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An Educational Help Desk Model for Mobile Environments

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Abstract: - Being on the way to Knowledge Society, the creation of a network of knowledge resources plays a significant role. Capturing, managing and retrieving knowledge are most relevant to Learning Objects. Furthermore, mobile learning is mostly characterized by the urgency of learning need. This paper constructs a model for presenting Learning Objects, that is suitable for mobile environments. The model is then used to select proper Learning Objects, thus facilitating learning just on site and just in time. The user types the appropriate keywords and the system proposes the proper short, concrete, helpdesk-like "lessons", in the form of retrievable Learning Objects.

Key-Words: - E-learning, Mobile learning, Information Retrieval, Knowledge Management, Information Systems for Crisis Response

1 Introduction

Viewed mostly from a corporate organizational context, Knowledge Management is the acquisition and codification of organizational knowledge, thus making it accessible within the organization, or even to other organizations. On the way to Knowledge Society, the creation of this network of knowledge resources plays a significant role.

Capturing, managing and finally allocating knowledge are most relevant to Learning Objects (LO) and learning object repositories: while being within its fourth major evolution-the interconnected multimedia computers-distance learning has put at the center of current thinking the concept of Learning Objects. There is a lot of discussion being done lately, and a lot of questions considering the incorporation of LO into the e-learning technology, still waiting to be answered. Furthermore, m-learning, a recently emerging field of research, is the intersection of e-learning and mobile computing. Being supported and funded during the last years by the E.U., it has as its main vision 'mobile learning, anytime, everywhere'. Among the various characteristics of m-learning, the urgency of

learning need is, if not the specific distinction, at least a very important one.

Knowledge Management, e-learning, m-learning, Learning Objects, Learning Objects Repositories, Connectivism, Intellectual Capital. The rising of the new era seems inevitable: a (near) future learner will be connected, multi-tasking, non-linear, technology-influenced, demanding immediate, just-in-time learning and instant payoff. Future learning will be the task of knowing *what* to look for, *where* to look for it, *how* to connect the retrieved material.

It is all about storing, retrieving and eventually, using knowledge. Future learning is more or less viewed from the corporate side and targets mainly the outcome, the achievement of objectives. Are we then heading back to Behaviorism? Hopefully not. In the forthcoming new era authorities are not affordable, nor unique or permanent solutions are acceptable. Lifelong learning comes by means of collaboration and decision making based on information that approach the problems through different views and opinions.

This paper uses sound instructional design principles to construct a model for presenting Learning Objects that fits the mobile environments, given the limitations and special characteristics of m-learning. The model is then used to select and propose proper Learning Objects, thus facilitating the connection of the right people, with the right content and context. The user types the appropriate keywords and the system proposes the proper short, concrete, helpdesk-like lessons retrieved from the repositories.

Next chapter unfolds all these notions, adopts certain corresponding definitions and combines them to a final target, the need for an educational helpdesk. In chapter 3, the LO vector space model is presented along with a model for LO retrieval, combined with keyword search. Finally chapter 4 presents a summary and a few concluding remarks.

2 Discussion and Reasoning

What is Knowledge Management (KM)? There is no commonly and clearly accepted definition. The notion is widely used without, in many cases, having defined before. KM has even been under serious criticism. For example, T.D. Wilson argues that the idea of KM is mostly a fad, a trend that will, sooner or later, fade away [20]. He claims that KM expands in two dimensions: i) management of information and ii) management of work practices, which is closely related with the human resources. The first is already a standard, mature science field, while the latter is, if not impossible, at least very difficult to achieve.

There is nothing really wrong with such ideas, since it is mainly a matter of definitions. For example, definitions of "information system" range from those focused on information technology, computer and network infrastructure, to broader ones that include also organizational and social structures [9].

According to [10], Knowledge Management is *"the name given to the set of systematic and disciplined actions that an organization can take to obtain the greatest value from the knowledge available to it"*. These actions include the identification and sharing of the available knowledge and the improvement of the personnel's competencies [16]. Two main processes are identified: acquisition of knowledge and transmission to other persons. Main vehicle towards this target is the unit of learning, the Learning Object [3].

The LOs are *"small self-contained chunks of learning content that can be stored, searched, retrieved and assembled in order to provide just in time learning"* [2]. Once again, there is no "official" definition of Learning Object. In present paper we define LO as a *"standalone, reusable, digital resource that aims at teaching one or more instructional objectives or concepts"* [11]. As referenced in [1], W. Hodgins argues that lifelong learning, information technology and global economy are converging, thus shaping a new status described under the term, he calls, "learnativity" [8]. The concept, among others, includes capturing, managing and utilizing knowledge within an organization or community. These actions are most relevant to learning objects and learning object repositories.

Contemporary Knowledge Management shifts towards a more holistic approach than it had initially focused, being nowadays less individual-centered [15]: knowledge is usually bundled outside the person, a technological issue, a process, a practice and so on. Decision-making is based on knowledge (information?) that is continuously increasing, ceaselessly changing and can reside outside the person. Furthermore, knowledge somehow stored in a database, has to be connected with the right people in the right context in order to be learning. This is the main concept of Connectivism [17]. According to this theory, learning may reside outside humans, is focused on connecting specialized information sets, and rests on diversity of opinions: *"The starting point of connectivism is the individual. Personal knowledge is comprised of a network,*

which feeds into organizations and institutions, which in turn feed back into the network, and then continue to provide learning to individual".

M-learning is a recently emerging notion. What is it about? McLean [12] reviews the relevant literature and reports it as the intersection of mobile computing and e-learning. Is it just adding some extra features to the existing courses? Obviously, m-learning adds value to e-learning with features such as alerts, real time/all time interaction among users and discussion forums [14].

Portability is a repeatedly reported (and straightforward..) advantage of m-learning: A person is able to study literally everywhere. As for the technological issues, m-learning uses wireless communications and a variety of devices that, in general, belong to three major categories: i) mobile phones, ii) palmtops/PDAs, and iii) portable computers/laptops.

It is apparent that due to the diversity of the platforms, we must also produce a similar diversity of educational material (Learning Objects) and m-learning software applications as well. For example, a LO designed for a mobile telephone has to be different from an equivalent, designed for a laptop. The latter may be an ordinary, typical LO, but this is not the case for the mobile phone. Bandwidth must also been taken into account. However, the approach discussed in this paragraph views things from a mostly technological aspect. Apart from these points, there is a common denominator for all m-learning cases: It is (almost) not possible for someone to take a two-hour course on a wireless-handheld device [14]. Why? We believe it is either because the device is small and inconvenient or because the user is usually in an inconvenient situation ("on the move") or even in an emergency situation. Therefore, an m-learner, in most cases demands small-sized, self-contained, adapted to current needs and instant, "lessons".

E-learning and m-learning share much in common, the pedagogy aspect included. Different researchers on the introduction of ICT in education agree that it is effective only when developers integrate technology into appropriate pedagogical practices [14]: *"You can't take PowerPoint to the Web and call it e-learning"* [4]. As for the m-learning pedagogy characteristics, McLean [12] reports urgency of learning need and orientation to performance (i.e. cases like instruction, guide, reference etc), linked to business workflow and processes.

Furthermore, it has been reported that a vast majority of users spend little or even minimal time with each page in an e-learning course [13]. This is a natural consequence of how "Homo Zappiens" learns [19]: people, especially the youngers, are learning in a TV-zapping manner, in a continuously accelerating, chaotic environment. According to W. Veen, we are entering the network era, where distributed electronic virtual knowledge centers ('the learning mall') will be the standard learning environment.

As we have already discussed, KM technology is being used in business to support organizational learning [18]. Combined to the LO technology, we almost naturally, reach the next step: collect organizational knowledge transform it to LO, store them into LO repositories (LOR) then use them for learning or decision-making support [3] [6] [7]. If we connect the LORs with searching via mobile devices we have our Educational Helpdesk. Next section models the LOs and presents a methodology for LO retrieval aiming to achieve instant, fast, online, "just on time and site" mobile learning.

3 Modeling and Retrieving

The learning hierarchy is a central idea in Gagne's Cumulative Learning Theory [5]. In order to plan instruction one must first identify a specific learning objective and construct a learning hierarchy for that objective. This learning hierarchy also determines the prerequisites for a given learning objective: the lower-level tasks must be mastered before higher-level tasks.

By using task analysis on a complex knowledge field, it can be broken down into constituent skills, which compose an m-dimensional information space:

$$F_x = \{f_1, f_2, .., f_i, .., f_m\}$$

For each complex knowledge field, we produce another information space. Let F be the set of all information spaces, where:

$$F = \{F_1, F_2, ..., F_x, ..., F_w\}$$

Besides, let L be the set of available Learning Objects where

$$L = \{\lambda_p\}, p = 1,2,...,t$$

dealing with a certain knowledge field, say F_x. Every $\lambda \in L$ can be then characterized by a couple of vectors (κ, μ), that present it as member of the corresponding information space:

-- a *Content* vector, indicating the skills/concepts it presents:

$$\kappa = (\kappa_1, \kappa_2, ..., \kappa_i, ..., \kappa_m) \in \{0,1\}^m$$

where

$$\kappa_i = \begin{cases} 1, \text{ if object } \lambda \text{ teaches skill } f_i \\ 0, \text{ otherwise} \end{cases}$$

-- a *Usage* vector, indicating the skills/concepts it uses without previously teaching/presenting:

$$\mu = (\mu_1, \mu_2, ..., \mu_i, ..., \mu_m) \in \{0,1\}^m$$

where

$$\mu_i = \begin{cases} 1, \text{ if object } \lambda \text{ uses skill } f_i \\ 0, \text{ otherwise} \end{cases}$$

The system we describe distinguishes two sets of words: the *Supported*, containing all search-enabled keywords, and the *UnSupported*, containing all the other words and, of course, does not need to be explicitly defined. Every search-enabled keyword in *Supported* is related to at least one Information space F_x in F, and furthermore connected with a certain constituent part of F_x. A certain, supported keyword may be connected, at most to one part in F_x, but may be related to parts in more than one information spaces (figure 1). A relation σ is therefore defined between the supported keywords and knowledge information spaces (and finally, constituent skills):

$$kw \; \sigma \; F_x \Leftrightarrow \exists f_i \in F_x : kw \text{ is related to } f_i$$

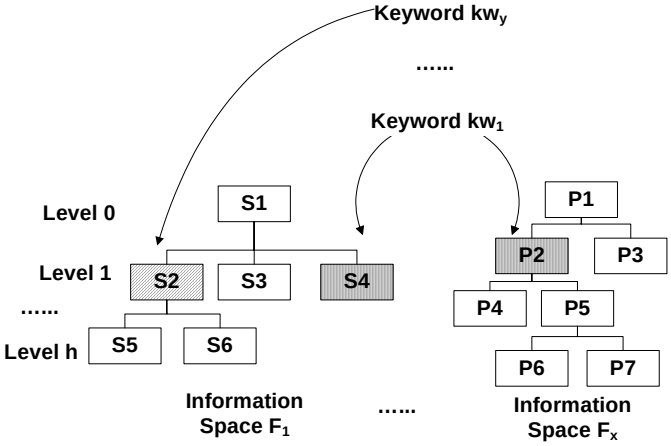

Fig. 1
Connecting Concepts, Educational Fields and Keywords

In the above example, shown in Figure 1, we have $kw_1, kw_n \in$ *Supported*. Furthermore, it is

$$(kw_1 \; \sigma \; F_1) \wedge (kw_1 \; \sigma \; F_x) \text{ and } (kw_y \; \sigma \; F_1) .$$

The HelpDesk search procedure is outlined as follows:

0. For each search term (word) *kw* given by the user, *kw* either belongs to *Supported* or not.

1. If $kw \notin$ *Supported* the word is being ignored and/or the user receives a negative message, for example "your query produced no results".

2. If $kw \in$ *Supported,* then it is related at least to one Information space. The system creates Relative Fields/Task Set, $RFT = \{F_x \in F : kw \; \sigma \; F_x\}$.

2.1 For each $F_x \in RTF$ a search is conducted within the Repository and -ideally- one relevant Learning Object $\lambda = (\kappa, \mu)$ is retrieved, under the following restrictions:

2.1.1 $\kappa_i = 1$

(LO presents skill/concept f_i)

2.1.2 $\sum_{j \in \{1,..m\} - \{i\}} \kappa_j = 0$

(LO presents no other skills. This criterion may be relaxed, though, by minimizing the number of additional skills it presents: $\min \sum_{j \in \{1,..m\} - \{i\}} \kappa_j$)

2.1.3 $\min \sum_{j \in \{1,..m\}} \mu_j = 0$

(LO uses a minimum-if not zero-number of undefined skills).

2.2 For each undefined skill f_j being used in the LO, a link is created. The link, targets another LO that presents this certain skill f_j. This LO is selected under the same restrictions 2.1.1, 2.1.2, 2.1.3, this time adapted to skill f_j.

3. End

The user types a few keywords. The system searches the database and finds connections between each keyword and educational skills or concepts. For each skill, a single LO is retrieved and presented as a choice to the user. The selected LO must exclusively target the skill in question, while at the same time, uses a minimal set of other skills. For each one of all these extra skills, an additional LO is selected, available to the user as links, "just-in-case" (s)he needs further information. This usually occurs when the skill requires one or more prerequisites, that the user is not already familiar with. The whole procedure is outlined in Figure 2.

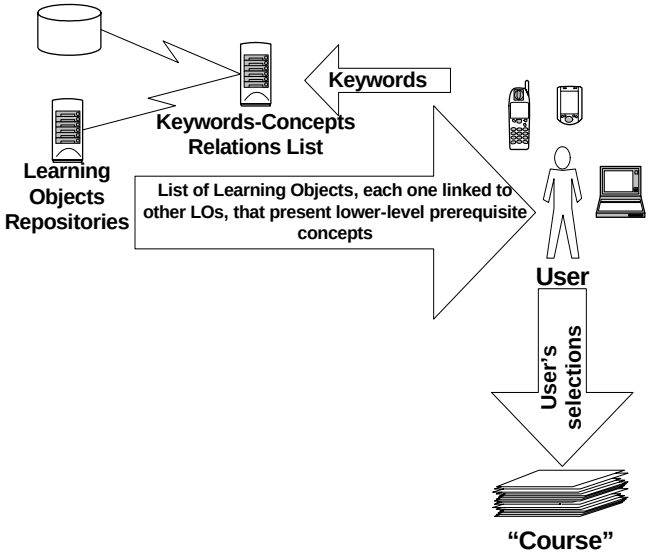

Fig. 2
HelpDesk Learning: user's selections create the "Course".

4 Summary and Final Remarks

M-learning can be used as platform for an online, educational Helpdesk system. Especially in the corporate context, it may be combined with knowledge management, thus facilitating learning and decision-making. This paper has presented a search model that selects Learning Objects from the Repositories and works in a Helpdesk manner. The LOs are selected by performing keyword-search. The search is not depending on the LO metadata though. It uses an instructional design model that connects keywords to skills and concepts. Skills are then used to retrieve the proper Learning Objects and the extra links to more, further education/help. Because of the limitations of m-learning environments, the LOs are selected under certain restrictions.

In this paper we took into consideration only the content-aware restrictions. There are also many others one might count. For example, the download size of the LO is another subject that must be considered and affect the LO selection; the type of instruction is another: certain learning theories fit better the m-learning environment than others; the type of m-learning platform and hardware also plays a major role.

Another major issue is controlling the number of search results and the ranking of the results as well, a problem that all search engines encounter. The ideal outcome is exactly one Learning Object, but this is almost impossible. A lot of work has to be done towards the direction of LO evaluation and ranking in LO selection for Learning.

Finally, the presented model can be adapted as an additional means for contingency-crisis management and response: a special member of a crisis management structure will be the educational-oriented component, part of the Advisory Component. This component may be used by the decision-makers and the on-site response teams as well. We must not lack to notice that contingency management presumes collaboration, and collaboration benefits a lot from mobile environments, the m-learning included.

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