

Pattern-Based Knowledge Building in Learning Organizations

Christina MATSCHKE^a, Johannes MOSKALIUK^b, Franziska ARNOLD^a
& Ulrike CRESS^a

^a*Knowledge Media Research Center, Germany*

^b*University of Tuebingen, Germany*

*christina.matschke@iwm-kmrc.de

Abstract. Learning organizations strive to encourage knowledge exchange and knowledge building. Through externalization of knowledge into a shared digital artefact, individual knowledge is integrated into organizational knowledge. Through internalization, organizational knowledge is applied individually. Through discussion and collaborative revision of the artefact, organizational knowledge develops and thus again stimulates individual knowledge. Cress and Kimmerle [1] describe this process as co-evolution of individual and organizational knowledge. The current paper adopts the co-evolution model to knowledge-in-use, defined as complex knowledge needed for activities that are performed frequently. Such knowledge is often tacit and therefore difficult to externalize, internalize, or discuss. We propose that patterns facilitate the exchange of knowledge-in-use. The implementation of a pattern-based knowledge exchange tool in a large, decentralized organization is introduced.

Keywords: pattern, knowledge building, lessons learned, knowledge-in-use, learning organization

Introduction

Most of today's organizations may be defined as *learning organizations*. A learning organization "facilitates the learning of all of its members and continuously transforms itself" [2] (p.2). Such an organization integrates learning into daily work practices and provides ongoing "experimentation, using lessons learned to draw a link between learning outcomes and changes in knowledge performance" [3] (p.133). Organizational research literature has mainly addressed the impact of learning at the organizational level [4], but from a Learning Science point of view, the interplay between individual and organizational learning (also referred to as *knowledge building*) is of no less interest.

A learning organization supports the exchange of knowledge within an organization. However, different types of knowledge are not equally easy to exchange. In contrast to declarative knowledge, little is known about the exchange of *knowledge-in-use* [5]. Knowledge-in-use is a combination of declarative, conceptual or procedural knowledge that is necessary to perform a given task, solve a problem or handle a complex situation. Knowledge-in-use is embedded in daily challenges and in most cases implicit, because it is based on experienced work routines, which are often carried out unconsciously [6]. Knowledge-in-use is highly situated [7]: individuals develop an association between a situation that requires certain knowledge and the knowledge itself [5]. This association helps to identify relevant features of a current problem, to build an adequate representation of the problem and to retrieve necessary knowledge to solve a problem.

We thus define knowledge-in-use as knowledge about activities that are performed frequently and that are well established in the action routine of a person. In an organization, such activities are often socially shared. Moreover, these activities are usually tied to a specific context, because different contexts have their own characteristics that require a

certain activity [8]. In contrast to declarative or conceptual knowledge, larger parts of knowledge-in-use are tacit, because it consists of implicit knowledge about sequences of action [9]. Thus, the externalization of knowledge-in-use is laborious. In order to externalize, members have to become aware of their work routines, have to draw general conclusions from situated knowledge-in-use, and present it in an abstract form so it can be transferred to other contexts. Internalization is also difficult: Individuals have to adapt information from an abstract level to a very concrete situation. Nevertheless, both externalization and internalization are indispensable components of what constitutes organizational knowledge building.

1. Individual Learning and Organizational Knowledge Building

Based on the *theory of knowledge creation* [10] and on the *concept of knowledge building* [11], the co-evolution model by Cress and Kimmerle [1] emphasizes knowledge creation by externalization, internalization and the use of shared digital artefacts. Going beyond earlier models, the co-evolution model [1] points out that individual learning and collective knowledge building are two parallel and equally important processes which support each other. Based on Luhmann's social systems theory [12], the model regards the exchange of knowledge as interplay between the cognitive system (i.e., the individual, operating through thinking, reasoning and learning) and the social system (i.e. the organization, operating through communication). The cognitive system externalizes knowledge into a shared digital artefact. Thus, the externalized knowledge exists independently. Another cognitive system is then able to gather the information and transfer it into individual knowledge (internalization). The social system operates through communication within the digital artefact. Thus, the shared artefact initiates a dynamic and self-organized process in which ideas are modified, reflected, discussed. Individual learning and knowledge building stimulate each other. Social software is capable of supporting these processes within the social system [13]. Taken together, the co-evolution model offers a framework to interlink the processes of individual learning and knowledge building within a learning organization and regards these processes as co-evolving.

The model has not explicitly focused on knowledge-in-use yet, but we propose that the processes are the same when applied to knowledge-in-use. Knowledge building can also take place in the exchange of how learners handle authentic real-life problems that require knowledge-in-use. Learning organizations should thus facilitate the exchange of different experiences and the collective creation of knowledge-in-use at the organizational level. Lessons learned may be regarded as a digital artefact which is useful for such knowledge-in-use. Members of a learning organization externalize their knowledge-in-use by creating reports on lessons learned. These reports will help other member to detect features of a current problem and retrieve relevant knowledge-in-use: They will be able to adopt and internalize lessons learned in the context of a specific situation (figure 1).

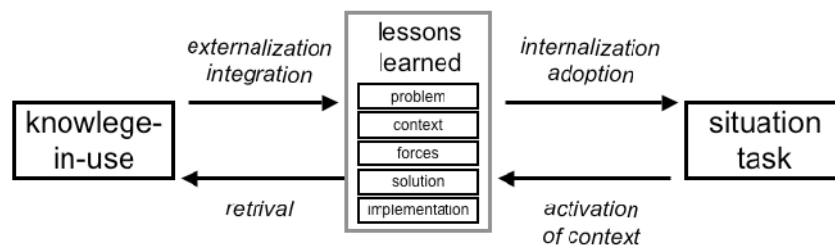


Figure 1: Process of internalization and externalization

Communication on the reported and adopted lessons learned leads to the development of the shared artefact, and thus increases organizational knowledge. In other words, the processes

of externalization and internalization not only lead to the development of knowledge-in-use at the individual level, but to a mutual development of individual and organizational knowledge. Such a co-evolution of individual and organizational knowledge-in-use is the key to successful knowledge building in organizations.

In local organizations, knowledge-in-use can be socially transferred by socialization, i.e. learning by observation, imitation and practice. Decentralized organizations with strong local characteristics do not have that possibility and thus depend more strongly on shared digital artefacts. The fact that knowledge-in-use is tacit, however, makes the externalization, internalization and discussion of knowledge-in-use within a shared artefact difficult, but these processes are crucial preconditions for successful organizational knowledge building. We propose that patterns can serve as a means to facilitate the co-evolution of individual and organizational learning.

2. Pattern and Knowledge Building

2.1 The Pattern Idea

Patterns are “concrete problems and solutions, yet phrased in a manner that affords generalisation and application in a broad set of contexts” [14] (p.1079). Formally, a pattern is a structured input format that connects a certain problem to a certain solution and stimulates reflection on the solution. A standard pattern contains the following fields: *name* (short description for the entire pattern), *problem* (describes the question that could be solved by using the pattern), *context* (describes in which situation one may use the pattern), *forces* (competing requirements) and *solution*. Originally, patterns were used in architecture [15] and software programming [16]. The concept of using patterns to store and transfer knowledge has also become popular in other technical and educational domains, for example, the design of human-computer interaction [17], programming Web 2.0-sites [18], and E-learning [19]. Based on the co-evolution model, we assume that patterns support the mutual development of organizational and individual knowledge-in-use.

Experienced members of a learning organization can use patterns to externalize situated knowledge-in-use, including invariant components of recurring problems and their successful solution within work routines. This way, reflection is stimulated and different situations and experiences are integrated into an abstract pattern that explicates the context as aggregation of different situations (figure 2a). Patterns thus describe lessons learned as successful solutions that may be used as samples for solving problems in similar contexts, and they make it possible to externalize implicit knowledge-in-use by providing structures for the externalization of knowledge.

Experiences of different experts may be integrated into one shared pattern, so knowledge will be reflected and revised in a collective process. This will lead to new, emergent organizational knowledge if different experiences influence each other and stimulate the integration and combination of individual knowledge-in-use (figure 2b).

Moreover, patterns are likely to support the internalization of organizational knowledge-in-use by identifying specific situations where that knowledge is needed. If a specific situation activates a context that is part of the shared pattern, the use and internalization of shared knowledge-in-use will be supported. This way, individuals can integrate organizational knowledge-in-use in the appropriate context. When particular organizational knowledge-in-use has been applied, that knowledge can, again, be reflected with other organizational members in the shared pattern. Taken together, patterns are likely to facilitate the externalization of individual knowledge-in-use, the internalization of shared

organizational knowledge-in-use, and enable a co-evolution of individual and organizational knowledge-in-use.

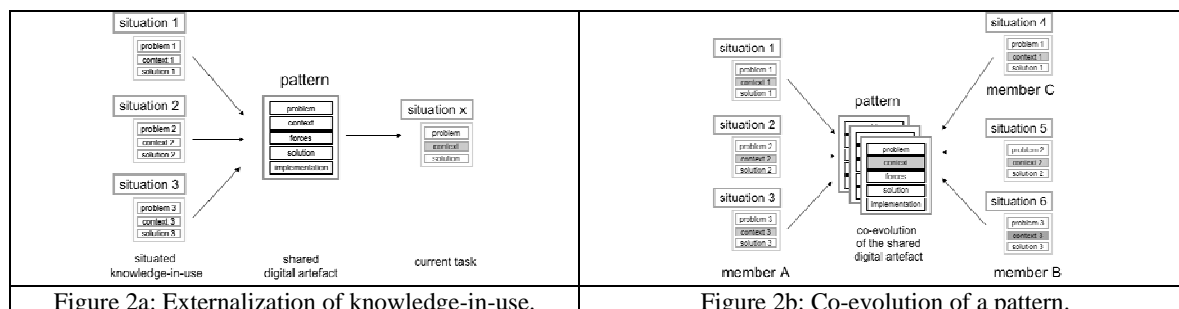


Figure 2b: Co-evolution of a pattern.

3. Implementation of Pattern-based Knowledge Building

3.1 The Patongo Project

The aim of the Research Project PATONGO (Patterns and Tools for Non-Governmental Organizations) is to investigate and optimize the exchange of knowledge-in-use between members of decentralized non-profit organizations. Together with the *Evangelische Kirche in Deutschland* (EKD, Evangelical Church in Germany) and *FernUniversität Hagen* (Distance Teaching University), we are developing and evaluating a knowledge exchange platform for the 250,000 full-time staff members and about one million volunteers of the EKD. These members possess tremendous knowledge-in-use, have a strong need to exchange their knowledge but rarely do so beyond their circle of colleagues and friends.

3.2 The Pattern Platform

The new Internet platform for the employees and volunteers of the EKD consists of three main areas that are named “idea space”, “experience space” and “knowledge space”.

In the *idea space*, users ask questions that concern their everyday working life, discuss current problems, and develop their ideas together. Users may post questions or ideas, and discussions on single topics are threaded. Each topic provides a conclusion field that invites users to write a short summary or present the result of this discussion in the experience or knowledge space. In the *experience space*, users describe specific individual experiences (e.g., a choir project with youngsters in a Berlin suburb) that have stood the test of practice. The lessons learned in this space are tied to a specific context and local characteristics. The pattern structure provides input fields for describing preparation, implementation, material, or costs. The *knowledge space* is more abstract and more collaborative: it establishes a common encyclopedia of the organizational knowledge-in-use (e.g., music projects). All users of the platform may edit the entries in this section as in a wiki. Patterns in this space use the classical problem-context-solution structure. Besides these artifact-focused spaces, the platform also facilitates communication and coordination between the members by providing an opportunity to fill in personal profiles and create groups. In this way, it is possible to find users with similar experiences and interests.

The three spaces of the platform are strongly linked together and technical tools encourage transformations of more concrete to more abstract forms of descriptions. Discussion around a topic in the idea space encourages users to collect ideas and encourages members to write about their own knowledge-in-use. When users search in the knowledge space for patterns

that do not exist yet, the platform advertises appropriate lessons learned from the experience space. At the same time the users are invited to sum up these different experiences into the knowledge space. Strong interlinks between the sections facilitate discussion, reflection and integration of lessons learned. This way, collaboration is supported and optimal conditions are created to stimulate individual learning and organizational knowledge building at the same time.

References

- [1] Cress, U., & Kimmerle, J. (2008). A systemic and cognitive view on collaborative knowledge building with wikis. *International Journal of Computer-Supported Collaborative Learning*, 3(2), 105–122.
- [2] Pedler, M., Boydell, T., & Burgoyne, J. (1989). Towards the learning company. *Management Learning*, 20(1), 1–8.
- [3] Marsick, V. J., & Watkins, K. E. (2003). Demonstrating the value of an organization's learning culture: the dimensions of the learning organization questionnaire. *Advances in Developing Human Resources*, 5(2), 132–151.
- [4] Yang, B., Watkins, K. E., & Marsick, V. J. (2004). The construct of the learning organization: dimensions, measurement, and validation. *Human Resource Development Quarterly*, 15(1), 31–55.
- [5] De Jong, T., & Ferguson-Hessler, M. G. M. (1996). Types and qualities of knowledge. *Educational Psychologist*, 31(2), 105–113.
- [6] Smith, E. A. (2001). The role of tacit and explicit knowledge in the workplace. *Journal of Knowledge Management*, 5(4), 311–321.
- [7] Greeno, J. G. (1998). The situativity of knowing, learning, and research. *American Psychologist*, 53(1), 5–26.
- [8] Wodzicki, K., Moskaliuk, J., & Cress, U. (in press) Patterns of social practice: A psychological perspective. In C. Kohls & J. Wedekind (Eds.). *Investigations of E-Learning Patterns: context factors, problems and solutions*. Hershey, PA: IGI Global.
- [9] Polanyi, M. (1966). *The tacit dimension*. Garden City, NY: Doubleday.
- [10] Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization science*, 5(1), 14–37.
- [11] Scardamalia, M., & Bereiter, C. (1994). Computer support for knowledge-building communities. *The Journal of the Learning Sciences*, 3(3), 265–283.
- [12] Luhmann, N. (1995). *Social systems*. Stanford: Stanford University Press.
- [13] Kimmerle, J., Cress, U., & Held, C. (2010). The interplay between individual and collective knowledge: technologies for organisational learning and knowledge building. *Knowledge Management Research & Practice*, 8, 33–44.
- [14] Winters, N. & Mor, Y. (2009). Dealing with abstraction: Case study generalization as a method for eliciting design patterns. *Computers in Human Behavior*, 25(5), 1079–1088.
- [15] Alexander, C. (1977). *A pattern language: towns, buildings, construction*. Oxford: Oxford University Press.
- [16] Beck, K., & Cunningham, W. (1987). Specification and design for object-oriented programming. Paper presented at OOPSLA'87. Orlando, Florida, USA.
- [17] Tidwell, J. (2005). *Designing interfaces*. Sebastopol: O'Reilly Media, Inc.
- [18] Mahemoff, M. (2006). *Ajax design patterns. Creating web 2.0 sites with programming and usability patterns*. Sebastopol: O'Reilly Media, Inc.
- [19] Schümmer, T., & Lukosch, S. (2007). *Patterns for computer-mediated interaction*. Hoboken, NJ: John Wiley & Sons.