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A Knowledge Acquisition System for the French Textile and Apparel Institute

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Abstract. The management of knowledge and know-how becomes more and more important in organizations. Building corporate memories for conserving and sharing knowledge has become a rather common practice. However, we often forget that the efficiency of these activities is strictly connected to the appropriation capacities and learning of the organizational actors. It is through this learning that new skills can be acquired. In this paper, we propose general guidelines facilitating the process of creation and appropriation of professions memories built by means of methods from the knowledge engineering and from the educational engineering techniques.

1 Introduction

The French Textile and Apparel Institute (IFTH) is leading a project on knowledge capitalization for "pullovers 3D knitting" by utilizing a framework for defining a training platform for workers in the knitting industry. The objective is to train the textile companies of a French region to this type of knitting in order to improve the manufacturing process. Our role in this project is to define and conceive a knowledge acquisition system on the pullovers 3D knitting. The learning system we defined is based on knowledge engineering and educational techniques.

2 Knowledge management

In order to take highest advantage of their intellectual capital, nowadays, the IFTH and most of the others companies develop and apply knowledge strategies. Thereby it becomes increasingly easier to realize an appropriate management, innovation and creation of their knowledge.

Dieng-Kuntz [1] presents some definition of knowledge management. "Knowledge capitalization in an organization has as objectives to promote the growth, the transmission and the preservation of knowledge in this organization" [2]. "It can carry both theoretical knowledge and know-how of the company. It requires the manage-

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ment of company knowledge resources to facilitate their access and their re-use" [3]. "It consists of capturing and representing knowledge of the company, facilitating its access, sharing and re-use. This very complex problem can be approached by several points of view: socio-organizational, economic, financial, technical, human, and legal" [4].

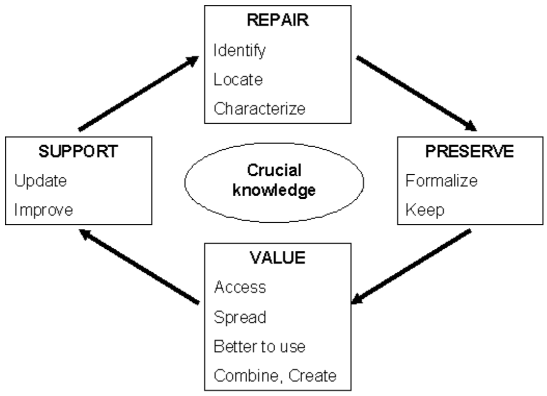

Fig. 1. Knowledge management life-cycle

We adopted the knowledge management life-cycle proposed by Grundstein (figure 1), where, according to him, "in any operation of knowledge capitalization, it is important to identify the strategic knowledge to be capitalized" [5].

3 Corporate memory and profession memory

Implementation in organizations of knowledge management cycle-life assures knowledge formalization. This formalized knowledge is more and more represented in the form of corporate memory. We can define this memory as the "explicit, persistent and disembodied representation of knowledge and information in an organization" [6]. A corporate memory should supply "the good knowledge or information to the good person at the right time and at the good level" [1]. One of the corporate memory types [7] is the profession memory, which clarifies the repository, the documents, the tools and the methods employed in a given profession. Our study is based essentially on the appropriation of knowledge from a profession memory.

For knowledge capitalization in the IFTH about pullover 3D knitting, we are going to focus on the design and the use of knowledge based profession memory. The latter is based on collecting and explicitly modeling knowledge. This knowledge can come from experts and specialists of the company as well as from documents [1].

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4 Appropriation of a profession memory

One of the main motivations for building a memory in a company is the improvement of employee's learning. This learning can be at an individual, group or organizational level [1]. In the case of our work in the IFTH, learning will be approached in an individual way for their employees. By looking at our preliminary experiences of constructing a profession memory, and more specifically at the learning from such memories, we noticed that the learning from a profession memory is not easy. These memories are generally presented under several points of view (classifications, constraints, processes, problem solving strategies, etc.). The links between these views are put in background because the knowledge formalization shows the nature of the knowledge [8]. Learning and following the learning progress in such a memory can be easy for a "cognitician" (cognition specialist) or a knowledge engineer but it is complex for an employee who is specialist on his profession and who wants to learn a know-how formalized by an expert in his domain.

To facilitate the learning from a profession memory, we adapted techniques from educational engineering by modifying the way of building the profession memory, and especially, by showing this memory, to the employee in a different way.

4.1 Educational engineering

According to Paquette [9], educational engineering or training engineering contains all principles, procedures and tasks that allow to:

- define the contents of a training by means of a structural identification of the knowledge and the recounted,
- realize an educational scenario of the training activities and to define the context of use and the structure of the learning material,
- define infrastructures, resources and services necessary for distributing lessons and preserving their quality.

We use the general architecture proposed for the educational engineering, constituted by four interdependent modules:

- Expert module: represents the knowledge of the taught subject;
- Student model: represents the students needs, his/her level and his/her difficulties, which represents, his/her knowledge state, as well as the history of his/her interactions with the system;
- Educational module: contains the educational system, its purpose is to plan and to pass the learning;
- Interface module: concerns the support management and the system's communication modes with the student.

In other terms, the educational engineering allows us to develop a learning system [10] [9]. Our particular interest is the construction of a system based on a profession

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memory. By taking into account the practical knowledge (problem solving) of the training contents, our system becomes a practical learning system.

5 CPLS: Construction of a Practical Learning System

In this article, we are going to present our proposition of the practical learning system's expert module for the pullover 3D knitting in the IFTH.

5.1 Proposition of the expert module

Our expert module is represented as a guide named "activity process". It is also used to explain on detailed each step of the process. Expert module stores teaching materials consisting of problem solving strategy, exercises and formative assessment (quizzes), help/hints, answers and solution's prototypes to each assessment and exercise.

5.1.1 Representation of the activity process

For the definition of the expert module, the knowledge engineer has to find and emphasize a guiding thread to assure the progress in learning, with the expert's help. This guide has to show the aims, the deep knowledge and the links inside the knowledge. Based on MASK [11], the proposed guide (figure 2) in the practical learning system on the pullovers 3D knitting at the IFTH, is an arrangement that allows understanding of the succession of stages to be realized within the activity.

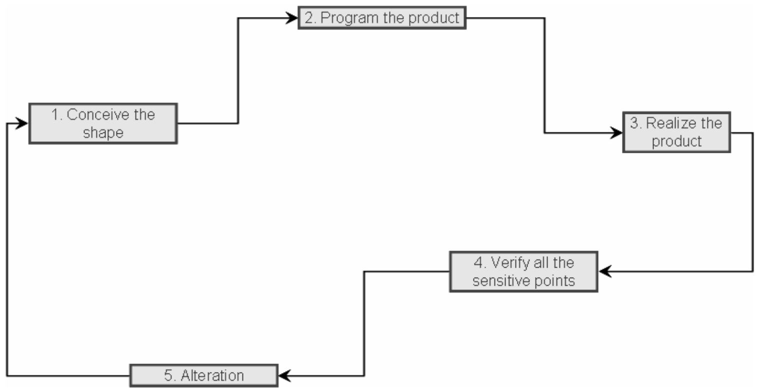

Fig. 2. Representation of the activity process

From this process, the knowledge engineer, always working with the expert, has to represent the interactions in every stage of the activity process and the problem solving strategy.

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5.1.2 Representation of the interactions at each activity process stage

The knowledge engineer and the expert have to represent the interactions of each step of the activity process with their environments. Still based on MASK [11], each step proposed in the practical learning system is described according to its inputs, outputs, resources and its actors.

5.1.3 Representation of the problem solving strategy

Every step in the activity process must be detailed, by showing how the expert behaved to reach his/her objectives. The problem solving strategy is generally represented by the objectives to reach and the sequence of the steps followed by the expert. Every problem solving strategy (figure 3) in the practical learning system on the pullovers 3D knitting of the IFTH is represented by a list of targets. Each target contains a list of steps and tasks that the student has to develop.

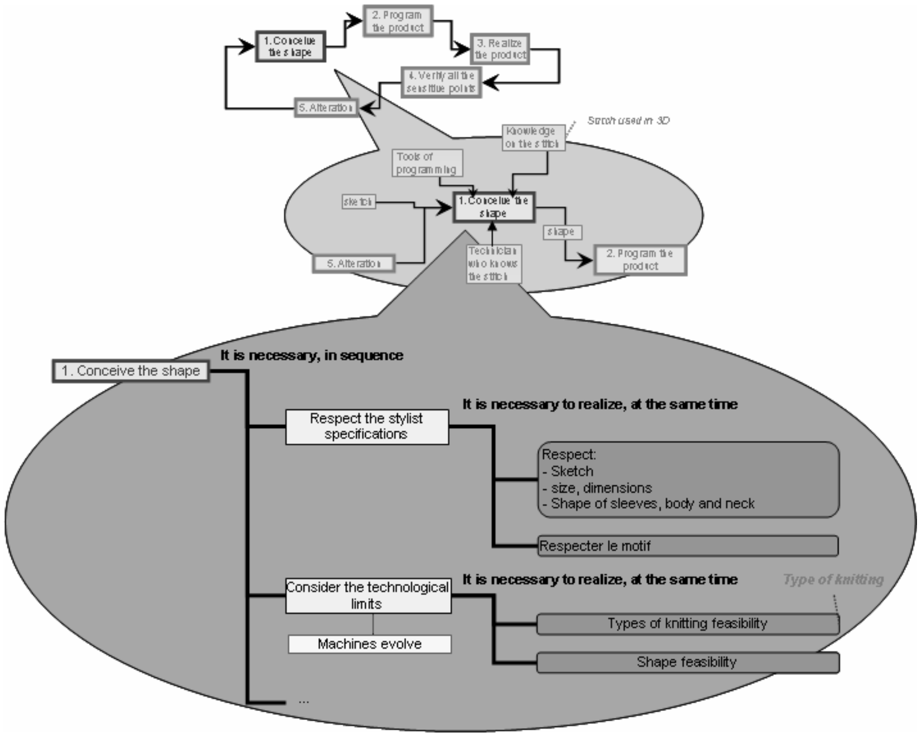

Fig. 3. Representation of the problem solving strategy

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5.1.4 Representation of exercises

To allow training and making practical experiences, the practical learning system offers the possibility for realizing exercises. On one hand the exercises allow learning in several phases of the practical knowledge, and on the other hand an evaluation of the student's progress. These exercises mainly teach problem solving strategies.

The learning system enables students to realize exercises of various complexity levels. Execution of exercises is also guided by the corresponding problem solving strategy. Indeed, this strategy is revealed to the student, step by step with these objectives and the control structure at each step. The student is then asked to execute the instructions one by one.

An exercise in the practical learning system on the pullovers 3D knitting at the IFTH can be represented with: a statement, indications and observations, a problem solving strategy, estimated time, a result's prototype (illustrations) and the result characteristics (list to tick and links with the corresponding skills).

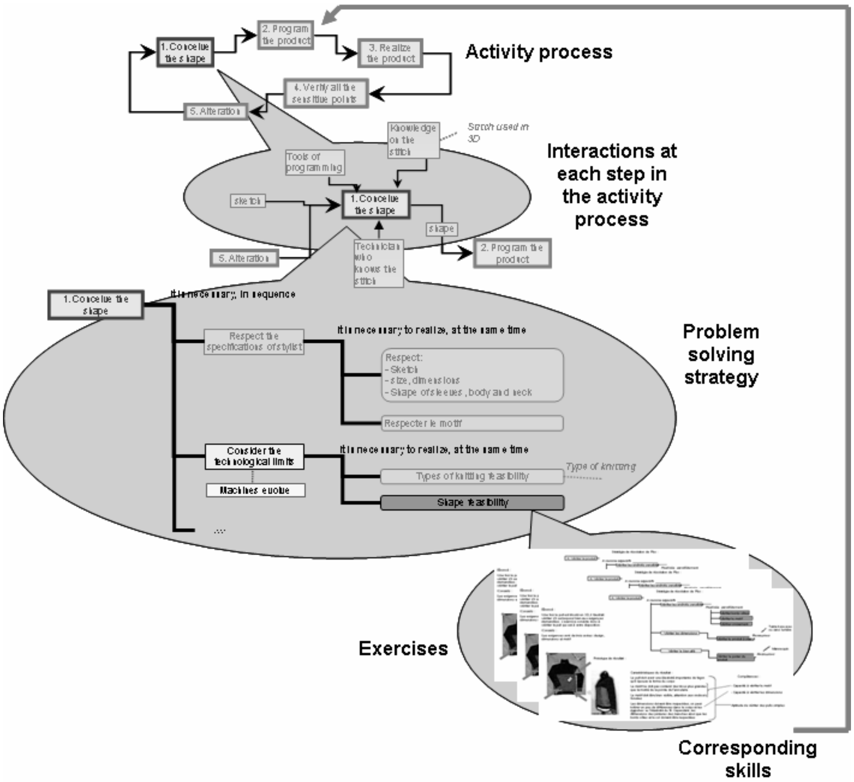

Fig. 4. Process illustration of knowledge learning progress

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5.1.5 Progress process for skills acquisition

The activity process can be a guide to the practical knowledge learning. It allows to supply a global view as well as to guide a student to focus on every step of the process and to learn the strategies as well as the difficulties of the activity. We show student the global process and we ask him/her to explore the system step by step. For every stage, interactions with the environment are shown at first, followed by the corresponding problem solving strategy (figure 4).

The link between skills and characteristics of the results of the exercises allows progress in skills acquisition. These skills are related to each activity level. More global exercises are finally presented to a student to assure a global understanding of the activity.

6 Conclusions

We are defining a tool to support this type of learning system. Together with the IFTH, an application for the textiles is being developed. Experiences on this type of domain will allow to deepen our studies and to enrich our learning system by other techniques.

The learning system on the pullovers 3D knitting will be integrated into a training platform which will be integrated into the textile industry in our region. We intend to study the feedback of this type of training.

We showed the relations which can exist between knowledge appropriation and skills acquisition. We aim at studying the representation formalisms and techniques of skills acquisition in a more detailed way.

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