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Unified Modeling Language and Relationship Management Methodology in the Development of Applications for Distance Teaching

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ABSTRACT

Applications development for distance teaching has become into a potentiality for the managerial market, specially for the training area. The absence of methodologies and specification languages for these applications can commit the production and development software processes for distance teaching (DT). There are several models used for the specification of applications at the most varied domains of the knowledge. Unified Modeling Language (UML) is characterized as a language (drawing) for systems specification, using OO concepts. Relationship Management Methodology (RMM) is defined as a methodology for hypermedia applications development, with its specification language (LRMM). Scientific community knows that DT applications constitute a knowledge domain, highly complex. Thus, this paper has the objective to present the capacity of LRMM and UML, and to verify their applicability for DT software development.

1. INTRODUCTION

On its fundamental expression sense, Distance Teaching is something very old, is the teaching that occurs when teacher and students are separated in the time or in the space. According to [Chaves 1999], so that DT can exist it is necessary some technology intervention.

The Computer is constituted in the main technological intervention at DT context. With the computer is possible to access, by Internet, remote information, facilitating the communication between students and the teacher.

With this scenery, this work has the objective to verify the potentialities of the specification language LRMM [Isakowitz 1995] and of UML [Booch 1999] in the development of DT applications.

This paper is divided in sections. At section 2 will be presented important concepts about LRMM. The section 3 presents the UML and LRMM concepts in the development of DT applications. The conclusions and the future works will be discussed in the section 4.

2 – SPECIFICATION LANGUAGE RELATIONSHIP MANAGEMENT METHODOLOGY (LRMM)

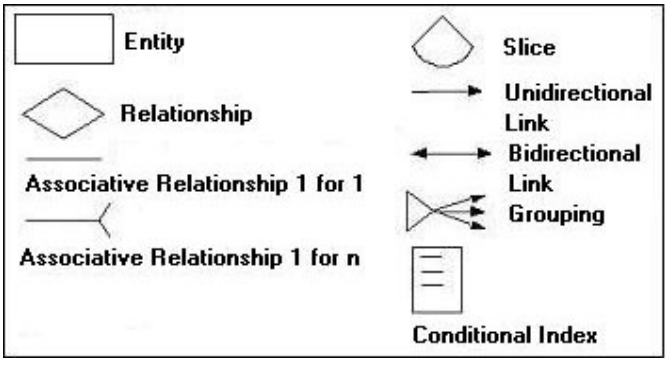
RMM methodology is recommended for the construction of hypermedia project. The project cycle and implementation of an hypermedia application specified by the RMM methodology is divided into seven phases: 1 Viability Analysis; 2 Necessity Analysis; 3 Equipment Selection; 4 Specification Project; 5 Interface Project; 5a Protocol Conversion Project; 5b Behavior in time of Execution Interface; 6 Construction; 7 Test. This paper will present the specification phase (4) using the LRMM [Isakowitz 1995].

LRMM presents a set of symbols for multimedia and hypermedia applications specification. Figure 1 presents this set of symbols.

Symbols Definition:

- Entity: represents a collection of objects of the real world, which individual members (examples or instances) have the following characteristics: each object can be identified by an only way. For example, if exists in an application, an object type called student, the development and the user should be capable to distinguish one student from another. Each entity can be described by one or more data elements (attributes (example: name, address)) [Yourdon 1989].
- Slice: represents the attributes grouping of a same entity that has correlation or that can interest the user, forming a visualization unit (a visualization unit is the exhibition of information in the computer display).
- Relationship: represents a connection set among entities. For example, any application has the entities teacher and disciplines, these

Figure 1 –LRMM Symbols.



should be related knowing that a teacher teaches one or more disciplines.

- Associative relationship: when a certain teacher teaches only one discipline and this discipline is taught by only one teacher, the 1 by 1 associative relationship is used. However when a teacher teaches several disciplines and the discipline is taught by only one teacher, we use the 1 by *n* associative relationship.
- *Unidirectional link* e *bi-directional link*: represent the access (navigation) between Slices of an entity.
- Grouping: constituted by a visualization unit, and this facilitates the access to several parts of the application. The symbol that represents the grouping (Figure 1) has a group of unidirectional links.
- Conditional Index: offers access to a certain entity, only when a condition is satisfied. For example: the access to an entity *x* can only be made by students that are registered.
- LRMM has other symbols for URL e-mail notation, etc. [Isakowitz 1997], however this work will not present the use of those symbols.

3 – RMM, UML IN DISTANCE TEACHING APPLICATIONS

The objective of this section is to present the LRMM and UML behavior in the specification of a DT application (turned to the WEB). As an example, one application requirement (to send task for correction) will be selected. It is important to remind that we will not use all the UML diagrams to specify that requirement.

3.1 – UML Specification

The two main actors that can be linked to a DT application are teacher and student. Based on the requirement, the use case to specify it will be "SendTaskCorrection".

Use case specification: After answering the question, the student sends task for correction.

Specification is a deepened description of use case.

After the specification, are presented the normal and alternative (behavior) courses of the use case.

From actors, normal and alternative courses, it is possible to graphically represents the use case (Figure 2).

Figure 2 shows that the student actor accesses the system by the tasks solicitation interface, opts to request the task or to answer questions or to send task for correction. Case the student opts to sending task for correction, the application will send the message "task sent for correction".

After the specification of the use case, this paper presents the classes diagram (Figure 3). This diagram was conceived after requirements elicitation and specification phases for the use case.

It is important to frizzle that we will not apply the other diagrams presented in the UML.

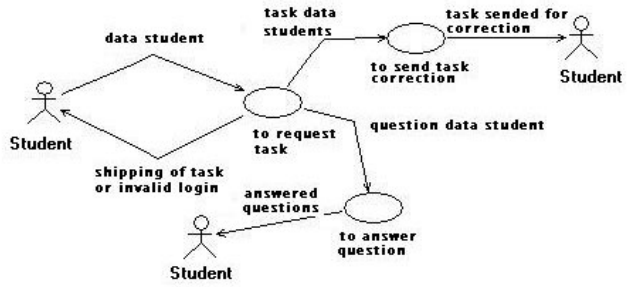
3.2 – LRMM Specification

The first specification object proposed by LRMM is the Entity Relationship Diagram (ERD) (Figure 4).

Table 1 –Normal and Alternative Courses of the Use Case SendTaskCorrection

Normal Course	Alternative Course.
Study informs login and password.	Study informs login and password.
System validates login and password.	System doesn't validate login and password and emits message: "Study not cadaster"
To access the interface "to request task".	
Opt to requests task or to answers question or to sends task correction.	
Study sends task correction.	
Study ends section.	

Figure 2 –Use Case SendTaskCorrection Graphic Representation



At Figure 4 there are the entities Teacher, Student, Questions, Discipline, Register Student and Task, and their respective attributes and the relationship among these entities. Visually, it is verified that the ERD is similar to the classes diagram.

The next step is the Entities Project (Figure 5) that consists in examining each entity separately and to determine as its attributes will be presented to the user. The correlate attributes are grouped in Slices. Each Slice is shown in a same visualization unit and contains information that relates to each other. It is important to remind that the amount of attributes should be adequate, because the excess of information in a same visualization unit should be avoided, for don't tiring the user [Isakowitz 1995].

The Slice Diagram defines the navigation among entity Slices. Figure 5 shows the Teacher and Student entities with two Slices each, and the navigation among both is bi-directional. The symbols used in the Figure 5 are presented in the Figure 1.

At this time, is necessary to elaborate the Relationship Management Data Model (RMDM) diagram. The RMDM diagram is based on the Entity Relationship model, which main characteristics are the navigation primitive that, added to ERD's, permit to define and to visualize clearly in the diagram which are the navigation possibilities to be offered in the information domain. The Figure 6 shows the RMDM diagram of the DT application.

In the Figure 6, can be verified the presence of the entities, of the conditional indexes that promote the interface between the users and

Figure 3 –Classes Diagram

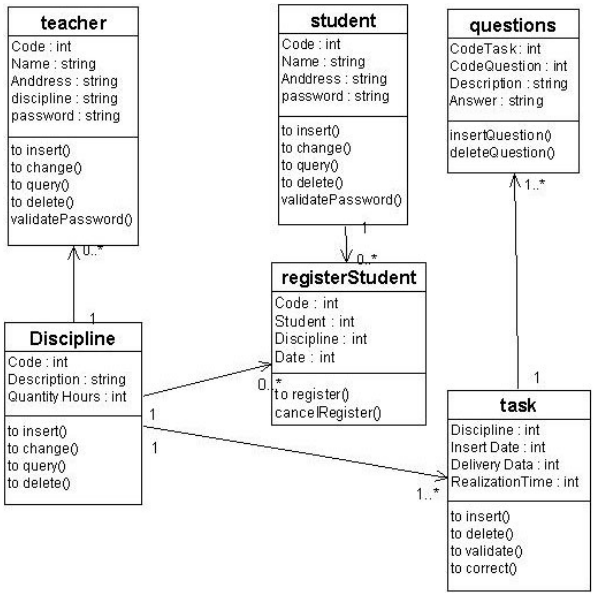
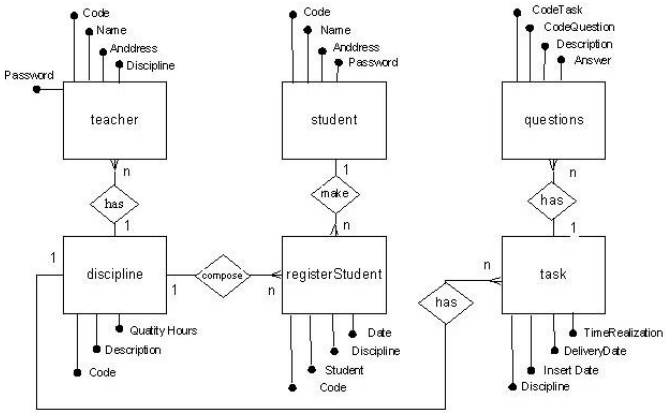


Figure 4 - ERD of a DT Application



the application. There are also the presence of the relationships and of the links (navigation) among the indexes. In that Figure can be verified that the student can access the system through the students' index, and this accesses directly the students' database. In case the student is not registered in the course, he can access the index registration, in which he makes direct access to the database register. When enrolling, the application searches for information from the database students, for example, the name and address, and exhibits such information in the registration index.

That figure provides to the development of the application the exact notion of the communication of the data with the interfaces. We can verify that Figure 5 and Figure 6 are complemented, because each index of the Figure 6 has an equivalent slice in the Figure 5. So, we can affirm that each attribute in the Slices of the Figure 5 will be presented as an item of the index in the Figure 6.

It is important to frizzle that the interface project, the behavior of the application in time of execution and the templates for implementation will not be presented in this paper.

3.3 – Comparing UML and LRMM

Comparing LRMM and UML we conclude that:

- UML represents the external agents, the actors. LRMM does not have the notation for such representation.
- Use Cases of UML can be characterized as a graphical representation of the functional requirements of an application. LRMM does not explicitly characterize the functional requirements.
- UML describes the behavior (normal and alternative) of each functional requirements, LRMM does not provide that description explicitly.
- By means of UML the responsible for the application development can verify the messages that the application sends to the user. In LRMM these messages should be inferred.
- Classes Diagram of UML has the attributes type and the methods that manipulate the data of the application, but in ERD proposed by LRMM these information are not found.

Figure 5 – Entities' Project: Slice Diagram

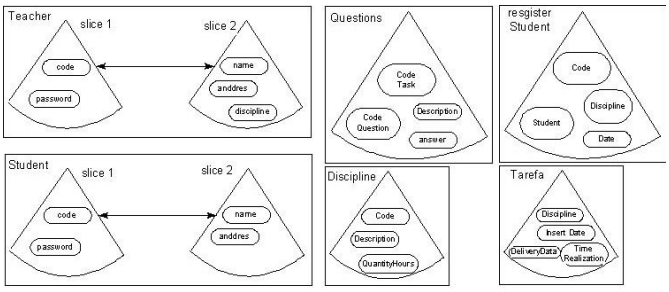
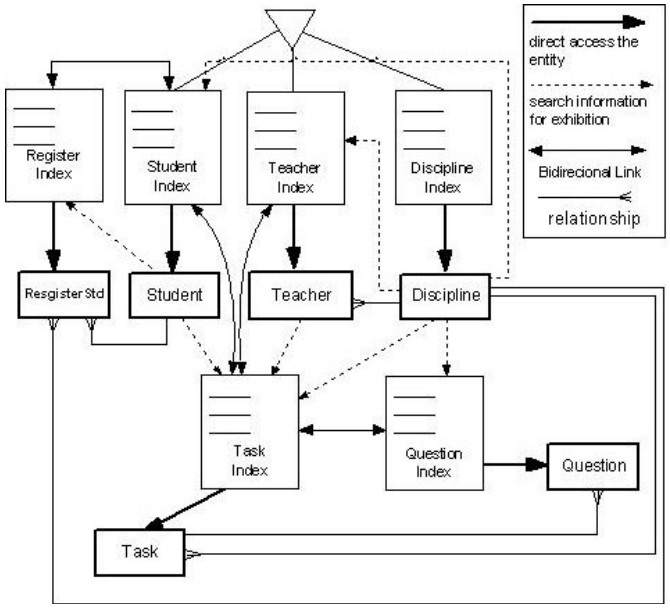


Figure 6 – RMDM Diagram



4 – CONCLUSIONS

By means of this paper was possible to verify that UML has a larger application in the specification of the functional requirements, being poor in the navigation specification of an application, what constitutes its weak point. LRMM provides a series of resources of navigation specification that are not found in UML. The not explicitly specification of functional requirements constitutes in a weak point of LRMM.

Is important to mention that as LRMM as UML can be used with success in project of DT. However, the union of techniques and diagrams, presented in LRMM, to the proposal of UML can bring more expressive results in applications that request a larger quality in the subject of the interface.

The union of models, methods, specification languages and methodology bring great contributions to projects as in the area of software engineering as for the scientific community.

As future works, we intend to compare LRMM to other software development methodologies.

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