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Specification and Description Language of Medical Activities

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Abstract. Modern health care management takes place in organizations and institutions that are becoming more and more complex. The management of these institutions requires broad clinical and business administrative knowledge, but also excellent scientific skills. The scope of our study, presented in this paper, is to emphasis the management of medical activities. Based on set theory and scientific management of work, we developed a method called Specification and Description Language of Medical Activities (SDLMA) that can monitor performance, and can provide instructions to ensure the most efficient ways of working.

Keywords. specification and description language, medical activities, management, education.

1. Introduction

Modern health care management takes place in organizations and institutions that are becoming more and more complex. The management of these institutions requires broad clinical and business administrative knowledge, but also excellent scientific skills [1]. The problem of an organization and management of a health institution is to know essentially: what are the communicating entities of this system, with which communicating entities each of them communicate, and how do they communicate?

For more than ten years, we have taught, as Lecturer, the medical informatics course to undergraduate students at the Faculty of Medicine at Simon Kimbangu University, a private institution in DR Congo. The course introduces the major concepts of medical informatics and aims to put a special emphasis on the management of medical activities, the management of computerized medical records and the use of medical decision support tools.

This paper presents a method of modeling medical activities called Specification and Description Language of Medical Activities (SDLMA). The SDLMA provides the following modeling elements: domain, event, entities, relationships, process carried out and duration. For the sake of completeness the paper also presents a sample application and online education of medical informatics.

In particular, the objective of the SDLMA is to allow young medical student to know the pathways to be traversed by the patient in a hospital and the associated sequence of medical activities to be performed by healthcare givers.

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2.Methods

There are two aims of the present paper. Firstly, we present the method SDLMA that is the main concern of the paper. Secondly, we outline the method of online education followed.

2.1. Specification and Description Language of Medical Activities

The proposed modeling system is based on set theory and scientific management [2]. Furthermore, we denote the scientific contributions, to our work, of others existing approaches such as SDL in telecom [3], UML [4], ontology [5] and medical language processing [6].

The SDLMA is the expression of hospital course of the patient from the admission to the discharge. It is composed of the following modeling elements: domain, event, entities, relationships, process carried out and duration. The temporal dimension is associated to it in order to express the evolution of the system.

a. Domain

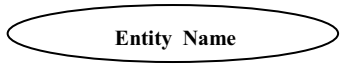
The domain defines the space and category of the problem that is related to medicine specialties such as: General Practice, Paediatrics, Obstetrics and gynaecology, Radiology, Nephrology, etc. It is denoted as: **Domain**: "Category"

b. Event

A given domain can include series of events. Event triggers the activities. The organization of activities depends of the domain and can concern the “Who or what should do what?”, “How?”, “With whom or what?”, “Why?”, “Where?” and “When?”. Events can be the following: Observation, Admission, Physical examination, Diagnosis, Treatment, Lab test, etc. It is denoted as: **Event** (1..n): “Activity”

b.1. Entity

An activity is performed by entities or actors. Entities can be the healthcare givers, the patient or the machine or medical device (Computer, Ultra sound scan, Tomograph, etc). It is denoted as:



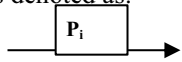
b.2. Relationships

The relationships put out the interactive communication between entities.
It symbolized by:

b.3. Process Carried Out and Medical Sentence

A given event can trigger activity that is a sequence of one or more tasks or processes and that allows the interactions between entities. Any process carried out is expressed in medical sentence, primitive phrase, for a semantic purpose. A primitive phrase can be note as the following: “fill out a form”, “write reports”, “take a blood pressure”, etc. The direction of the arrow indicates the entity in action. It is denoted as:

Entity1 - P_i - Entity2



P_i: primitive phrase

b.4. Duration

The duration expresses the "when or how long?" any event or activity occurred. The duration can be fixed such as a date or a period such as an interval of times or dates. This highlights the temporal aspect of medical activities. It is denoted as:

Duration: **T** for a fixed period or $\mathbf{[t_i - t_j]}$ for an interval period.

2.1.1. Formal Ontology of Medical Activity

The SDLMA is relied on an ontology that supplies medical terms and sentences (primitives). Our ontology is a multi-axial representation that has three root concepts namely: consultation, actors and specialty.

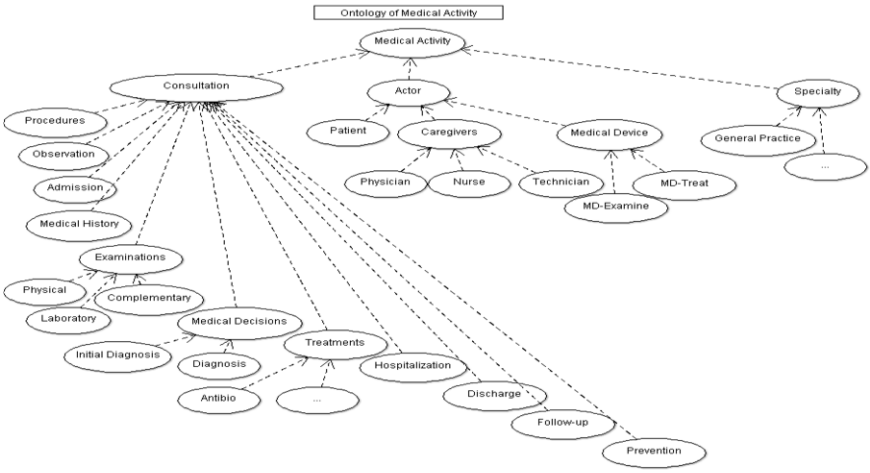


Figure 1. Ontology of Medical Activity

2.2. Online Medical Informatics Course

There are certainly many eLearning systems [7, 8, 9], but the main difficulty lies in structuring the in line content and information with the existing learning models in order to achieve greater integration and comprehensiveness of the learning environment by this providing better quality education.

To perform these challenges, we have been proposed a method based on the web 2.0 technologies and that implies three main steps: setting online classroom, determining the learning content and the learning activities.

a. Setting Online Classroom

The pedagogy used is pragmatic. Our pragmatism is the fact that we favor an educational content focused on special topics and we prompt learner to activities. Furthermore, there is an asynchronous communication between the teacher and the learner.

b. Learning Content

The contents proposed are not a copy paste of the course teaches in auditorium but a kind of special topics. An evaluation is associated to the content in form of electronic

questionnaire that can be multiple choices and/or open query (free text entry based key words). This evaluation is considered as a secondary activity

c. Learning Activities

There are two kinds of activities: practical works on the management of a hospital and the eHealth simulation. The eHealth simulation is related to some application such an online medical record, an e-prescription, etc. The practical works is the main activity that allows learner to work in a team on a specific subject (patient case).

3. Results

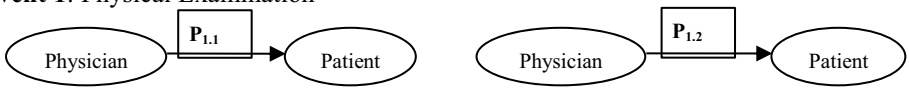
3.1.Case Study on SDLMA

a. Patient Case Problem

25 year-old man student admitted, the April 14, to university hospital after a 3-week history of fever, fatigue, and 25-lb weight loss. On exam, by a GP, febrile (T 40), tachycardic, mildly tachypneic, looks unwell.

b. Resolution

Domain: General Practice
Event 1: Physical Examination



Processes:
- $P_{1.1}$: Take blood pressure
- $P_{1.2}$: Check Neurological Functions

Duration: - T_1: 14/04/2018

3.2. Presentation of eLearning in MAESOFT1 Platform

Our MAESOFT1 platform provides two eLearning systems namely: an eLearning opened to public [10] (English version) and an eLearning intended to academic [11] (French version). The last one includes two applications one for teachers and other for students. In the teacher application, there are the features to organize the online classroom (set up the system, load the content of courses and activities, etc.).

The student application is, of course, the eLearning presented in this paper. The student application is developed a round of four components, namely: Student Panel, Continuing Education, eHealth and Activities. The student panel component serves for communications between the teacher and the students. The continuing education component provides courses on special topics such as different types of medical record, classification systems (CIM-10) and allows the evaluation. The eHealth component permits students to do simulation on online medical record for example. Activities component focus students on a project related to the management of hospital activities. The project is organized in several small workshops such as hospital organization (department), patient case description, investigation, medical recording, specification of

patient's hospital course. At the last step of the project, the system generates a report containing all necessary information of each workshop that looks like tasks description.

4. Discussion and Conclusion

The scope of our study is to emphasis the management of medical activities. The method of modeling medical activity experimented to students of human medicine is purely for educational purpose. As described in the Results section, used in context of case patient, it allows to students to visualize the patient's hospital course and the dynamic aspect of medical activities performed by the caregivers. Furthermore, when students work in teamwork, the method permits to debate and to exchange point of views on what should be done. Students learn and improve the medical language since the ontology intervenes by providing a list of possible domain, a list of events related to a specific domain and a list of primitive sentences related to an event. This is due to the fact that the ontology proposed has multi-axes and allows relationships between concepts.

At least, the contribution of our study is firstly the semantic and temporal representation of medical activities through the event and specifically the process carried out with its duration. The event gives the clinical context, based on an ontology, in which entities or actors (caregiver, patient, etc) interact. Temporal dimension can be a bound data to disease progress, to duration of treatment, to motive of hospitalization, to follow-up, etc. Secondly, the SDLMA can monitor performance and can provide instructions, in form of report, to ensure the most efficient [12] ways of working.

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