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A process for knowledge reuse in communities of practice of e-learning

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Abstract

Knowledge management aims at capturing, transferring, and reusing knowledge. We are interested by knowledge reuse within Communities of Practice of E-learning (CoPEs). Pertinent reuse would facilitate learning of e-learning actors, increase their productivity and finally improve the quality of their artefacts. The present paper proposes a process for knowledge reuse within a CoPE, composed of two subprocesses: (1) reification process, transforming Tacit and Elicit knowledge to a new Elicit Knowledge, and (2) An indexing process, making reusable the previous resulted knowledge. Two knowledge indexing techniques are used: (a) Knowledge Annotation, using the concepts of O’CoPE ontology, and (b) Knowledge intentionalisation using members’ intentions. Moreover an adaptation process of Knowledge regarding the members’ profiles allows a personalized reuse of that knowledge.

Keywords: CoP of e-learning, Knowledge reuse, Knowledge reification, Knowledge indexing, Knowledge adaptation member’s Profile, Reuse intention;

1. Introduction

Today we are witnessing a fast and significant expansion of the e-learning domain. Indeed many large e-learning projects are launched everywhere in the world. However, despite the large quantity of knowledge accumulated in this field, the know-how and the feedback from acquired experience are not always capitalized and exchanged in a systematic way between the different actors (tutors, teachers, administrators, moderators…).

Recently there has been an increased recognition of the importance of Communities of Practice (CoPs) in several domains including education, engineering, management, health, etc. They are seen as a new organisational structure, where members are interacting, producing, exchanging and adapting resources and knowledge to meet their needs. The CoP concept is initially derived from the work of Lave and Wenger (1991), showing that learning means to participate in order to gain expertise. We have defined in some previous works, CoPs of e-learning (CoPEs) as
subclass of CoPs (Chikh et al., 2007, 2008a). We consider a CoPE as a virtual framework for exchanging and sharing techno-pedagogic knowledge and know-how between actors of e-learning.

We aim to solve the problem of knowledge reuse within CoPEs. Indeed pertinent reuse would facilitate learning of those actors, increasing their productivity and improving the quality of their artefacts. The interactions within a CoPE are conducive to nurturing new knowledge, stimulating innovation, or sharing existing tacit knowledge between e-learning actors. Community of Practice has become associated with knowledge management, in particular as a way of transferring tacit knowledge.

Actors in e-learning have tacit techno-pedagogic knowledge which they learnt from their accumulated experience in different e-learning projects. For example, one person can share the best way to design a special kind of learning situation based on his own experience, which may enable the other members to be inspired from it in order to design other learning situations. In a CoPE, members can openly discuss and brainstorm about a given problem or project related to e-learning.

We propose in the present paper a process for knowledge reuse within CoPEs. The process is based on the identification and representation of knowledge and is supported by two pillars: (1) members’ profiles for adaptive knowledge access; and (2) the definition of the intentions of reuse. Furthermore, our approach is based on O’CoPE, an ontology dedicated to CoPEs, for knowledge interpretation. An example of knowledge reuse is presented in section 5 to illustrate this process.

2. Background

CoPs are defined as people who share a concern, a set of problems or a passion about a topic and deepen their knowledge and expertise in this area by interacting on an ongoing basis (Wenger et al. 2002, 2000). They are a group whose members regularly engage in sharing and learning, based on their common interests (Mitchell, 2002) and were mainly aimed at learning through exchange and collaboration (Tremblay, 2004).

We define a CoPE, which is a subclass of CoPs, as a group of professionals in e-learning who gather, collaborate, and organize themselves in order to: (i) share information and experiences related to e-learning development and use; (ii) collaborate to solve together e-learning problems (e.g. Platform interoperability between different e-learning systems) and to build techno-pedagogic knowledge and best practices ; (iii) learn from each other and develop their skills in instructional engineering ; (vi) promote the use of e-learning standards: IMS-LIP, IMS-LD, SCORM, LOM; etc.

Therefore, a CoPE can be considered as an excellent framework for exchanging and sharing techno-pedagogic knowledge and know-how between actors of e-learning. A CoPE is supported by a technical environment composed of a set of services and resources, that helps members during their exchanges as well as when performing activities and producing artefacts.

As a result of their interactions, members will collectively build up techno-pedagogic knowledge. One of the major concerns of CoPEs is to reuse this knowledge, which can be classified according to (Nonaka, 1991) into Tacit Knowledge and Explicit Knowledge. Due to the informal character of learning within a CoP in general, most of the knowledge is mainly tacit and needs to be reified for a possible reuse. However, sharing such knowledge is considered as a big challenge: it must be efficiently and effectively represented in order to be further exploited. Burk (1999) describes the process of capturing and sharing knowledge as a cyclic process composed of four steps: find/create; organize; share; and use/reuse.

3. Research Problem

We distinguish two types of knowledge reuse in the context of a CoPE: (i) the Explicit Knowledge Reuse: which refers to the reuse of knowledge resources and artefacts (documents, learning scenarios, patterns...); and (ii) the Tacit Knowledge Reuse: interactions between members represent another form of reuse: to design his course, one member can reuse a complete/partial answer or some hints/examples provided by another member having more experience and competence in teaching.
Our objective consists to make the reuse explicit and to well organize it, so as to make it more efficient. However, the knowledge explicitation must be supported by approaches and techniques. Knowledge is often capitalized in a way that does not facilitate its access and reuse. This situation is due at least to the following problems: (1) a lack of models for uniform representation of knowledge in a given CoPE; (2) often knowledge capitalization doesn’t allow its adaptation; and (3) in general, objectives and intentions of CoPEs’ members against knowledge reuse are not explicit. Therefore, we address in this paper the problem of knowledge reuse issue in terms of organization of this process, so as to facilitate knowledge access and reuse. The resolution of this problematic might be guided by the following set of questions:

- What is the knowledge to reuse and what is the best approach for its representation?
- How to make adaptive the knowledge access according to members profiles?
- How to enrich this knowledge with members’ intentions?

4. Contribution

Recently, a lot of research works was interested to knowledge management and reuse within a CoP, to name but a few: the PALETTE project (2006), where several knowledge management services were proposed to support CoPs. These services rely on a semantic web-based approach using ontologies (Tifous et al., 2007), for annotating knowledge in order to facilitate their transfer and sharing. (Casalini et al., 2007) present a formal model for a knowledge repository to be used to underpin collaborative problem-solving in a virtual CoP. Other works are based on the concept of learning organizational memory to capitalize Tacit Knowledge (Leblanc and Abel, 2008). The authors take into account different levels of memory, different ways to facilitate exchanges between the organizational actors and different tools to enable knowledge externalization.

The present paper proposes a process for knowledge reuse within a CoPE, composed of two subprocesses: (1) A reification process transforming Tacit and Elicit knowledge to A new Elicit Knowledge; and (2) An indexing process making reusable the previous resulted knowledge. Two knowledge indexing techniques are used: (a) Knowledge Annotation, using the concepts of O’CoPE ontology (b) Knowledge intentionalisation using members’ intentions.

Moreover an adaptation process of Knowledge regarding the members’ profiles allows a personalized reuse of that knowledge.

4.1. The reification process

Based upon the work of Nonaka (1994), Huber (1991) and Alavi (1999), Knowledge is defined as “justified personal belief that increases an individual’s capacity to take effective action.” As stated above, Knowledge can be classified as in (Nonaka, 1991) into Tacit Knowledge (TK) and Explicit Knowledge (EK). EK is the knowledge that is often codified and easily expressed, captured, stored and reused. It can be transmitted as data and is found in databases, books, manuals, messages, etc. TK, however, is highly personal, less tangible and thus more difficult to obtain, manage and present in a meaningful form. TK is hard to formalize and therefore difficult to communicate to others. Nonaka and Takeuchi (1995) propose the SECI process, for knowledge creation through the four modes of knowledge conversion of tacit and explicit knowledge, including: Socialization, Externalization, Combination, and Internalization. These stages, present formalized communication structures as the mechanisms for transfer, capture, and making tacit knowledge explicit. According to Grundstein (2000), knowledge should be considered as the organization’s capital. This capital has to be increased and well managed.

One of the major concerns of CoPEs is to reuse both tacit and explicit techno-pedagogic knowledge. In this context, knowledge is interdisciplinary: psycho-cognitive, related to learners’ profiles; pedagogic, related to teaching approaches, methods and techniques; software-oriented, related to all the software used during the life cycle of e-learning systems (“Authoring Tools”, “Communication Tools”; “Learning Management Systems”…); hardware-oriented, related to all the hardware used during the life cycle of e-learning systems (Cameras, Smart board…); etc.

Figure 1 describes the knowledge reification process in the CoPE. Both TK and EK may be reused in the reification of new knowledge, according to the SECI model. New knowledge, once created, becomes in turn the basis for a new spiral of knowledge creation. To represent knowledge in CoPEs, different techniques may be used:
Documents, Patterns, Case-based Reasoning (CBR), etc. Example: for Knowledge used and developed during problem solving, Berkani and Chikh (2008) propose the development of Knowledge Management Systems (KMS) using the CBR approach. CBR is a problem-solving paradigm (Aamodt & Plaza, 1994). It relies on the reuse of past experiences, called "source cases" for the resolution of problems called "target problems". The authors identify and model different forms of knowledge: “Problem”, “Solution”, as well as the “Discussion” (traceability of interactions) to support the problem-solving process in the CoPE.

4.2. The indexing process

4.2.1. Knowledge Annotation

to enable knowledge reuse and sharing, the CoPE’s members need a shared vocabulary to be able to represent the core concepts of CoPEs. A formal specification of this vocabulary will be used in specifying knowledge, in order to support automatically the exchanges and transfer of knowledge. This shared vocabulary can be represented by means of ontologies. An ontology as stated by Gruber (1993) “…is an explicit specification of a conceptualization”.

The definition of a generic ontology for CoPEs, named O’CoPE, was done in a previous works (Chikh, et al., 2008b; 2008c; Berkani & Chikh, 2009). As shown in Figure 2, knowledge is used or developed by an “Activity” in the community “Environment”. The activity is performed by a “Member” having a “Role”. Figure 2. The conceptual model of a CoPE
Moreover, a generic knowledge ontology for CoPs is proposed in (Sarirete & Chikh, 2008) and a meta-ontology for CoPs in the European project PALETTE (2006) was developed. The present work goes in the same direction proposing a generic knowledge ontology for CoPEs. It is used to define a high level ontology of the knowledge used in the CoPE. A categorization of knowledge is defined by Nonaka et al. (2000): experiential, conceptual, systemic, and routine knowledge assets. We have adopted this classification and adapted it to CoPE’s context.

- Experiential knowledge assets: can be interpreted as hands on experiences and skills, acquired through discussion and shared practice, for the different steps of an Online Learning System (OLS) development life cycle. Example: formulating pedagogic objectives in requirements document.
- Conceptual knowledge assets: represent the EK articulated through symbols and language. It may refer for example to the knowledge acquired from e-learning standards and pedagogical ontologies to design an OLS.
- Systemic knowledge assets: consist of systematized and packaged EK. Example: pedagogical resources required to develop an OLS such as reusable guidelines showing how to define objectives.
- Routine knowledge assets: consist of the EK that is customized and embedded in the actions and practices. The different stages of an OLS can lead to the definition of best practices considered as lessons learnt and can be capitalized using pattern approach (e.g. representing best practices for building an OLS requirements document using pattern approach).

The Knowledge concept is structured as following:
- Content: designates the resource itself (What is it about?).
- Annotation: Represents the related concept in the O’CoPE ontology.

All such knowledge will be elicited through a participative approach and modelled and formalized in CoP-dedicated ontologies and knowledge bases.

4.2.2. Knowledge intentionalisation
Integration of intentions in knowledge aims to show the expected goals of the knowledge reuse process. These intentions may be related to the types of learning situations (e.g. problem-resolution, decision-making, project, etc.) where knowledge will be reused; the conditions for its use, the features of members who will use it; its nature, and so on. The following is an example of intention to take into account when reusing knowledge: Helping members to build an OLS responding to some competitiveness criteria. By expressing goals and the several ways of their achievement, the MAP formalism (Rolland & Prakash, 1999) seems to be ideal as a means for specifying intentions in the knowledge reuse process. This formalism is based on two concepts: Intention and Strategy.

4.3. The adaptation process
In order to personalize the knowledge reuse, we propose to adapt knowledge to members’ profiles. Given the fact that learning is a major part of a CoPE’s activities, especially for knowledge capturing and sharing, we will therefore focus on the role of a learner. After the consideration of some existing approaches (PAPI, 2000; IMS-LIP, 2001; Evangelou et al., 2006), we present a generic member profile model that can be used for the representation of both individuals and group members (see Figure 3). It consists of two types of information, namely static information and dynamic information. Static information includes personal characteristics of the members such as contact details, academic background, working experience, member status (e.g. expert, novice), qualification (e.g. technical, pedagogical), specialty, languages, etc. The dynamic information elements were chosen to reflect one’s individual behaviour during his participation in a CoPE’s knowledge capturing and sharing activities. We have proposed the five dynamic elements: Preferences and Needs regarding the use of knowledge resources, as well as Relations among individuals for the clustering issue (i.e. composition of groups of learners) and learning items (e.g. learning scenario, document) for the annotation of knowledge resources (i.e. knowledge assessment issues). Experience reflects learners’ expertise and know-how about a specific domain. Competences refer to cognitive characteristics such as the creativity, perception and social skills.
During the adaptation process, the reuse intentions will be confronted with the information included in member’s profiles.

![Member Profile Diagram](image)

**Figure 3. The CoPE member profile model**

The whole proposed reuse process is illustrated in the figure 4.

![Proposed Knowledge Reuse Process Diagram](image)

**Figure 4. The proposed knowledge reuse process in a CoPE**

### 5. Conclusion

We have proposed in the present paper a process for knowledge reuse within a CoPE, composed of two subprocesses: (1) A reification process transforming Tacit and Elicit knowledge to a new Elicit Knowledge. (2) An indexing process making reusable the previous resulted knowledge. Two knowledge indexing techniques are used: (a) Knowledge Annotation, using the concepts of O’CoPE ontology (b) Knowledge intentionalisation using...
members’ intentions. Moreover an adaptation process of knowledge regarding the members’ profiles allows a personalized reuse of that knowledge. Our future work directions concern the technical support and the validation of the proposed reuse process.

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