

# Knowledge Maturing and the Continuity of Context as a Unifying Concept for Knowledge Management and E-Learning

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**Abstract:** Although both e-learning and knowledge management are about facilitating learning in organization, the major obstacle to bring both of them together can be traced back to different paradigms of learning, resulting from the different nature of the knowledge they are dealing with. In this paper, a knowledge maturing process is presented to illustrate the change of nature and the discontinuities. This lays the foundation for a better understanding. In order to overcome the discontinuities, the consideration of context is proposed, which offers the required continuity.

## 1 Introduction

Recent years have seen an upsurge of interest in learning and learning processes in corporate environments. With the ever accelerating product and service lifecycles, employees need to update and expand their knowledge at a pace that traditional human resource development methods can no longer cope with. Together with the new job mobility of employees, this leads to a time lag between innovation in research and development departments, and the acquisition of knowledge in the areas of marketing and customer support. If this time lag can be reduced to a minimum, this can reduce the time-to-market of new products and services; if it cannot, it will either slow down the rollout of new products or services, or lower the product and service quality – both of which will translate into a competitive disadvantage.

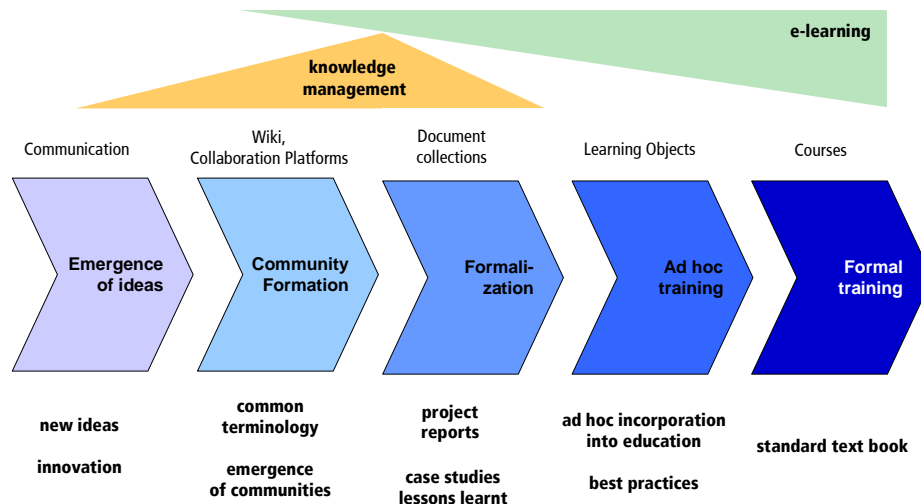
Two disciplines compete with one another in reducing this time lag with the help of current information and communication technology: knowledge management and e-learning. Whereas e-learning focuses on how to support the individual's learning process through pedagogical guidance (e.g. by a tutor organizing the learning process), knowledge management takes an organizational perspective and practices a more naïve, but also more versatile peer-to-peer philosophy of "sharing" and "transferring" knowledge. Knowledge management is mainly concerned with facilitating purpose-oriented learning in organisations (*what* and *why*), and the field fails to take into account the importance of *how* learning takes place [Schmidt, 05]. Despite these conceptual differences (and the resulting technical incompatibilities), it has been increasingly recognized that both of them are essentially about the same thing: *how to facilitate learning in organizations*. This has led to intensified research in the harmonization and combination of these two disciplines.

The major obstacle is the incompatibility of the conceptual models underlying knowledge management and e-learning. While the models for e-learning are founded on learning theories and focus on learning processes in which an individual constructs new knowledge with the help of learning resources and tutoring, the models of knowledge management (and organizational learning) focus on modelling a sequence of knowledge activities. None of them currently analyzes the problem of passing on knowledge within companies along the “knowledge flow” from the emergence of ideas up to teaching in seminars. While there are many transformations and many interwoven individual learning processes in between, it seems to be important to consider that (1) there is a continuity of some kind and (2) that the nature of knowledge that needs to be learnt changes along the way.

These observations were the starting point for the concept of knowledge maturing presented in the following section. After presenting a process model, we will analyze the discontinuities in this process. Section 3 will explore the role of context in this process. In the last section, the process model will be summarized and compared to the state of the art.

## 2 Knowledge Maturing Process

### 2.1 Process Model



**Figure 1: Knowledge Maturing Process**

The guiding principle in designing a process model was to analyze the changing nature of the knowledge that is passed on, learnt and taught, while at the same time making visible that there is continuity worth exploiting. We have decided to describe this phenomenon by the metaphor of knowledge maturing. After studying the literature in both e-learning and knowledge management and analyzing the state of the art in technology support, we present a five phase knowledge maturing model:

- **Emergence of ideas.** New ideas are generated in this most early phase, they are communicated in very informal ways without having a clear or even shared terminology. People learn from one another in discussions or casual conversations.
- **Community Formation.** With the emergence of communities, an important step in knowledge maturing takes place: a common terminology is developed. Typical tools used in this phase are collaboration platforms and wikis, enabling communities to easily exchange their views and work together on common artefacts. This working together on a common subject area is the primary form of learning.
- **Formalization.** While the explicit elements of the previous phase were inherently unstructured, this phase adds more structure to it. It typically produces purpose-oriented documents like project reports, design documents etc. Others learn new ideas from these documents and communicating with their authors.
- **Ad hoc training.** The documents of the previous phase are typically not usable as stand-alone learning material. This phase now adds didactical and pedagogical preparation of specific topics, which are most important. In this phase, the knowledge can be distributed to a wider range of target groups because the produced so-called learning objects are designed to be independent of the context in which they were created.
- **Courses.** The final phase carries out the task of putting together individual learning objects to complete courses, covering a wider subject area. At this stage, the knowledge can be learnt by novices. Standard courses are offered, schools and/or universities start to teach it.

It is important to note that in many cases the knowledge does not advance to the latest phases, but rather stays at the early phases until it turns out to be obsolete. A second important observation is that maturing typically involves combining, aggregating and recombining different pieces of knowledge.

If we have a look at this process from the macro perspective, we will discover that the primary focus of e-learning both in research and practice lies in the later phases, whereas knowledge management has concentrated especially on the community formation (via *communities of practice*) and the formalization phase. Recent developments, however, show that e-learning expands to earlier phases via the consideration of informal learning, and knowledge management acknowledges the importance of aggregated and well-prepared content, e.g. in the form of *best practices*.

## 2.2 Discontinuities

If we follow the process of knowledge maturing from the emergence of ideas via a first formalization and the incorporation into corporate training, it becomes obvious that each phase and the transition between the phases involves learning, but also several conceptual and technical incompatibilities in current approaches to support these learning processes become obvious:

- **Knowledge transfer & sharing vs. Training.** There are two paradigms for learning in organizations: on the one hand the self-organizing knowledge sharing paradigm where everybody is supposed to be learner and teacher, on the other hand the organized training paradigm in which there is a clear separation of learner and tutor roles. This can be traced back to the nature of knowledge: while training can rely on a relatively stable body of knowledge in the late phases with clear learning objectives and methods of assessment, the early phases with their more elusive ideas require more collaborative ways of learning.
- **Informal vs. formal learning.** The early phases of the knowledge maturing process consist almost exclusively of informal learning, while the late phases are dominated by formal learning. E-Learning has begun to investigate more deeply the importance of informal learning [Cook, 04, Heyse 02], thus addressing more “immature” phases in the knowledge maturing process. However, the methods and pedagogical theories for formal and for informal learning do not fit together very well. Even more, informal learning support from an e-learning perspective conflicts with collaboration support practiced in knowledge management.
- **Explicit knowledge vs. learning resources.** This discontinuity becomes most obvious between the formalization and ad-hoc training phase where the learning content production is currently almost completely separate from the documents produced in the process of knowledge management.
- **Knowledge management vs. human resource development.** The field of human resources management focuses on how to align the competencies of the employee with corporate strategies. It concentrates under the label of skills management on acquiring the appropriate staff and developing employees’ competencies towards the company’s needs. In order to accomplish this, it relies on well-defined, longer-term competencies, which are on a different conceptual level as knowledge areas dealt with in e-learning and knowledge management.

What at first sight seems to be a smooth transition along the way, currently is characterized by inefficiencies and time- and resource-consuming friction. But how can these discontinuities be overcome? In order to be able to reply to this question, we will consider the notion and role of context in learning in the following section.

### 3 The role of context

#### 3.1 The importance of context for the knowledge maturing process

Context is increasingly recognized as a neglected factor in all learning-relevant disciplines (and beyond them). In the case of corporate learning, context can encompass the individual characteristics of the learner, the tasks at hand, the business process context, or the organizational environment. The most prominent roles of context are the following:

- **Situated Learning.** The descendents of the constructivist learning theory have been emphasizing the importance of situated learning [McLellan, 95], i.e. learning should occur in context, in an authentic setting that is close to the real world. Here, corporate learning provides (through its immediacy of context) a pedagogical potential. that can be realized e.g. if e-learning resources adapt to the context in which they are executed (which includes both the individual and the work context).
- **Context-aware selection.** If the system knows about the context of a user, it the user need not make his contextual assumptions explicit, but the system can exploit it automatically to filter for relevant artefacts. This context-aware selection has been used both for e-learning ([Schmidt & Winterhalter, 04]) and (business process oriented) knowledge management [Abecker et al. 00].

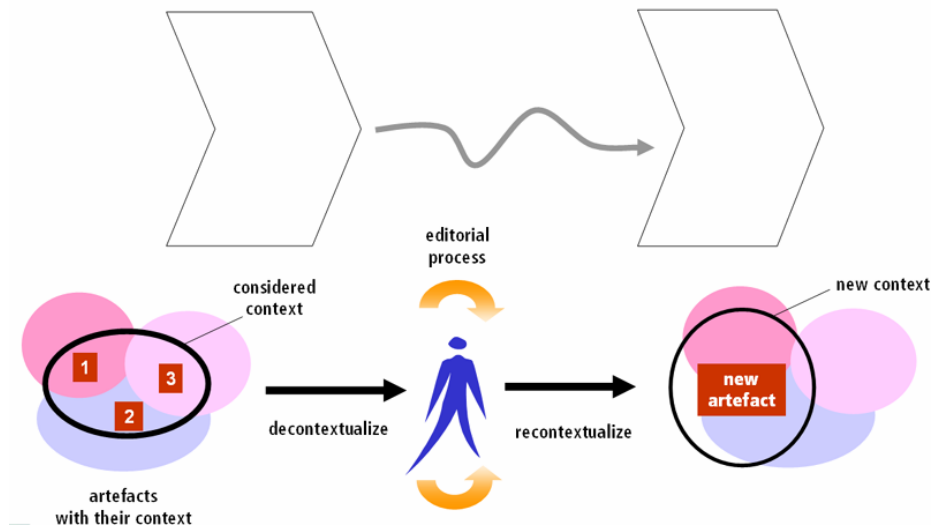
But how does the notion of (work) context relate to the knowledge maturing process? The answer are two propositions that seem to be paradoxical at first sight:

- **Context is the stable element** in the process and can provide the glue between the different phases.
- **Context is the changing element;** knowledge “matures” basically by decontextualizing it from its originating context and recontextualizing it in a different, in most cases broader context.

These two propositions seem to contract each other. But in fact, both of them are true. a maturing step (see figure 2) can be interpreted as step in which knowledge is taken out of its original context, transformed through learning and put into a new (often broader) context. If we look at the artefacts involved, we discover that part of their context changes, but that also part of their context remains constant. This is due to the fact that the context consists of many different aspects. For example, the emerging idea is inseparable from the person in whose mind this idea emerged. Passing it on to others is only possible by decontextualizing it. But still, the topic area or the business process context remains constant. Via this context, the individual can find others (sharing these context aspects) to form communities. Likewise, the context can help to organize the documents generated in the formalization phase and even integrate it into the ad-hoc-training phase (as the following phase will briefly show).

This offers the potential of supporting the whole process of knowledge maturing by considering the context and the changing or constant aspects. With respect to the identified discontinuities, the consideration of context can help to smooth them by:

- helping to create pedagogically sound learning resources from knowledge assets created in a peer-to-peer manner
- linking informal learning to formal learning via the shared context
- offering different types of resources (e.g. at different maturity stages) in a uniform way
- linking competencies to work contexts (e.g. via requirements, goals etc.)



**Figure 2: A Knowledge Maturing Step**

In the following subsection, an approach will be presented that tries to (1) provide an appropriate technology support for the ad-hoc-training phase and (2) to bring the formalization and ad hoc training phase closer together. Both of these goals are based on the consideration of context

### 3.2 The Case of “Context-Steered Learning”

In the project “Learning in Process” (LIP, [Schmidt, 04]), the idea of context-aware learning support has been investigated. The work context of the learner was supposed to be used in the selection of relevant learning resources in order to achieve the integration of working and learning (similar to [Lindstaedt & Farmer, 04]). The research has focused on the “ad hoc training” phase, but also considered how to extend the learning support to the formalization phase.

The foundation for LIP was the identification of a new type of learning process, which is particularly important in the ad-hoc training phase: context-steered learning. Whereas in traditional course-based learning (or traditional seminars) the course structure, pre-defined by the course designer (or trainer), directs the learning process, self-directed learning empowers the learner to select relevant resources and control the learning process. Self-directed learning is definitely more in line with constructivist views on learning, but it requires high cognitive skills to recognize an immediate learning need, to formulate a query for relevant material and to control the navigation in larger networks of learning resources. In the case of context-steered learning on the contrary, the system observes the employee’s work context (task, process, but also role and organizational unit) and deduces from a comparison of knowledge requirements and the employee competency record a (presumable) knowledge gap, which serves as an indicator for selecting available and relevant learning resources. These learning resources are recommended in an unobtrusive way to the employee. If she chooses to learn, the system automatically compiles a learning program, which may contain additional learning objects required to understand the

selected learning resource. Learning resources in LIP are not restricted to classical learning objects, but can also encompass similar cases, more subtle interaction possibilities in discussion fora or pointers to expert colleagues.

With the approach of context-steered learning and the automatic compilation of learning programs from semantically enriched learning objects, the concept of pedagogical guidance has been retained for knowledge in the later phases of the knowledge maturing process while at the same enabling the integration of less mature knowledge. User acceptance studies [Cook et al., 2004] have shown that this form of learning is seen as a valuable extension of traditional learning platforms.

## **4 Related Models**

There are plenty of models for learning in organizations. Most of them either focus on human activities (like [Senge, 94]) or assume a high degree of stability in the knowledge itself like the classical knowledge spiral model from [Nonaka & Takeuchi, 95], which has highlighted an important aspect of knowledge management: Knowledge primarily exists in the individual's mind as tacit knowledge. The flow of knowledge between individual can be characterized by four modes of knowledge conversion from tacit knowledge to tacit knowledge (socialization, e.g. sharing of knowledge in a team), from tacit knowledge to explicit knowledge (externalization, creation of artefacts), from explicit knowledge to explicit knowledge (combination of artefacts), and from explicit knowledge to tacit knowledge (internalization). This process is repeated in a spiral-like manner (see also [Tsoukas, 2002]). This model suggests a rather continuous process and does not mirror the change in nature of the knowledge, i.e. the maturing of the knowledge. The methods for socialization of knowledge or the internalization are very different in the different phases of the knowledge maturing process. As a conclusion, the knowledge spiral model provides a good micro model, but the spiral-like development is too simplistic. Here the knowledge maturing model provides a better macro perspective that helps to understand the different nature of knowledge.

## **5 Conclusions**

The knowledge maturing process model provides a reference model for workplace learning and allows for analyzing the possibilities for learning support in a more differentiated way. It especially helps to detect the discontinuities along the process with the current concept and tools.

In order to support the cohesion among the different phases and thus to reduce the "knowledge flow" barriers, the role of context in learning and knowledge management has been investigated. All learning processes occur in context and can be more efficiently supported if the system exploits available context information. Additionally, the maturing involves repeated steps of decontextualization and recontextualization in which the knowledge is detached from and reattached to some aspects of context, while other context aspects remain unchanged and can provide the glue between the different phases.

Future research will investigate how this potential of contextual support can be realized beyond the context-aware selection of relevant learning resources in LIP.

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## **References**

- [Abecker et al., 00] Andreas Abecker, Ansgar Bernardi, Knut Hinkelmann, Otto Kühn und Michael Sintek: Context-Aware, Proactive Delivery of Task-Specific Information: The KnowMore Project. *Journal on Information Systems Frontiers (ISF) 2* (314); Special Issue on Knowledge Management and Organizational Memory. Kluwer 2000. S.139-162.
- [Cook & Smith, 04] J. Cook, M. Smith: Beyond Formal Learning: Informal Community eLearning. *Computers and Education, CAL03 Special Issue*, 43(1-2), 35-47, 2004
- [Cook et al., 04] J. Cook, C. Bradley, P. Franzolini: Gathering Users' Requirements Using the Artifact-Claims-Implication Technique. In: *Proceedings of Ed-Media 2004*, Lugano, Switzerland, June 21-26, 2004.
- [Farmer & Lindstaedt, 2004] J. Farmer; S. Lindstaedt: AD HOC: Work-integrated Technology Supported Teaching and Learning, *Proceedings of Organisational Knowledge, Learning and Capabilities*, Innsbruck, Austria 2004
- [Heyse, 02] V. Heyse: Competence profiling: continuing vocational training needs and forms of learning in sectors with good future prospects. Münster: Waxmann Verlag, 2002
- [McLellan, 95] H. McLellan: *Situated Learning Perspectives*. Englewood Cliffs, NJ: Educational Technology Publications, 1995
- [Nonaka & Takeuchi, 95] I. Nonaka, H. Takeuchi: *The Knowledge-Creating Company*, Oxford University Press, 1995
- [Schmidt, 05] A. Schmidt: Bridging the Gap Between Knowledge Management and E-Learning with Context-Aware Corporate Learning Solutions. In: *3rd Conference on Professional Knowledge Management - Experiences and Vision (WM 2005)*, Workshop on Learner-Oriented Knowledge Management and KM-oriented Learning (LOKMOL), Kaiserslautern, Germany, April 2005
- [Schmidt, 04] A. Schmidt: Context-steered learning: The learning in process approach. In: *IEEE International Conference on Advanced Learning Technologies (ICALT '04)*, Joensuu, Finland, September 2004
- [Schmidt & Winterhalter 04] A. Schmidt, C. Winterhalter: User context aware delivery of e-learning material: Approach and architecture. *Journal of Universal Computer Science (JUCS) 10* (2004) 28-36
- [Senge, 94] P. Senge: *The Fifth Discipline*, Currency, 1994
- [Tsoukas, 2002] H. Tsoukas: Do we really understand tacit knowledge?, *Knowledge Economy and Society Seminar*; LSE Department of Information Systems, 14 June 2002