



Knowledge transfer as interaction between experts and novices supported by technology

Maximiliane Wilkesmann and Uwe Wilkesmann

*Center for Continuing Education, Dortmund University of Technology,
Dortmund, Germany*

Abstract

Purpose – The aim of this paper is to link two sides of knowledge transfer (obtaining and providing knowledge), represented by the interplay between experts and novices, possibilities of technical support, and individual and organizational outcomes. An heuristic is developed to link up these different aspects and focus on practical application of some of them; the authors seek to answer the following research question: how can the organization support activities that would encourage knowledge transfer between novices and experts?

Design/methodology/approach – The authors used interviews, document collection, and observations on-site to gain insights into knowledge management and e-learning activities at Lufthansa, a German airline company, beginning in 2004, with the first qualitative investigation, in the form of telephone interviews. Over the following six years, the authors followed up with archival analysis and in 2010 conducted interviews with four experts who are responsible for knowledge management and e-learning at the group level at Lufthansa. All interviews were recorded, transcribed and coded, then a qualitative content analysis was conducted. The interviews were complemented by several demonstrations of the system during a visit on-site.

Findings – Every person can be simultaneously a novice and an expert in different fields of knowledge. Novices and experts need organizational leeway which allows time for creating “knowledge nuggets” (providing knowledge) and for learning (obtaining knowledge). The Lufthansa example shows that organizational leeway, the convergence of e-learning and knowledge management in the form of rapid e-learning, and introduction of knowledge transfer methods that provide opportunities for employees to obtain and provide knowledge, i.e. practice knowledge transfer on the job.

Originality/value – The contribution of this paper is that the authors develop an heuristic, which explains technically supported knowledge transfer processes among novices and experts, and their individual and organizational outcomes. The heuristic helps to classify knowledge transfer processes and their outcomes.

Keywords Knowledge transfer, Experts, Knowledge management, E-learning, Organizational culture

Paper type Research paper



Introduction

Knowledge is the central resource of many organizations. The operating core of organizations consists to a great extent of specialists and their expert knowledge. Knowledge transfer among the members of an organization is a basic necessity. The aim of our article is to answer the following research question:

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RQ1. How can organizations support knowledge transfer activities of their members, and facilitate exchanges between experts and novices?

We start with a brief introduction to levels of knowledge transfer. Then, we discuss providing and obtaining knowledge as different directions of knowledge transfer, and illustrate both processes with empirical examples. Next, we show the difference between novices and experts, and discuss individual and organizational learning outcomes. We integrate these different approaches into an heuristic model, and use the case of Lufthansa, a German airline company, to give a prime example of how organizations support knowledge transfer among novices and experts with the help of:

- organizational leeway;
- the convergence of e-learning and knowledge management in the form of rapid e-learning; and
- the introduction of knowledge transfer methods.

Levels and directions of knowledge transfer

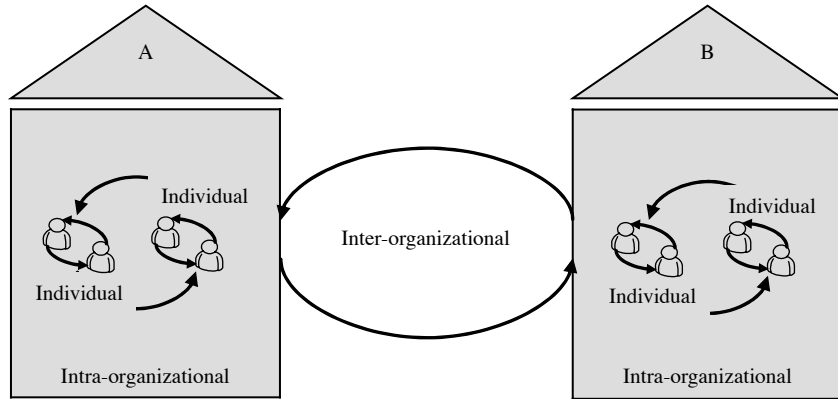
Individual, intra-organizational, and inter-organizational levels of knowledge transfer
Knowledge transfer is the most common term in the literature to describe knowledge exchange processes. Therefore, so we use this term even though the term data or information transfer is more adequate (Aamodt and Nygård, 1995; Willke, 1998). If we take this into account, knowledge transfer signifies the creation of new knowledge through the exchange of information. We also have to consider that only the person who obtains information can decide whether or not information transfer leads to knowledge transfer. We define knowledge transfer as a multilevel phenomenon that can be realized on the individual, intra-organizational, or inter-organizational level (Wilkesmann *et al.*, 2009a). All three levels are discussed in the Nonaka's and Takeuchi's (1995) SECI model. Argote and Ingram (2000), Inkpen and Tsang (2005) and van Wijk *et al.* (2008) define organizational knowledge transfer as a "process through which organizational actors – team, units, or organizations – exchange, receive and are influenced by the experience and knowledge of others" (van Wijk *et al.*, 2008, p. 832). Intra-organizational knowledge transfer means the transfer between departments in an organization which "manifests itself through changes in knowledge or performance of the recipient unit" (Inkpen and Tsang, 2005, p. 149). At the individual level, these "units" are members of an organization, at the intra-organizational level they are business units, and at the inter-organizational level, units are organizations (Figure 1).

Regardless of whether knowledge transfer takes place on the intra- or inter-organizational level, it has to be conducted by individual organizational members. In alignment with Empson (2001, p. 843) who concluded that "knowledge transfer is above all an inter-personal process" and with Hedberg (1981, p. 6) who stated that "organizations have no other brains and senses than those of their members", we assume that even if organizations transfer knowledge at the intra- or inter-organizational level, processes of knowledge transfer always include the individual level. Therefore, we focus on knowledge transfer as an interaction between experts and novices at the individual level.

Directions of knowledge transfer: obtaining and providing

In the beginning of the twentieth century behaviorists believed, as did cognitive scientists in the middle of the twentieth century, that knowledge could be transferred

Figure 1.
Levels of knowledge
transfer

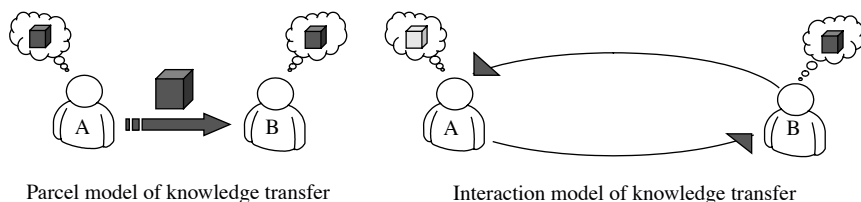


without loss like an object or a parcel (parcel model of knowledge transfer, see Figure 2). The underlying idea is the simple transmission model of communication by Shannon and Weaver (1949). Knowledge that is transferred by person A (sender) will be incorporated in the same way in the memory of person B (receiver). Nowadays, social interaction and processes of personal understanding as well as sense making are seen to play a more critical role. This is the starting point of the constructivist theoretical considerations made by constructivists (Watzlawick, 1976; also known as the “Palo-Alto communication model”). Knowledge cannot be transferred intact because learning is an active process of constructing knowledge in the receivers mind (Savery and Duffy, 1995; Duffy and Cunningham, 1996; Oliver, 2001).

For a closer look at the individual process of knowledge transfer, we developed seven items that measure explicit or tacit knowledge processes, based on Nonaka’s and Takeuchi’s SECI model (Nonaka’s and Takeuchi’s, 1995; Nonaka *et al.*, 2006). The items were measured on a five-point Likert scale (1 – strongly disagree, 5 – strongly agree). In 2006, we conducted a survey of nurses and physicians in 11 hospitals in Germany. Altogether, we distributed 3,024 questionnaires, out of which 1,047 were returned; representing 34.62 percent response rate (Wilkesmann *et al.*, 2009b). A principal component analysis (varimax rotation with Kaiser-normalization) shows two latent variables, which we named “providing knowledge” and “obtaining knowledge” (Table I). With a KMO value of 0.8 and an explained variance of 64.3 percent the two factors can be distinguished.

In the second survey that we conducted in 2008 in the biggest German charity organization, we used the same items to measure knowledge transfer (Wilkesmann *et al.*, 2009c). It was an online survey regarding the knowledge management system

Figure 2.
Models of knowledge
transfer



Items "knowledge transfer"	Factor 1	Factor 2	Cronbach's α
I show colleagues special procedures so that they can learn them	0.868	0.073	Providing knowledge 0.860
I support colleagues' efforts to gain work experience	0.834	0.111	
Colleagues learn a lot by watching me on the job	0.817	0.130	Obtaining knowledge 0.775
I learn a lot by observing colleagues doing their job	0.089	0.797	
I turn to colleagues for advice regarding special procedures so that I learn them	0.100	0.779	
Colleagues support my efforts to gain work experience	0.127	0.739	
I learn a lot by asking colleagues	0.007	0.714	

Note: $n = 1,047$

Table I.
Hospital survey: principal components analysis of "knowledge transfer" with varimax rotation

of the charity organization, and was accessible over the intranet. A total of 647 employees answered the questionnaire (48.7 percent male and 51.3 female). Again, the principal components analysis with varimax rotation and a KMO value of 0.79 and an explained variance of 66.8 percent distinguishes the same two latent variables (Table II).

Both results lead us to the conclusion that the two latent variables, providing knowledge and obtaining knowledge, are different aspects of the knowledge transfer processes. If we take a closer look at both factors, we can see that knowledge is not a simple object, nor is exchange a simple transmission. In this regard, knowledge transfer is comparable to the communication process Luhmann (1995, p. 139) introduced: "The metaphor of transmission is unusable because it implies too much ontology. It suggests that the sender gives up something that the receiver then acquires". For Luhmann, communication is something that requires selection by (or is attributed to) two actors. From this point of view, the person who is obtaining knowledge has to integrate new information in his or her existing knowledge, and creates new knowledge through this process. The person who provides knowledge cannot say anything about the obtaining process of the other person. Here, we take a constructivist point of view on knowledge transfer into our considerations. If person A teaches or transfers knowledge to person B, person B brings his or her own needs and previous knowledge to this learning situation.

Items "knowledge transfer"	Factor 1	Factor 2	Cronbach's α
I show colleagues special procedures so that they can learn them	0.825	0.216	Providing knowledge 0.764
I support colleagues' efforts to gain work experience	0.800	0.207	
Colleagues learn a lot by watching me on the job	0.776	0.103	Obtaining knowledge 0.818
I turn to colleagues for advice regarding special procedures so that I learn them	0.161	0.845	
I learn a lot by asking colleagues	0.093	0.834	
Colleagues support my efforts to gain work experience	0.177	0.812	
I learn a lot by observing colleagues doing their job	0.356	0.626	

Note: $n = 647$

Table II.
Charity survey: principal components analysis "knowledge transfer" with varimax rotation

Therefore, we can conclude that the knowledge which person A provides is never the same knowledge that person B obtains (interaction model of knowledge transfer, see Figure 2).

Beside these constructivist considerations, obtaining knowledge (learning) is affected by different factors besides the provision of knowledge (teaching). Wilkesmann *et al.* (2009b) investigated the factors influencing knowledge transfer in a hospital setting, and found that the occupational tenure is an important factor regarding providing knowledge: with longer tenure more knowledge is provided. Obtaining knowledge, however, is not associated with tenure (Wilkesmann *et al.*, 2009b). This leads us to the differentiation between experts and novices.

The difference between experts and novices

The longer a person works in a field, the more expertise that person develops in that field. The most prominent approach to the difference between experts and novices is the model of skill acquisition by Dreyfus and Dreyfus (1980). Their model is based on studies of chess players, air force pilots, army tank drivers, and commanders (Dreyfus, 1982; Dreyfus and Dreyfus, 1979, 1980, 1986), and nurses (Benner, 2004). They postulate that novices have to pass at least five stages of skill acquisition in order to become experts (Table III).

In the beginning, novices conform to rules. They have more or less “textbook knowledge” without connecting this knowledge directly with practice. At the expert stage, persons use an intuitive mode of reasoning because they have authoritative knowledge across their area of practice. The intuitive mode of reasoning is also known as tacit knowing (Polanyi, 1967), knowing-in-action (Schön, 1983) or practical consciousness (Giddens, 1984). This circumstance makes experts autonomous, reflexive, and evaluative in their daily action, whereas actions of novices are more or less rule based (Table III). The crucial point is that there are information asymmetries between novices and experts. This knowledge gap is then the driver of knowledge transfer: a person can only learn something from another person if the provided knowledge is new information for him or for her. This is consistent with Bateson’s (1979, p. 68) understanding of information. For our further considerations, we have to take into account the fact that every person can be simultaneously a novice and an expert with regard to different topics. In one context someone might be very experienced but in another context, e.g. if the work task changes, the same person can be a novice.

Know that

- | | |
|----------------------|---|
| 1. Novice | Rigid adherence to rules
No discretionary judgment |
| 2. Advanced beginner | Guidelines for action based on attributes
All attributes are treated separately and given equal importance |
| 3. Competent | Action is perceived in terms of longer-term goals
Conscious deliberate planning |

Know how

- | | |
|---------------|--|
| 4. Proficient | Sees situations holistically rather than in terms of aspects
Perceives deviations from the normal pattern |
| 5. Expert | No longer relies on rules or guidelines
Intuitive grasp of situations based on deep tacit understanding |

Table III.

From novice to expert

Source: Dreyfus and Dreyfus (1980)

Individual and organizational learning outcomes

Ideally, in an organizational setting, experts ideally provide knowledge and novices obtain knowledge. According to our assumptions above, a person is almost always simultaneously an expert and a novice. The members of a project group, for example, are experts in only one or two specific areas. But they are not experts in other areas compared to the rest of the project group members; in these areas they are novices – otherwise a project group would be useless. The idea of a project group is to bring different experts together in order to create solutions for a certain problem.

How can we now link individual knowledge transfer to organizational outcomes? Does it mean that the whole organization learns if a single person learns, or if some members of the organization learn? Organizational learning is neither individual learning nor learning of a “super individual”, but it starts from an individual perception as Argyris and Schön (1996, p. 16) pointed out:

Organizational learning occurs when individuals within an organization experience a problematic situation and inquire into it on the organization’s behalf. They experience a surprising mismatch between expected and actual results of action and respond to that mismatch through a process of thought and further action [...]

Consequently, we describe a model of organizational learning as collective action that can link both levels: individual and organizational learning (Wilkesmann, 1999, 2005; Figure 3). This model distinguishes two different types of collective action in organizations:

- (1) routine games; and
- (2) innovation games.

Routine games are the processes by which organizations produce their goods or services (this is what an organization does most of the time). Innovation games are the processes by which organizations change and rearrange routine games (these are more or less exceptions in the daily business).

The day-to-day business of an organization is structured by routine games. All members know what they have to do. Routine games reproduce organizational structures. They also define the frames of every day negotiations because they assign power resources to members. Therefore, every novice in an organization has to learn and to reproduce the routine games of the organization. When Mrs Smith as a novice learns, e.g. via e-learning, how to use a new software program, it is more or less irrelevant for the company as a whole because it is primarily an individual outcome. After finishing the e-learning course only individuals, e.g. Mrs Smith and some other colleagues, have the qualification to operate the program. By using the new software in her daily workflow, Mrs Smith develops routines based on replicating the guideline. The individual learning outcome is rule-based action. In contrast to that, experts’ learning

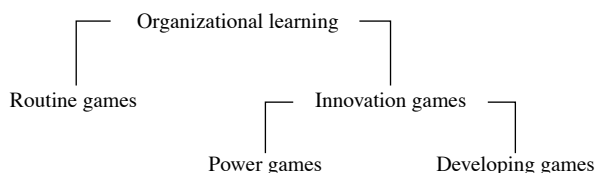


Figure 3.
Learning in organizations

results differ from the learning results of novices because experts are able to rearrange routine games to innovation games. Perhaps, after a while Mrs Smith turns becomes an expert in using the software. She may then supports colleagues, or develops new ideas about how to optimize the software or the whole work procedure. In this regard, we can say that experts develop new rules for new routine games (Courpasson, 2000). We call these new routine games innovation games. They can be further divided into power games and developing games. Power games do not necessarily lead to the “best” innovation. Here, the most powerful decision makers can impose or avoid innovations. The aim of developing games is to create new ideas or new knowledge. Therefore, a number of employees have to discuss a problem, i.e. they have to transfer knowledge, for example: how can we produce faster? How can we enter the market of e-commerce? In such a situation, experts develop new ideas for organizational problems. In this regard, knowledge transfer is a way in which complex problems can be solved. Complex problems (Hirokawa, 1990) are defined as problems:

- which cannot be solved with the information of only one person;
- without criteria for a “right” solution; and
- without a well-known approach.

Complex problems can only be solved in collective learning situations. Collective learning is defined as a situation where all persons exchange different perspectives and afterwards integrate these perspectives into one solution. A well-known example for such a situation is the working procedure in a project group (see above). This is also a classical example of a face-to-face knowledge transfer situation between experts and novices (see above). All group members are experts in some area that is relevant to solving the problem – but they are more or less novices in all other relevant areas. If all members were experts in all areas, one expert could solve the problem alone and the company could save the wages of all other group members.

Generally, we have to take into account that new solutions can change the power and domination relation within the organization. If a new product is launched, some skills for producing the old product become superfluous. Therefore, experts are not only transferring knowledge – they have to handle their power, too. We want to focus on the last-mentioned power aspect when we talk about power games. The power of actors is related to their control of valuable resources (e.g. exclusive knowledge) in which other actors are interested (Coleman, 1990; Crozier and Friedberg, 1979). The more power an actor possesses, the more interest he or she can impose. If all actors in a group are (more or less) equally powerful, cooperative behavior will emerge. If one actor has more power, a strategic bargaining process will occur. Finally, outcomes of the collective learning process have to be transformed into organizational learning. The new solutions (created in a project group) have to be implemented within the organization; otherwise no organizational learning will take place.

To generalize the link between knowledge transfer and the individual with respect to organizational outcomes, we can say that while individual novice’s learning processes support, to a greater or lesser degree, the practicing of routine games, experts’ knowledge transfer can support an innovation game process. For leveraging innovation games enough power and commitment is needed to allow organizational change and organizational learning to take place. Knowledge transfer is a necessary prerequisite for innovation games but power is the sufficient condition.

Organizational support on knowledge transfer

How can organizations support the knowledge transfer activities of their members? In accordance with Szulanski (2000), Baum and Berta (1999) and Shaw (1964), we propose that the organizational context may enable transfer by providing direct channels where employees can exchange their knowledge directly and without a middleman, as well as by nurturing an appropriate organizational culture. As mentioned above, Wilkesmann *et al.* (2009b) investigated factors influencing knowledge transfer in a hospital setting. While meetings and the use of the internet, for example, promote the activity of providing knowledge, the more informal channels of knowledge transfer (coffee breaks) and database use have a positive effect on obtaining knowledge. That means that employees need time and space to transfer knowledge on the job. If we take a closer look at the channels mentioned above, we find that e-learning technologies and knowledge management technologies in organizations support employees' knowledge transfer processes. Most of the time, e-learning and knowledge management technologies have a different purpose: the main aim of e-learning platforms or learning management systems is to qualify persons in a certain direction (e.g. software trainings, business communication, language skills, etc.). In contrast, knowledge management is a widely accepted instrument for organizations dealing with complex tasks. The purpose of knowledge management systems is to store knowledge and to support the development of new knowledge. Additionally, knowledge management systems enable experts to store relevant information for other users.

In the following paragraphs, we will discuss e-learning and knowledge management as enablers of knowledge transfer. In the literature, we find some contributions discussing a convergence of knowledge management and e-learning, mostly from a technical point of view (Metaxiotis *et al.*, 2002) or from a managerial point of view that describes different collaboration forms (Lau and Tsui, 2009; Kane *et al.*, 2010; Wild *et al.*, 2002; Efimova and Swaak, 2003). Other articles refer to special cases in the higher education system (Oliver, 2001; Joshi *et al.*, 2002). Only few approaches or articles reflect the integration of e-learning and knowledge management systems (Leblanc and Abel, 2008, 2009). We will return to the convergence of e-learning and knowledge management systems later.

From the perspective of the acquisition process, knowledge management requires a certain knowledge base on part of potential users. When a person is searching for information, the person must be able to enter the "right" keywords. Normally, knowledge acquisition by e-learning is more official, more formal, and more organized (qualification), whereas the acquisition of knowledge by knowledge management is more informal and unstructured (competency). A person who has finished an e-learning unit, for example, can be evaluated by a test at the end. Moreover, successful learners sometimes receive an official certificate. In contrast, a person who uses knowledge management does not obtain a comparable certificate. Moreover, Reamy (2003) speaks about different levels of self-direction. In the case of e-learning, the self-direction is relatively low, whereas it is quite high for knowledge management.

The Dreyfus and Dreyfus model mentioned above helps us understand the learning needs and styles of learning at different levels of skill acquisition. From the point of view of an employee obtaining knowledge, we assume that novices are more likely to take part in e-learning seminars to acquire knowledge in the form of (formal) qualifications, while experts are more likely to use knowledge management to acquire knowledge that

broadens their competencies. From the other point of view, i.e. an employee providing knowledge, we suppose that experts are likely to undertake this role in both supporting technologies, i.e. e-learning and knowledge management systems. The best practice example below demonstrates how experts use rapid e-learning to provide knowledge, and thus fuse e-learning and knowledge management systems.

Synopsis

The combination of all theoretical approaches mentioned above leads to an heuristic in terms of the so-called “ideal type” shown in Figure 4. An “ideal type” is not a picture of reality; it is a typology that helps us classify and integrate the presented approaches.

Our starting point is the differentiation between novice and expert levels of knowledge. While novices orient themselves more toward facts (“know that”), experts have already developed “know-how” to a certain extent in a special field of knowledge. In obtaining knowledge, too, we have to distinguish between experts and novices: as a result of their greater knowledge, experts are able to act more autonomously, reflexively, and evaluatively. In contrast, novices need more guidance, i.e. rule-based action, because their knowledge is still in a developmental stage. If we compare the use of e-learning and knowledge management systems, knowledge management systems will likely be the first choice for experts to improve their competency because they are typically searching for a specific piece of information. Asking good questions requires a knowledge base. Novices, however, need broader and more elaborately presented information, because they have less previous knowledge than experts. Therefore, novices are more likely to learn via e-learning in order to improve their qualification as an individual outcome. In case of providing knowledge, we assume that primary experts have relevant knowledge that they can provide, either with the help of knowledge management systems or authoring tools via e-learning. As mentioned before, we have to emphasize that a person is simultaneously a novice and an expert in different fields of knowledge. On the organizational level, the outcome of a novice’s learning process supports routines because obtaining knowledge prevails, while experts’ knowledge can support innovations because providing knowledge prevails. Our condensed heuristic therefore suggests that the convergence of e-learning and knowledge management systems can integrate both knowledge transfer purposes. Using the example of Lufthansa, we will demonstrate on how knowledge transfer activities among novices and experts can be supported in practice.

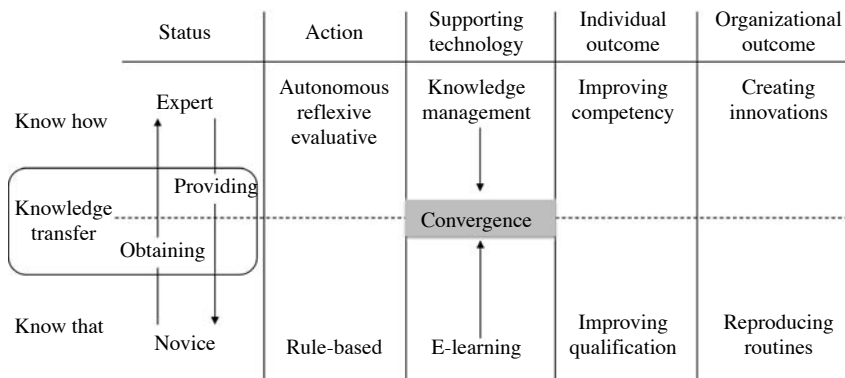


Figure 4. Knowledge transfer as an interaction between experts and novices

Best practice by Lufthansa

Airline companies are knowledge intensive organizations and need knowledge transfer and knowledge management systems to improve their services (Kwong and Lee, 2009). Lufthansa is one of the world's leading airline companies. The average number of employees is about 100,000 worldwide. The corporate structure is divided into the following major divisions: passenger airlines, cargo, systems, catering, technical division, and financial services. In the following section, we will not focus on the technical implementation of e-learning and knowledge management; we will mainly concentrate on the organization of knowledge transfer among experts and novices at Lufthansa.

Method and sources of information

We used qualitative research techniques because our interest lies in the stories and the development of knowledge management and e-learning activities in the company over a period of time. We used three different sources, i.e. interviews, document collection, and on-site observations. The first insights into knowledge management and e-learning activities at Lufthansa were gained in 2004, when we conducted the first qualitative investigation in the form of telephone interviews. Over the next six years, we followed up with archival analysis, and in 2010 we conducted interviews with four experts who are responsible for knowledge management and e-learning at the group level of Lufthansa. We recorded all interviews, transcribed and coded them, and conducted a qualitative content analysis (Mayring, 2000). The interviews were complemented by several demonstrations of the system during an on-site visit. The next section offers a brief overview of the development of e-learning and knowledge management at Lufthansa.

Development at Lufthansa

The company began to implement e-learning very early, if we define e-learning as any kind of learning with the help of electronic media. In the late 1960s, the first computer-based training was implemented for ground personnel responsible for making reservations, and for pilot skill enhancement with the help of the so-called "Autotutor" (Plate 1).

The presentation of the content was quite rudimentary (green letters on black background) but these first learning units served their purpose. Small training rooms ("learning islands") were arranged at several international airports all over the world and pilots refreshed their knowledge during stopovers. Nowadays, pilots have their own laptops so that they can learn wherever they are. In the early 1990s, the company became more engaged in e-learning and knowledge management in the form of parallel projects. In 2001, a competence center for e-learning was founded and e-learning got new impetus primarily as a result of the booming technological development of e-learning facilities.

It was quite advantageous that the project group responsible for e-learning activities and the project group, that developed the knowledge management system for the whole company, were located for the most part in the same division. This provided the opportunity to exchange thoughts about these two different projects at an early stage. Finally, this led to the integration and standardization of both technical applications within an e-learning and knowledge management environment. The core pieces of the integrated system are the workspace and the search engine. The workspace contains a personalized area via single sign-on where every employee can find and use all applications that are needed for his or her daily work. The workspace also includes ongoing interactive e-learning courses and user-friendly authoring software for

Plate 1.
The Autotutor



Source: www.lufthansa-flight-training.de/image/image_gallery?img_id=33589&t=1199305549242

developing self-made e-learning modules. Recently, activities in the field of e-learning and knowledge management are unified to a certain extent. In this sense, the learning management department at the Lufthansa base in Frankfurt operates like a company-wide knowledge broker and a non-profit-oriented consulting unit across the company. Apart from that, most of the training initiatives, such as development by e-media modules and classroom teaching, are still carried out by local divisions (e.g. training and education management). In the following section, we will present three of Lufthansa's different approaches to supporting knowledge transfer activities within the company:

- (1) organizational leeway;
- (2) rapid e-learning; and
- (3) the introduction of knowledge transfer methods.

Organizational leeway

More than 4,000 pilots work at Lufthansa. They are generally obliged to refresh their knowledge on a regular basis, i.e. pilots have to revalidate their flying license biannually. To receive the revalidation, they have to provide a medical certification and attach a proficiency check amongst other documents. The preparation for the proficiency check is supported by e-learning. The pilots produce the e-learning units themselves because they are experts concerning technical requirements. About 20-25 pilots prepare the content of the units. Principally, pilots are not allowed to work more than 60 hours monthly, so once a month they have a rest period of about one week. The pilot's authoring team has one additional week per month to work on e-learning content for their colleagues. The interesting point is that the organization gives them leeway to produce e-learning units, which is also high-status task within the organization. For each pilot, it is a step forward in his carrier to be part of the authoring team. Another remarkable point is that in the beginning, all authoring pilots were domain experts in flying planes and technical requirements, but novices in developing e-learning units. For that reason, they completed a crash course in e-learning, e.g. in didactics, how to use authoring software, or how to write a script for e-learning units, before they started to develop e-learning units for their colleagues. As a result, they are not only domain experts in operating a special type of aircraft, but they have also developed

competencies and skills in generating e-learning units. Furthermore, when pilots cannot realize some content using the authoring software, then they get additional technical support from the Lufthansa Flight Training. Lufthansa Flight Training is a subsidiary of Lufthansa that specializes in the realization of media-based training courses for more than 170 airlines worldwide (e.g. programs for flight simulators, 3D animations for the cabin crew of the A 380, etc.). In the technical realization pilots are novices again, but in this context they will remain novices because their main task is still flying planes.

Rapid e-learning – experts teach novices

Another interesting development is the proportion of content distributed by e-learning: it increased from 8 percent in 2001 to 27 percent in 2006. Which factors led to this rapid development in the company? Earlier, e-learning was only seen as a technical equipment acquisition in the form of ready-made learning platforms and content. The company commissioned contractors to produce the e-learning content. The quality of these e-learning products was very high. In the meantime, they have changed to a “rapid e-learning” approach in order to produce tailor-made tutorials by themselves (e.g. with the help of screen capture tools). Although the quality is not as high as the professionally produced content, the utilization level is quite high. This change brought about many advantages:

- employees as experts can transfer their knowledge easily with this tool;
- costs are much lower than for the professionally produced content;
- the production process is much faster; and
- the content follows a modular approach.

This enables employees to learn “just in time” and “on demand”. It is also quite interesting to note that the content of these tutorials is not provided top down by the corporate level of the company. It is a decentralized bottom-up process because the members of the divisions are responsible for providing e-learning content. Every employee who perceives him or herself to be an expert in a certain topic has the opportunity to create small e-learning modules – so-called “knowledge nuggets” – by using the authoring software.

These self-made “knowledge nuggets” contain simple information modules, knowledge modules, or learning modules. Learning modules take about 5 to maximum 30 minutes to complete. The success of these self-made learning modules lies in the fact that employees produce the content for employees. This is why the content is in step with actual practice. Another advantage of the combined e-learning and knowledge management environment is the integrated search engine. If Mrs Smith is searching for an information about diversity she will not only find documents about diversity rules and regulations (e.g. the General Equal Treatment Act), she will also find an e-learning unit which was created by an another employee who is responsible for diversity guidelines at Lufthansa (Figure 5).

Using the example of “Mrs Diversity”, novices are sensitized with regard to diversity in their daily work. It takes about 30 minutes to complete the “knowledge nugget” (Figure 6).

Methods of knowledge transfer

The division that is responsible for the rubric “knowledge and education” develops an e-learning unit about methods of knowledge transfer. The main purpose of this e-learning unit is to sensitize experts and novices to knowledge transfer processes,

e.g. job rotation or maternity replacement. As mentioned in the theoretical section above, with longer tenure, more knowledge can be provided. Each time an employee changes his or her job, important knowledge is lost. With the help of this e-learning unit on “knowledge transfer”, both sides, i.e. the knowledge provider (expert) and the knowledge recipient (novice), get methodical know-how about accomplishing the knowledge transfer process successfully. In order to ensure the handover, the e-learning unit contains a checklist for the concrete transfer process. This example reflects a kind of “meta level” of knowledge transfer activities among experts and novices. Again, the people are domain experts but novices in the methods of knowledge transfer. Moreover, the person who developed this knowledge transfer e-learning unit in this sense introduced in this sense a process innovation (innovation game) at Lufthansa. As mentioned above, leveraging innovation games requires enough power and commitment to allow organizational change and organizational learning to take place. In this respect, the responsible person is located at the group level of the company and the commitment is accordingly high. Nevertheless, it will be interesting to observe how this innovative process becomes routine in the future.

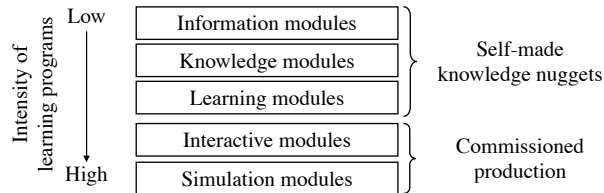


Figure 5.
Intensity of learning programs at Lufthansa

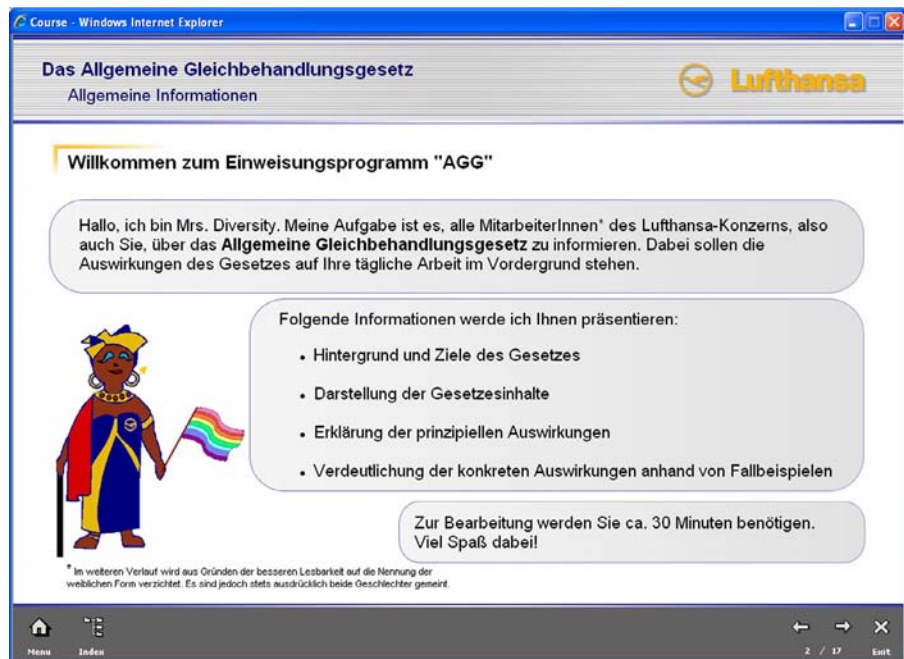


Figure 6.
Knowledge nugget “Mrs Diversity”

Summary and concluding remarks

The example of Lufthansa shows that the company deals with knowledge transfer processes between experts and novices in a very responsible way: both groups need organizational leeway, which allows time for creating “knowledge nuggets” (providing knowledge) and for learning (obtaining knowledge). If computers are not available at ones place of work, employees also need designated spaces in the organization, such as the “learning islands” mentioned above. On the one hand, experts can share their knowledge and their experiences not only by database entries; the authoring tools enable them to act as “teachers”. On the other hand, novices receive “knowledge nuggets” of higher value. The technical platform at Lufthansa is a converged e-learning knowledge management system. In this respect, e-learning supports not only the achievement of “pure” and “formal” qualifications, but also the achievement of informal competencies. The combined e-learning and knowledge management technology puts novices in the position to learn more often, especially when they require knowledge which is up-to-date. Since every employee is an expert in a certain field of knowledge and also a novice in other fields of knowledge, knowledge transfer becomes a reciprocal process. In this regard, a positive change in the learning culture of the company takes place. This culture can lead to organizational learning and to innovations, if the experts reflect the organizational routines. The e-learning unit on knowledge transfer in the case of job rotation is a good example of how an expert introduces a process innovation. All in all, technologies can only create opportunities for individuals to provide and obtain knowledge, but employees or members of organizations have to achieve the individual and organizational outcomes. Further research has to investigate the relationship between individual learning and organizational outcome. More quantitative research is necessary to test the broader impacts of knowledge transfer processes generated by novices and experts.

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About the authors



Maximiliane Wilkesmann is an Assistant Professor at the Faculty of Business, Economics, and Social Sciences, Dortmund University of Technology. She received her PhD in 2009 at the Ruhr-University of Bochum. She is Visiting Lecturer at the Knowledge Management Research Centre of the Hong Kong Polytechnic University. Her research interests include knowledge transfer, organization studies, teaching and learning with new media, management of competencies, and handling ignorance in organizations. Maximiliane Wilkesmann is the corresponding author and can be contacted at: maximiliane.wilkesmann@tu-dortmund.de



Uwe Wilkesmann is Professor of Organizational Studies, Continuing Education, and Social Management and the Director of the Centre for Continuing Education at the Dortmund University of Technology. He is also Adjunct Professor at the Knowledge Management Research Centre at the Hong Kong Polytechnic University. His research interests include knowledge management, organizational learning, motivation, governance of higher education, and continuing education.