to the definition of the interactions provided in the following section.

The interactions, associated to the roles and the arenas

The main flow is sequential and combines several interactions. The places where the activity takes place have also to be identified: the interactions are situated.

The interactions are summarized in *Table 1*, associated to the roles which are involved in the interaction.

The Role …	**Is the Addresser of …**	**The Addressees are**	**The interaction takes place in…**
Learner	Read the statement,	Learner	The statement
	Play the interlude	Learner	The interlude
	Choose a group (A or B)	Learner, Teacher	A questionnaire
Teacher	Create the learning activity for group A (*idem* for group B)	Learner	Organization activity
	Operationalize the learning activity of group A (*id.* for group B)	Learner	Organization activity
	Create the observation activity	Teacher	Organization activity
	Operationalize the observation activity	Teacher	Organization activity
	Start learning activity of group A (*id.* for group B)	Learner	Organization activity
	Start observation activity	Teacher	Organization activity

Table 1: The interactions of the organization activity

The rules and the associated positions

The organisation activity starts automatically with the reading of the statement. It has been stated that the choice of the group can only be made when all the learners have finished reading the statement. This is translated in the model by a start-up rule of the “Choose a group” interaction which tests whether each learner has taken the position “I have finished reading the statement”. This leads to the introduction of the “Play the interlude” interaction in the scenario, so that the learner spends the time waiting for the other learners to finish reading the statement. The start-up of this interaction is also related to the end of the “Read the statement” one, when the learners are considered individually.

The operationalization of the learning activity can start when the learners have chosen their group. All the other interactions start automatically, as soon as the previous one is over.

The stopping of all the interactions of the organization activity depends on the user’s action: when the user declares that s/he has finished, the interaction stops and the following one can start.

This is in the organisation activity where the teacher takes the position “I declare that the learning activity can start”; one position per group.

2.3.3.2 The learning activity

The learning objectives are listed in the informal scenario, together with the way to reach them. The learning scenario describes what may happen in the learning activities. There are two learning activities in the planet game, one for each team involved. The main participants in these activities are the learners. Thus most of the interactions specified in this scenario are intended for them.

The interactions, associated to the roles and the arenas

To model the learning activity, first, we considered the requirements described in the informal scenario. This led to the design of a first minimal scenario including 3 interactions (see table 2): the "Negotiate clues with the other team", "Discuss with your team members", and "Read the interview with the expert" ones. This skeleton was then extended in order to propose funnier and richer interactions to the participants. It was also an opportunity to show LDL's expressiveness. For example, the "Complete the planets' properties table" interaction allows the learners to gather and share the clues discovered and the planets' properties. The arena supporting this interaction is a shared table in which clues and properties can be registered. Another example is the "Take a test to win a clue" interaction. It has been added as another fun way for the learners to obtain clues. They can choose a quiz to answer in the "test bag" and, if the answer to the quiz is correct, they win a clue (the "Get clue" interaction in table 2). Finally, the "View the group members" interaction has been added to provide the members of a team with awareness. This interaction allows them to know the identity of their team mates involved in the same shared quest.

The Role …	Is the Addresser of …	The Addressees are …	The interaction takes place in …
Teacher	Add a test	Learner	Test bag
	Go and consult ESA Web site	Teacher	ESA Web site
	Stop the learning activity	Learner, Teacher	The learning activity
Learner	Negotiate clues with the other team	Learner	Forum
	Discuss with your team members	Learner	Chat room
	Read the interview with the expert	Learner	Notes taken during the Interview
	Take a test to win a clue	Learner	Test bag
	Get Clue	Learner	Clue
	Complete the planets' properties table	Learner	The table
	View the group members		The list of the team mates

Table 2: The interactions of the learning activity

The teacher is in charge of deciding when the learning activities ends (the "Stop the learning activity" interaction). To help with making such a decision, s/he observes what is going on in the activity. The observation is carried out in the "observation activity", described by the observation scenario (see the following section). Teachers can also add new quizzes in the test bag, in order to enlarge the set of clues which can be discovered by the learners. To help them produce these quizzes, they may access the ESA (European Space Agency) website via the "Go and consult the ESA website" interaction.

Figures 5 and 6 are snapshots of the player put respectively at the learners' and teacher's disposal during the learning activity, once the scenario has been operationalized and the execution has begun.

The interactions to which they had access at the moment when the snapshot was taken are listed in the upper part of the interface. In Figure 5, the learner has chosen to perform the “Complete the planets’ properties table” interaction. That is why the arena associated to this interaction appears on the interface. At that moment, the “Get clue” interaction is not visible, as the learner either has not yet answered a quiz or has done so, but has given a wrong answer.

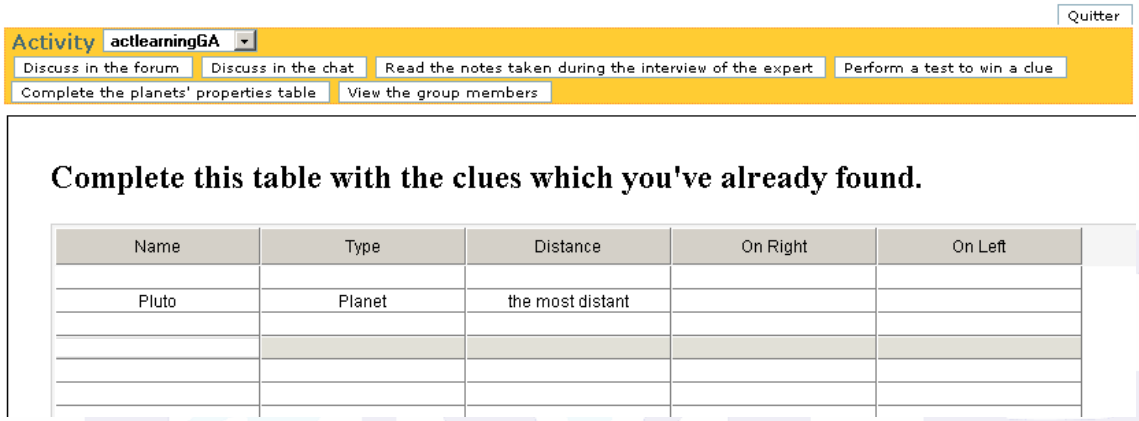

Figure 5: Learners’ player during the learning activity.

In Figure 6, the teacher is currently performing the “Go to the QTI folder” interaction. It gives her/him access to the corresponding arena, allowing the addition of new quizzes.

Figure 6: Teacher’s player during the learning activity.

The arenas appearing in the two previous figures have been chosen during the operationalization phase. They reify the arenas described in a generic way in the scenario.

The rules and the related positions

Interactions are proposed simultaneously to their addressers, who can choose which one to perform. This means that they are organised in a main parallel structure and that they start automatically as soon as the learning activities are started (“automatic start-up” rule). The “Get clue” interaction is an exception. It has to be put at the learners’ disposal only when – first - they have chosen the “Take a test to win a clue” interaction and – second - they have answered the test correctly. This has been modelled in the learning scenario as follows:

1. The interactions “Take a test to win a clue” and “Get clue” are embodied into a sequential structure which is itself embodied in the main parallel structure. An “automatic start-up” rule is attributed to this new structure.
2. A start-up rule is defined for the “Get clue” interaction. It tests the position “I have answered the quiz correctly ” of the learner, the position named P_answer in *Table 3*. This position has thus to be defined.
3. The P_answer position is defined as being an observed one. It is associated to an observable defined in the scenario as “The answer to the question”.

This is an example of an observed position. Observables, positions and rules are the means proposed by LDL to take into account what occurs in an ongoing activity and to influence the performance of the activity with regard to these events. It should be noted that several kinds of basic observables have been defined (see following section). They can be combined to compose more complex ones.

Table 3 shows the complete descriptions of some examples of observed and declared positions defined and used in the learning scenario. Some of these positions are shared by several activities. This is the case for example for P_start_learning and P_stop_learning. P_start_learning is a position taken by the teacher in the organisation activity. They are also checked in the condition part of the start-up rule of the learning activities.

Position Id	Title	Value	Type	taken by…	on…	Shared
P_start_learning	I start the learning activity	True or false	Declared	teacher	The learning activity	Yes
P_stop_learning	I stop the learning activity	True or false	Declared	teacher	The learning activity	Yes
P_answer	The exactitude of my answer	True or false	Observed	learner	The question	No

Table 3: Examples of positions used in the learning activity

2.3.3.3 The observation activity

The observation activity is specified to allow the teacher to apprehend and verify the progress of another activity and to detect difficulties encountered by the participants. To manage this, it has to be performed in parallel with the activities to be observed.

The importance of allowing such observations led the authors of LDL to propose that what is to be observed be specified in the model of the activity. To do so, they propose that each concept of the model be observable (Martel et al. 2006). For a description of the observable concept, see section 4.1.

Considering the Planet Game example, the teacher may be interested in the observation of the learning and of the assessment activities. So, the interesting concepts to be observed are: the productions (the identity cards of the celestials), exchanges between teams, exchanges within each team, the progression of the activity itself, etc.

Here are some examples of concepts defined as observable in the learning activity, associated with their semantics:

- For a given arena, who is inside? – This provides the localisation of the learners.
- The state of the interactions (started/active/stopped) – This gives information on the progress of the activity.

- The answer to a test, and more particularly who has answered the tests and is the answer correct? – This helps to know whether the learners manage to obtain more clues, and to decide whether more tests are to be proposed.
- The content of the table – This allows one to know whether the learners have acquired enough knowledge and to decide whether the learning activity can be stopped.

A dashboard is completed with the value of the observed positions associated to these observables.

The interactions, associated to the roles and the arenas

The observation activity gives the teacher the means to access this dashboard through a dedicated interaction. S/he can also access the content of the forum.

The rules and the associated positions

This interaction starts in conjunction with the learning activity. To manage this, both activities share the same position. This position is the one taken by the teacher in the organisation activity "I declare that the learning activity can start". It stops when the teacher so decides (another position is thus used).

2.3.3.4 The assessment activity

After the teacher has decided that the exchanges have ended, the evaluation of the knowledge acquired by the learners can be carried out. This is done through an individual questionnaire about the planet classification in which each learner has to associate the names of the planets to their position relative to the sun. The winner is the first learner to give the right associations: <Planet – Order>. The activity finishes when a winner is nominated.

The interactions, associated to the roles and the arenas

Two interactions are executed sequentially: "To Do Test" performed by each learner in a questionnaire (the test), followed by "To Proclaim the Winner", allowing the teacher and the learners to have access to the prize list (from the fastest to the least rapid one who has answered the test correctly). The interaction "To Proclaim the Winner" is thus situated in the prize list.

The rules and the associated positions

As shown in Figure 7, the interaction "To Do Test" starts when the assessment activity is started. It stops when the learner validates the test.

The next interaction, "To Proclaim the Winner", starts when all the learners have validated the test. This means, as in the organization activity, that it starts when each learner has taken the corresponding position.

```
<Interaction id="toDoTest">
        <action>Complete the map</action>
        <dans>test</dans>
        <destinataires> <role>learner</role>  </destinataires>
        <destinateurs> <role>learner</role> </destinateurs>
        <results />
        <startOn>
                <Rule id="toDoTestStartOn">
                <si>
                 <ExprConditionnelle>
                        <exprCond>conditionStartTest</exprCond>
                        <Condition id="conditionStartTest">
                                <laPosition>startAssessment</laPosition>
                                <comp>equalTo</comp>
                                <val>1</val>
                        </Condition>
                </ExprConditionnelle>
                </si>
                </Rule>
         </startOn>
        <terminateOn>
                <Rule id="toDoTestTerminateOn">
                 <si>
                <ExprConditionnelle>
                        <exprCond>conditionStopTest</exprCond>
                        <Condition id="conditionStopTest">
                                 <laPosition>stopTest</laPosition>
                                <comp>equalTo</comp>
                                <val>1</val>
                        </Condition>
                </ExprConditionnelle>
                 </si>
                </Rule>
          </terminateOn>
  </Interaction>
```

Figure 7: The XML binding of the interaction “To Do Test”

3 Operationalizing and running the activity

An infrastructure, called LDI, and a player have been developed which are in charge of: (1) parsing the scenario, (2) requesting, through the player, the participants and their roles and the resources, (3) requesting, through the player, the targeted environment in which the teacher wants the activity to run, (4) deploying users and resources in the chosen environment, (5) orchestrating the scenario execution using a rule engine which controls the activity progress with regard to the structures and the rules, (6) storing the traces, (7) giving administration and supervision interfaces. Operationalization is concerned by steps (1) to (4).

The operationalization of the case study starts with the operationalization of the organisation activity. The operationalization of the other activities is done through interactions specified in the organisation scenario. Part of this process is shown in the following videos:

The execution of the operationalized scenarios will provide the learners, teachers, tutors, etc. with the means (resources, services, tools, etc.) to take part in the activity. An extract of the learning activity performed by a learner is illustrated in the following video:

The observation activity the teacher could performed is shown in Figure 8.

Figure 8: The “observation activity”

After asking to “Observe the learning Activity”, i.e. performing the corresponding interaction, the teacher could observe, for each group: in which arena the learners are situated, the state of the interactions for each group, and the answers each team has given to the quiz to win clues (see Figure 9).

Figure 9: The available trails

When the teacher decides it, the learning activity finishes and the assessement one starts automatically. Figure 10 shows the player for one learner with the map s/he has to fill to, perhaps, become the winner!

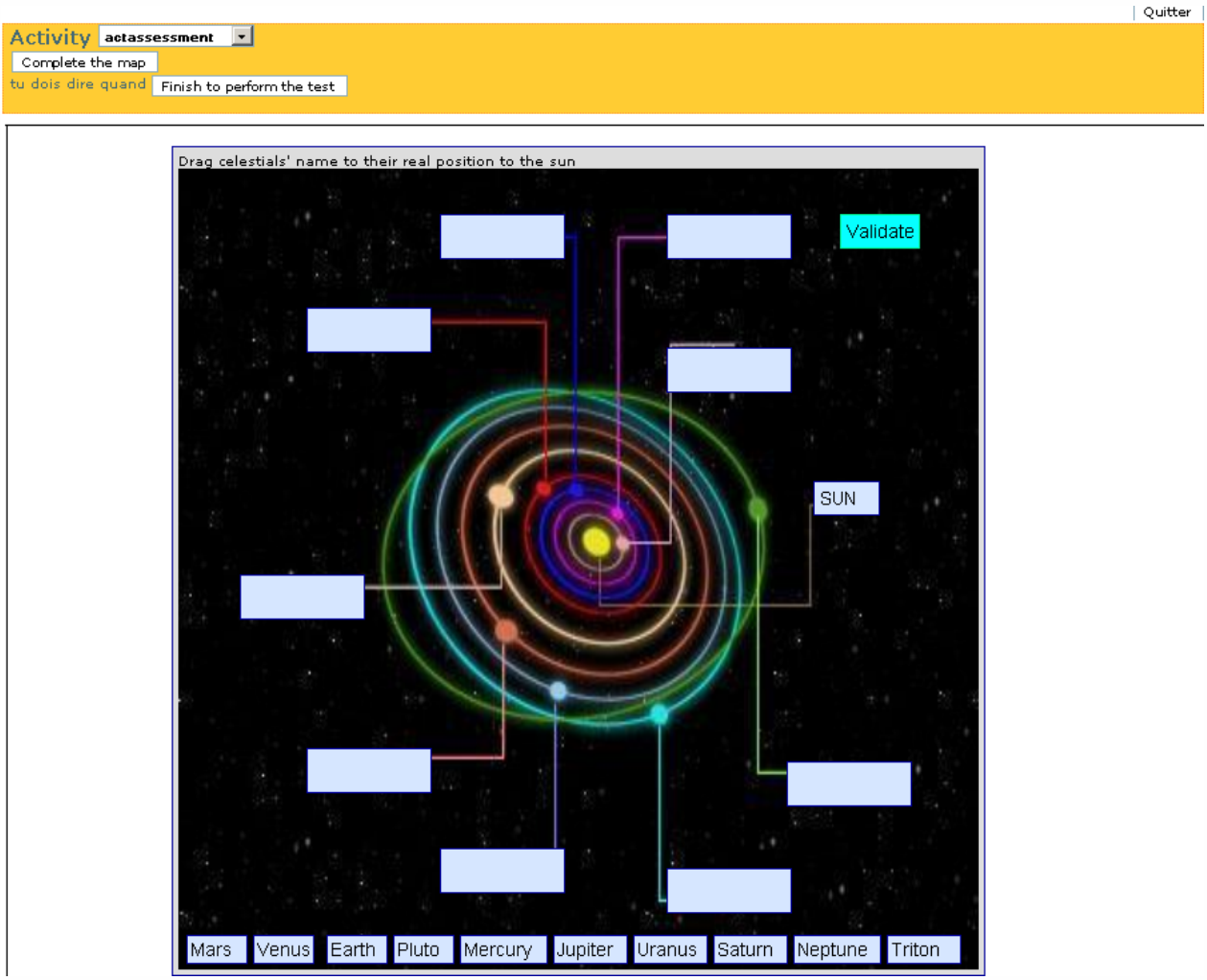

Figure 10: The assessment activity

Finally, s/he could know the name of the winner, performing the last proposed interaction of the scenario (see Figure 11).

Figure 11: The last step of the scenario

4 Step 2: observing, adapting and re-use

4.1 Observing the activity

In LDL, every concept is *observable*; thus, the designer of the scenario can specify what can be observed. The observable is introduced as a means of collecting relevant information on the progress of the activity, information which makes sense to the observer. The collected information is thus situated in the activity. This concept presupposes every time the presence of an observer who also takes part in the activity. This observer is a participant, considering also the system as a participant.

When an observable is declared, a corresponding value will be stored in a dedicated database when the activity is performed. The value of these observables could thus be used to state the value of an observed position.

Observed positions could therefore be used in the conditional part of a rule and/or to build a dashboard of the activity.

The type of what is observed depends on the type of the concept observed. For instance, for arenas, the intrusion/extrusion, the presence/absence, the answer (to a question) or the text produced in a forum can be observed. For the structures and on the interactions, its state (started/active/stopped) can be observed, but also, who has performed in the structure/interaction, when it was started/active/stopped, and its duration. Finally, it is possible to observe, for the rules, its state (triggered/not triggered) and when it is tested and by whom.

4.2 Adapting an activity and re-using a scenario

Two kinds of adaptation of an activity modelled with LDL can be considered. They are described in the following.

4.2.1 Adapting the context of use

The first kind corresponds to the adaptation to another context of use. The scenario is not changed: it is re-used as it has been modelled. What may change is the data that are set during the operationalization phase that can be considered as the actual parameters of the activity. Such data include the participants to be involved, the contents to be involved - LO (Learning Objects) and services to associate to the arenas in order to reify them – the distribution of roles between participants but also the number of groups to be involved in the activity. Changing these data can be done very easily within the operationalization phase. For instance, changing the number of groups involved in the planet game is just a matter of creating as many learning activities as the desired number of groups.

When the contents (LO and services) are changed, there is a change in the learning context. For instance, the planet game scenario could be re-used in the context of learning traffic rules, with an individual examination at the end. This kind of adaptation definitely corresponds to the re-use of the scenario.

4.2.2 Adapting the activity as it runs

The second kind of adaptation concerns the adaptation of the activity whilst it is going on, that is to say when its progress should be modified according to the events that happen. This is called the “adaptation on the fly”. Once more, it is possible to distinguish between two ways of carrying out adaptation on the fly, considering the cases where the adaptations are predefined in the scenario or not.

First, events, as well as the way to react to them, may have been predicted by the designer and modelled in the scenario. The LDL concepts of rule, position and observable have been defined for that purpose. They allow one to specify what to observe (the observables), how to interpret these observations (the positions of the participants) and how to react (rules indicating which interactions to start for which participants according to their collective or individual positions). For example, this is the case of the “Get clue” interaction in the learning scenario. It becomes visible to participants when and only when a quiz has been completed successfully. This is also the case for the “Add new quiz” interaction. It is provided freely to the teachers who monitor the ongoing learning activities. As they are able to observe what is going on (this is done in the observation activity), they can evaluate the current situation and decide when it is relevant to add a quiz. This example is different from the “Get clue” one, in which what to observe, how to interpret the observations and how to react are completely modelled and predefined in the learning scenario. In the “Add new quiz” one, the teacher is in charge of observing, interpreting and deciding on the reaction (provide a new quiz). In both, the interactions are predefined and modelled in the scenarios. Here the scenario designer has anticipated a potential

tension that may occur in the activity: the clues provided are not sufficient, and the learners are not able to achieve their goal.

But a designer cannot imagine every problem, tension or opportunity that could occur. So it is necessary to provide participants in an activity - at least the one who monitors it (e.g. the teacher in the example of the planet game) - with the means of modifying its progress dynamically, even if the situation faced has not been predefined. For example, the teacher could adapt the difficulty of a test by modifying the time-limit; s/he could put some help content at the learners' disposal, etc. This would lead to changing a rule dynamically, as the activity is running, or to creating new interactions, etc. In a general way, this requires the provision of means of modifying, adding or deleting any concept of an LDL scenario that describes an activity, whilst the activity is going on.

Dynamically adding, modifying or deleting instances of LDL concepts is technically supported by LDI. It can be done in an ad hoc way, via the administration functionalities provided by the infrastructure. But this remains a hazardous process and adaptation on the fly within LDL/LDI still has to be studied.

5 Conclusion and Perspectives

The challenge proposed during the workshop "Comparing Educational Modelling Languages on a case study" at ICALT in 2006 was the opportunity for the authors of LDL to show the expressiveness of their language and the efficiency of the associated infrastructure, LDI.

With respect to the modelling of the case study, details have been given in this paper, highlighting the more interesting ways of modelling.

First of all, one novelty is to propose to distinguish between four types of activity while analysing the informal scenario. For this case study, this leads to the breakdown of the activity into five activities, starting with an organization one, followed, when the teacher so decides, by two learning ones (collaborative, one per group) and an observation activity, and ending, when the teacher so decides, with an assessment activity (individual).

Then the detailed description of each activity underlines the original concepts of the languages and their use:

- The modelling of the organization activity emphasizes the way to automatically organize the initialisation of the other activities. It also shows that a position, "Read the statement" in this case, could be used either to start the following interaction, "Play the interlude", or to synchronise the start of the "Choose a group" interaction for all the learners.
- The modelling of the learning activity stresses how the activity could be adapted dynamically. It also illustrates the use of observed positions.
- The modelling of the observation activity details the concept of observed positions that could be used to observe what is going on. It gives several examples of such positions and their use.
- The modelling of the assessment illustrates the use of positions to synchronise the activities.

Several experiments have been conducted using LDL and the associated tools,.as the one described in Michelet, Adam, Luengo (2007) and in Lejeune David, Martel, Michelet, Vezian (2007). There were successful experiments from the learning point of view. There also allow to highlight that the model editor proposed is too linked to the model and hardlyl usable by end-users.

Let's consider the new approach LDL's authors have taken, collaborating with Instructional Designers from Symetrix Corp. First, the concept of Pedagogical Procedures (PP) has been introduced. A PP is a paticular scenario which contributes to the organisation of the learning. A PP is not linked to one particular subject. It includes a set of instructions given to future participants about what they have to do. Considering learning objectives, the application of these instructions conduces to a quasi-certain result as only scenarios validated by teachers' experience could be considered as PP. For instance, the

controvery or the tresor hunt scenarios could be considered as PPs. For more examples, see Martel, Villiot-Leclerq., Vignollet., Despont., Ferraris. (2008).

To model these specific scenarios, a Domain Specific Language (DSL) is introduced,. It is easily affordable by the teachers and instructional designers as it is based on few and well-known concepts: Instructions (grouped in phase if necessessary), that are given to Participants, and consists in the transformation of Artefacts.

A graphical editor based on this DSL is under development. Model Driven Engineering tools like EMF, GEF and GMF are used to generate this graphical editor.

From a PP, eventually adapted from a canonical one chosen in a specific repository, this tool will also help to build, by successive enrichments, the LDL version of this scenario in LDL so that the PP becomes operationalisable and executable as described in this paper.

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