

Secondary Publication



Sieber, Stefanie; Henrich, Andreas

Knowledge Management for Hybrid Learning

Date of secondary publication: 05.03.2025

Version of Record (Published Version), Bookpart

Persistent identifier: urn:nbn:de:bvb:473-irb-1068909

Primary publication

Sieber, Stefanie; Henrich, Andreas (2010): Knowledge Management for Hybrid Learning, in: Fu Lee Wang, Joseph Fong, und Reggie Kwan (Ed.), Handbook of Research on Hybrid Learning Models : Advanced Tools, Technologies, and Applications, Hershey, PA: IGI Global, pp. 424–449, doi: 10.4018/978-1-60566-380-7.ch026.

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Chapter 26

Knowledge Management for Hybrid Learning

Stefanie Sieber

University of Bamberg, Germany

Andreas Henrich

University of Bamberg, Germany

ABSTRACT

The merging of knowledge management and hybrid learning has gained more and more attraction and has been put in the focus of interests lately, for the simple reason that both areas can benefit from each other. As a result, this chapter deals with knowledge management for hybrid learning. This chapter begins with a short introduction, followed by a brief clarification showing our understanding of hybrid learning. Afterwards, knowledge and associated attributes are defined precisely – definitions are derived and taxonomies for knowledge are described. This section closes with a first reflection on knowledge in the context of hybrid learning. Subsequently, the authors take a closer look at knowledge management by introducing different schools of thought and models for knowledge management. Opportunities to delve deeper into the subject individually are offered passim. The main part of the chapter provides a comprehensive view of knowledge management for hybrid learning. The described features range from general conclusions to theoretical aspects, exemplary projects, and finally practical aspects – previous deliberations are brought together, current insights concerning the research perspective are described and tools as well as techniques which foster knowledge management for hybrid learning are presented. Finally, a critical reflection as well as an outlook and some thoughts concerning future issues conclude this chapter.

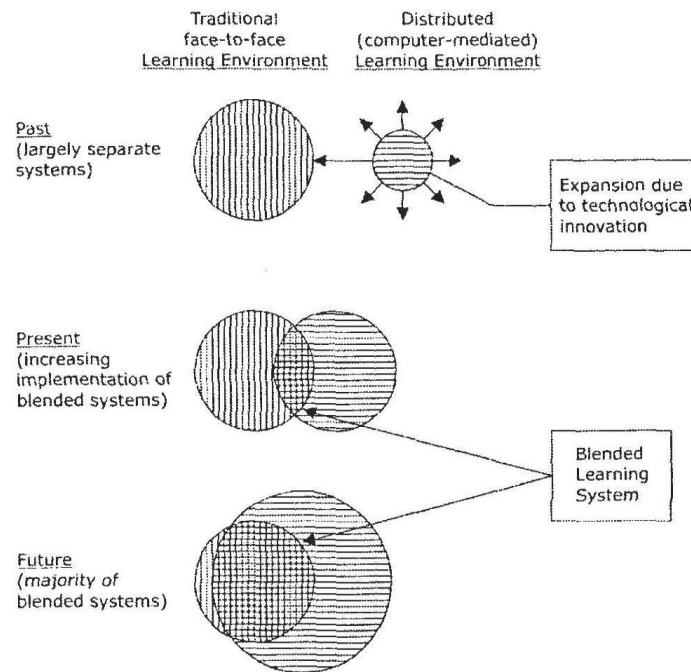
INTRODUCTION

Knowledge management as well as learning in general or e-learning and hybrid learning in particular

DOI: 10.4018/978-1-60566-380-7.ch026

are two areas that have developed independently in the past. Lately these fields are starting to converge, and theories, methods, and findings are being combined. These joint considerations benefit both areas with new insights and enhancements but also increase the complexity and number of obstacles for

Figure 1. Shift in learning paradigms reflected by number of existing systems (Graham, 2005, p. 6)



those interested in these topics and those in charge of setting up a proper solution for a specific setting. Individually, the area of hybrid learning already brings with it a vast number of settings. The virtual parts of learning can range from a minimum support up to a broadly considered, pedagogically sophisticated offer. Of course traditional learning can be scaled the same way.

Figure 1 shows the shift of learning paradigms by summing up the resulting number of systems assigned to each paradigm, and it gives an impression of the consequential increasing importance of blended and hybrid systems, respectively.

Knowledge management, on the other hand, can be strictly formalized and strategically grounded in a learning institution, or can be more informal, dynamic and self-paced. If an attempt is made to combine these two already complex and partially opposing areas, it is just a simple matter of mathematics to realize that complexity increases and the number of possibilities is overwhelming.

The main objective of this chapter is therefore not to describe one way of setting up knowledge management for hybrid learning, but instead to

build a continuum of possibilities and opportunities that knowledge management offers for hybrid learning – and the other way round – considering a variety of important aspects that differ from one setting to another. Depending on the particular instance, one setting can turn out to be extremely helpful while it is hardly of use for a different problem or field of application.

HYBRID LEARNING

Real learning gets to the heart of what it means to be human.

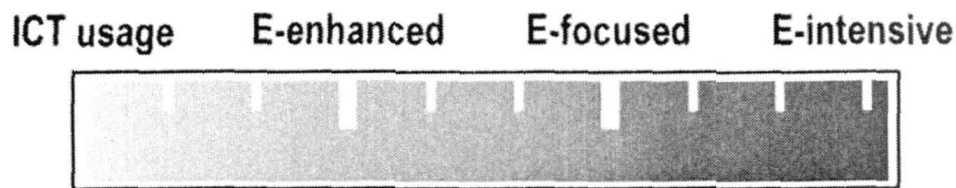
Through learning we re-create ourselves.

Through learning we become able to do something we never were able to do.

Through learning we re-perceive the world and our relationship to it.

Through learning we extend our capacity to create, to be part of the generative process of life.

Figure 2. Blended learning continuum(Jones, 2006)



There is within each of us a deep hunger for this type of learning. (Senge, 2006, pp. 13-14)

Since this whole book is dedicated to the area of hybrid learning, definitions have been given in previous chapters. In addition, there are already good definitions and descriptions as for instance in Bonk, Graham, Cross, & Moore (2005). Therefore, the intention behind this part of the chapter lies in clarifying our understanding of hybrid learning rather than giving a broad literature review and discussion on possible definitions, understanding, and views of hybrid learning.

There is a variety of approaches to defining hybrid learning. For our concerns, we adopt the perspective that defines hybrid learning as a mix of two general approaches to learning – the traditional classroom learning on the one hand, and the technology enhanced e-learning on the other hand. “The hybrid instructional model is a blend of conventional face-to-face instruction and Web-based distance learning. In other words, a hybrid instructional model consists of both classroom face-to-face meetings and distance learning” (Koohang & Durante, 2003, p. 106), where distance learning or distance education “is any form of teaching and learning in which teacher and learner are not in the same place at the same time, with information technology their likely connector” (Gilbert, 1995). Briefly stated “Blended learning is the integration of classroom learning with elearning” (Siemens, 2005).

We also adopt the term “blended learning” since – in our opinion – the terms “hybrid learning” and “blended learning” are interchangeable and can

be used synonymously. “Blended” therefore also refers to the mix of traditional classroom learning and technology enhanced distance learning, as defined above.

In order to visualize our understanding of hybrid learning we use the continuum of blended learning introduced in Jones (2006) that is shown in Figure 2.

This chapter is meant to serve as guideline for anyone in charge of a particular instance of learning that takes place in a hybrid environment consisting of face-to-face as well as virtual parts. This may be as teacher at a university, school, or in a unit of an enterprise responsible for further education of employees. Hence, we explicitly include university as well as enterprise settings on a general stage in order to be of use for a variety of specific settings.

KNOWLEDGE

Knowledge is the only resource that increases with use. (Probst, Raub, & Romhardt, 1999, p. 1)

To be able to talk about knowledge management, it is important to agree about what is to be managed. Therefore, this section gives a broad but considerate definition of knowledge. The general definition will then be followed by a distinction of different knowledge types according to varying differentiations. Finally, this part concludes with some reflections about the definition and the – as assumed – special kind of knowledge concerning hybrid learning.

General Definition

The term itself derives its origin from philosophy as an elementary problem from the early stage of this science. Debates in this area typically start with Plato's formulation of knowledge as "justified, true, and believed". Perception is, according to Plato, only achieved because of prenatal knowledge. In contrast, Aristotle, Plato's student, already disagreed and argued that knowledge is abstraction gained by experience and reflection. These two Greek philosophers are the first known representatives of two contrary approaches to epistemology, the branch of philosophy concerned with the nature and scope of knowledge, – Plato and rationalism on the one hand, and Aristotle and empiricism on the other hand. These early roots were later continued and strengthened by the two mainstreams of modern epistemology: Continental rationalism and its representative René Descartes and British empiricism with its advocate John Locke. A third mixed approach was founded by Emmanuel Kant by trying to combine the two contrary approaches.

Since nature and scope of a subject are commonly initially expressed in a profound definition, definitions of knowledge are available in abundant supply. To start at a general and neutral point, the Oxford English Dictionary¹ provides a very broad definition: knowledge, noun (i) information and skills acquired through experience or education (ii) the sum of what is known in a particular field or in total (iii) awareness or familiarity gained by experience of a fact or situation.

Proceeding in trying to get a suitable definition for the concerns of hybrid learning, we employ the differentiation of the well-known chain data, information, knowledge, and wisdom, which serves as an important aid in defining the term knowledge and delimiting its boundaries. In the field of information technology, at least two different branches concerned with an appropriate definition of knowledge can be found – information science and knowledge management. Roots

of today's common definitions can therefore be found in both of these branches (Sharma) and will briefly be described below.

Nevertheless, one of the first definitions unexpectedly comes from a completely different field at a quite early stage; art of poetry and one of its famous representatives T.S. Eliot. At the beginning of his play "The Rock", published in 1934, the questions "Where is the life we have lost in living? Where is the wisdom we have lost in knowledge? Where is the knowledge we have lost in information?" (Eliot, 1934, p. 7) are part of the first scene. Hence Eliot is supposed to be the first to have promoted this hierarchy.

Looking closer at the branch of information science, roots can be found in a publication by Harlan Cleveland. The article "Information as Resource", published in the journal "The Futurist" in 1982 (Cleveland, 1982), picks up Eliot's suggestions and provides the three-level hierarchy of information, knowledge, and wisdom. Cleveland's focus is on depicting information as a special intangible resource that is expandable, compressible, substitutable, transportable, diffusive, and shareable all at once. In the following, knowledge is distinguished in a bottom-up differentiation to information.

The branch of knowledge management and its early roots for defining knowledge are represented by two authors – Milan Zeleny and Russell L. Ackhoff. Zeleny (1987) supplies a four-level hierarchy that explicitly includes data as its first syntactic layer. This layer is followed, bottom-up, by information, knowledge, and wisdom. The important shift, according to Zeleny, happens between the layers of information and knowledge, since data and information are always just partial or atomic by nature and knowledge and wisdom are, in contrast, holistic, integrative, and most importantly expressed through systemic network patterns. To signify his definition, Zeleny remarks that "knowledge is not 'processing of information' but a coordination of action" (Zeleny, 1987, p. 59). The state of management and metaphors

Table 1. Association of management description and metaphors with data, information, knowledge, and wisdom (Zeleny, 1987, p. 60)

	Management	Metaphor
Data	Muddling through	KNOW-NOTHING
Information	Efficiency (measurement + search)	KNOW-HOW
Knowledge	Effectiveness (decision making)	KNOW-WHAT
Wisdom	Explicability (judgement)	KNOW-WHY

describing the state of knowledge at a particular level, as shown in Table 1, facilitates a deeper understanding.

In contrast, Ackhoff’s insights (1989) classify the content of the human mind in five categories: data, information, knowledge, understanding, and wisdom. His definition of data and information is quite simple; data are symbols and products of observation, while information is contained in descriptions and inferred from data. The final differentiation of all categories is accomplished by employing the different lifetimes of those categories: “Information, like news, ages relatively rapidly. Knowledge has a longer life-span, although inevitably it too becomes obsolete. Understanding has an aura of permanence about it. Wisdom, unless lost, is permanent; it becomes a permanent endowment of the race.” (Ackhoff, 1989, p. 9) The finding that information, knowledge, and understanding focus on efficiency, while wisdom adds value by requiring judgement and can therefore, in contrast to previous stages, not be automated, concludes his deliberations.

Figure 3 summarizes the different definitions and shows the most common hierarchies.

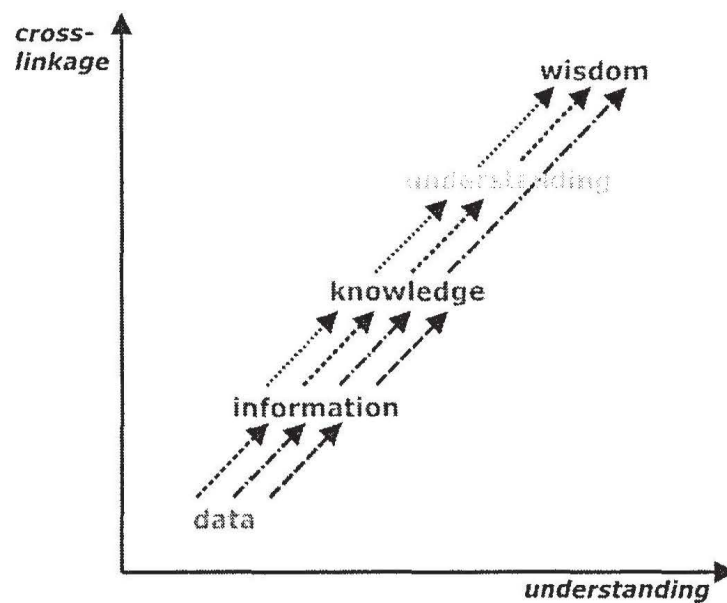
Numerous variations and extensions of these basic models exist and have been summarized, broadly described, and carefully examined by various authors. For further literature review, two of them should be mentioned: Rowley (2007) offers a sophisticated literature overview of definitions as well as the origins of the structure in the beginning,

and he finally revises the hierarchy by outlining several findings and including a well-considered discussion, while Hey (2004) first provides broad definitions, and then takes a closer look at the links between two particular levels.

To summarize, nowadays common understanding of the main hierarchy data, information, knowledge, and wisdom is briefly defined according to Ahsan & Shah (2006): “Data is seen as simple facts that can be structured to become information. Information, in turn, becomes knowledge if it is interpreted, put into context, or when meaning is added to it. (...) Finally, when values and commitment guide intelligent behavior, behavior may be said to be based on wisdom.” (Ahsan & Shah, 2006, p. 272)

Of course there are different approaches that attempt to get a suitable definition. Nonaka & Takeuchi (1995, p. 58) address the definition problem by defining knowledge according to its differences and communalities to and with information. Their definition of knowledge after all is coined by three observations. “Knowledge is about beliefs and commitment” and “Knowledge is about actions” express differences between knowledge and information, while “Knowledge is about meaning” describes common features. These observations finally conclude in the predication that “information is a necessary medium or material for eliciting and constructing knowledge”.

Figure 3. (Sub-)models of the hierarchy data, information, knowledge, understanding, and wisdom



Taxonomies of Knowledge

A scientific paper dealing with definition and types of knowledge has almost no alternative but to start with the distinction of tacit and explicit knowledge that was first made public by Michael Polanyi (Polanyi, 1967). His famous expression “We can know more than we can tell” (Polanyi, 1967, p. 4) constitutes this distinction. Polanyi shows that human beings actually “know” certain aspects and issues without actually being aware of knowing, even if explicitly questioned.

Tacit knowledge, according to Polanyi’s definition, always requires two things: the two terms of tacit knowing that need to be logically connected in order to become tacit knowledge. Moreover, tacit knowledge consists of three constituting aspects: the phenomenal, the semantic, and the ontological aspects, each of them expressing a particular connection between the two terms of tacit knowing. The functional structure of tacit knowing expresses the fact that “(...) in an act of tacit knowing we attend from something for attending to something else” (Polanyi, 1967, p. 10).

In a final step, Polanyi reasons that the attempt to explicitly formalize all tacit knowing is condemned to failure; identifying problems

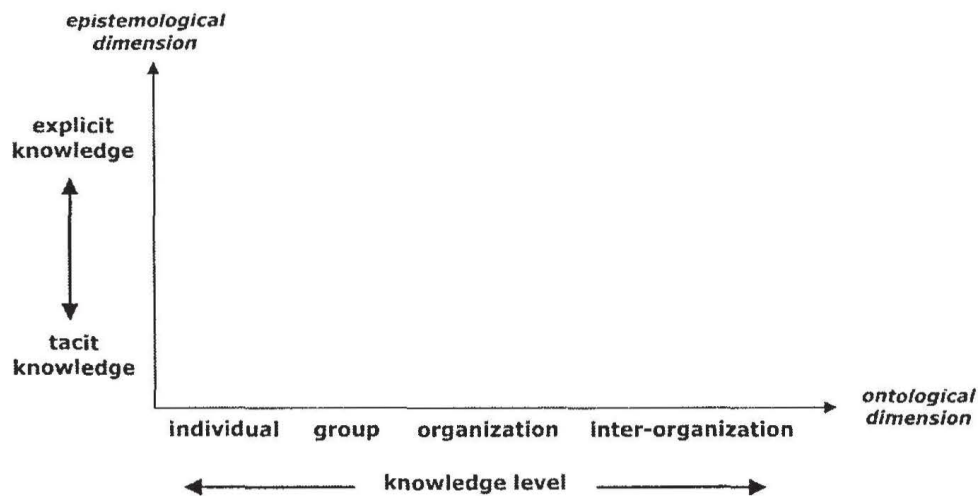
for instance – mathematical or other nature – requires tacit knowledge that often cannot be explicated.

These thoughts about the distinction of different knowledge types were later taken up and extended by the work of Ikujiro Nonaka and Hirotaka Takeuchi (Nonaka & Takeuchi, 1995). The core foundation of this knowledge and knowledge creation are classified by two dimensions: the epistemological dimension and the ontological dimension. The two dimensions and their features are shown in Figure 4.

The epistemological dimension has two values: explicit and tacit knowledge as defined by Polanyi. Tacit knowledge herein includes cognitive as well as technical elements and is created “here and now”, while explicit knowledge is more about past events or objects, or the “there and then”. Linking to Bateson (1973), these two types of knowing are also attributed with “analog”, referring to tacit knowing, and “digital” concerning explicit knowledge.

The ontological dimension symbolizes the different levels of knowledge which create entities such as individuals, groups, organizations and inter-organizational entities. Strictly, knowledge can only be created by individuals. In order to

Figure 4. The two dimensions of knowledge and knowledge creation (Nonaka & Takeuchi, 1995, p. 57)



enable organizational or even inter-organizational knowledge creation, it has to be understood that organizational knowledge creation amplifies the knowledge created by individuals (Nonaka & Takeuchi, 1995, p. 59).

Other contributors to this area, like Beckman (1999), also start with the work of Polanyi but add a third kind of knowledge – implicit knowledge. The accessibility of knowledge is used as criterion for this distinction. Tacit knowledge is therefore only indirectly accessible and always involves “(...) difficulty through knowledge elicitation and observation of behaviour” (Beckman, 1999, pp. 1-4). In contrast, implicit knowledge is accessible more easily through discussions or the querying of the knowledge carrier; however, this kind of knowledge has to be located before it can be communicated. Obviously, explicit knowledge is characterized by its direct accessibility.

Of course, tacit and explicit knowing are not the only origins for distinguishing different kinds of knowledge. Hence, the overview given in this section cannot be all-embracing. Nonetheless, a few selected and miscellaneous distinctions should be mentioned in order to provide further interesting aspects.

One further classical distinction that is often chosen is the differentiation of declarative and

procedural knowledge. Concisely stated, declarative knowledge is the knowledge of facts about the world. In contrast, procedural knowledge is knowledge concerning how to do something (Anderson, 1976, p. 78).

Other criteria that can be employed are the degree of formalization (Beckman, 1999) or the stage where knowledge is needed and accessed – before, during, or after knowledge-related activities. Various authors like Davenport & Glaser (2002) or El Sawy & Majchrzak (2004) are working on the accessibility of knowledge at certain desired stages.

Knowledge in the Context of Hybrid Learning

The general definition, and especially the data, information, knowledge, wisdom chain, is certainly also applicable for hybrid learning, but of course the context of hybrid learning provides several special aspects and attributes that need to be considered.

If we apply the findings presented above to this context, the ontological dimension of knowledge and knowledge creation consists of four different perspectives: the perspective of a single user, the perspectives of groups of users,

the organizational, and the inter-organizational perspective.

Moreover, the context of hybrid learning presents at least two kinds of users that need to be considered: learners on the one hand, and teachers or tutors on the other hand. Even additional complexity increases due to each learner's and teacher's choice to adopt different perspectives. Taking into account the structures usually applied for learning, a learner can adopt an intra-course perspective, a broader view including all courses of a particular semester, or, more generally, a particular time unit, and finally an all-embracing perspective involving all courses constituting a particular course of study or training. Similarly, a teacher can adopt the following perspectives: starting bottom up, a teacher also can adopt an intra-course perspective and a semester-wide view including all courses the teacher is in charge of for a particular semester or time unit, as well as the all-embracing perspective.

Of course these deliberations also apply to the organizational perspective. Herein, the structural organization of the institution in charge of providing the knowledge has to be considered; different granularities depending on the specific structure are possible. In the instance of universities, perspectives can be the view of a single chair or the perspective of a whole faculty. Naturally, equal deliberations can be made for enterprises of all sizes.

Further – more informal – questions arising from dealing with knowledge in the context of hybrid learning are various: What exactly is knowledge in the context of hybrid learning? How does knowledge differ from information and data or content in this context? In which manner is knowledge in learning? Who actually creates content and knowledge? How can knowledge belonging to the non-digital part of hybrid learning be digitalized? Are there special types of content? How is the content used? Which part of the content can be used to which extent?

Some of these questions can already be answered by applying the definitions given above.

The imprecise definition of knowledge prevents the limitation of knowledge to certain aspects of hybrid learning. What became obvious is the indispensability of paying particular attention to tacit knowing. Especially in hybrid learning where a certain factor of distance separates teachers and students at a given time, tacit knowledge seems even harder to caption, convert, and communicate than it already is. The question of whether this endeavour is possible at all will be discussed in section 5 of this chapter.

Therefore, general questions concerning the creation, maintenance, and conversion of knowledge need to be discussed initially and will be answered in the next section by presenting models for knowledge management. Specific questions which take into account the kind of content and special features of hybrid learning will be answered in section 5 of this chapter.

This section concludes with an assertion of Thomas H. Davenport and Laurence Prusak published in “Working Knowledge” in order to, in conclusion, express the multiplicity of knowledge.

Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms. (Davenport & Prusak, 1998, p. 5)

KNOWLEDGE MANAGEMENT

The key to success is to bake specialized knowledge into the jobs of highly skilled workers – to make the knowledge so readily accessible that it can't be avoided. (Davenport & Glaser, 2002, p. 108)

Since the last section described our understanding of knowledge – knowledge in general as well as peculiarities of knowledge in the context of hybrid learning – the literal next step is now to think about ways of how to manage knowledge. Since knowledge is considered to be the most important resource of today's economy, it should be appropriately managed.

(...) the real, controlling resource and the absolutely decisive 'factor of production' is now neither capital nor land nor labor. It is knowledge. (Drucker, 1993, p. 6)

The field of knowledge management arose as part of general management theories in the 1990s, and therefore most of the classical literature deals with organizational knowledge management. Since we explicitly do not exclude organizational settings, and most of the publications include a general consideration of knowledge management, most of these deliberations can be considered useful or can even be substituted for knowledge management in hybrid learning. The overall assumption upon which this section is based, is the conviction that knowledge management in general has the objective to ensure the delivery of the right information to the right person at the right time. This assumption seems tenable and applies to knowledge management for organizational concerns as well as for the concerns of hybrid learning.

In particular, there is a variety of different schools of thought for knowledge management that will be briefly described below. The practical aspect of knowledge management, basically referring to knowledge management tools, will be directly integrated into the next part of this chapter and will concentrate solely on knowledge management for hybrid learning, since there are a huge number of tools available in general.

Knowledge Management According to Nonaka and Takeuchi (Nonaka & Takeuchi, 1995)

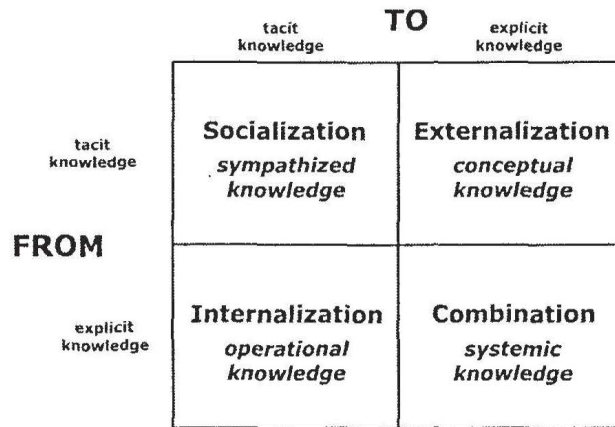
Ikujiro Nonaka and Hirotaka Takeuchi are often seen as cofounders of knowledge management. Their book "The Knowledge-Creating Company", published in 1995, is still one of the foundations of many publications and entrepreneurial decisions. Although their thoughts were originally meant to be relevant just for knowledge management in organizations, their work concerning knowledge creation has become an international standard throughout the entire domain of knowledge management.

Based on Michael Polanyi's definition and distinction of tacit and explicit knowledge, Nonaka and Takeuchi develop a theory of organizational knowledge creation which is considered to be the most important asset for successfully managing knowledge, and therefore serves as the core part of their theory. The important part that constitutes most of knowledge creation is "the mobilization and conversion of tacit knowledge" (Nonaka & Takeuchi, 1995, p. 56). According to this model, knowledge is created by a continuous transformation between tacit and explicit knowledge that takes place between individuals.

The central part of this theory is therefore a model describing the different modes of knowledge conversion – the SECI-model. The four existing transformations – socialization, externalization, combination, and internalization – are shown in Figure 5.

The first mode is the conversion from tacit to tacit knowledge – socialization. An individual acquires tacit knowledge during the process of experience-sharing with others. The most common way of gathering tacit knowledge takes place by observation, imitation, and practice and is an important part of programs like training-on-the-job. Knowledge gathered by socialization is called "sympathized knowledge".

Figure 5. The four modes of knowledge conversion (Nonaka & Takeuchi, 1995)



The transformation from tacit to explicit knowledge – called externalization – serves as the second part of this model. The mode is “(...) typically seen in the process of concept creation and is triggered by dialogue or reflection” (Nonaka & Takeuchi, 1995, p. 64). Even simple writing can be an act of converting tacit knowledge into explicit knowledge. The knowledge resulting is usually called “conceptual knowledge”.

Thirdly, explicit knowledge is transferred to explicit knowledge. This mode is the combination that happens when concepts are systemized and different parts of explicit knowledge are combined in order to create new knowledge. Existing information is sorted, added, combined, and categorized and therefore gains new value. The output of this mode is referred to as “systemic knowledge”.

Finally, the process of converting explicit knowledge to tacit knowledge, internalization, takes place. All experiences gained by socialization, externalization, and combination are adapted and integrated into an individual’s knowledge base by being converted to tacit knowing. Experiences of others, personal experiences, or information gathered become part of “what an individual knows”. This process is often referred to as “learning by doing” and produces “operational knowledge”.

Obviously, the process of transforming knowledge is supposed to take place several times. The

continuous and dynamic interaction of these modes results in a knowledge spiral that is shown in Figure 6. Recalling the different dimensions of knowledge, it is important to be aware that this process does not take place within a single individual but requires interaction with others in order to shift between the different modes.

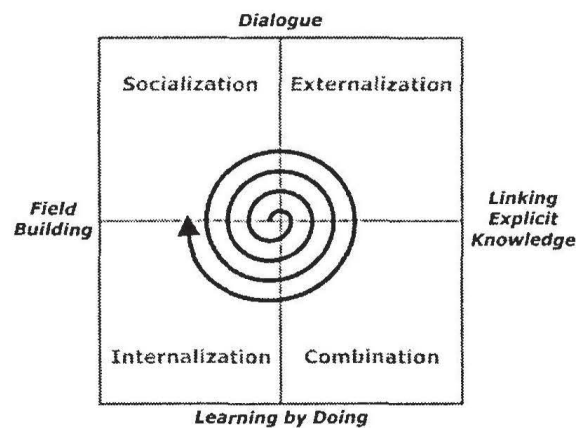
At a later stage the SECI-model was completed by the concept “Ba” that “offers an integrating conceptual metaphor for the SECI model of dynamic knowledge conversions” (Nonaka & Konno, 1998, S. 45). “Ba” can be thought of as a shared space where knowledge can be exchanged. Hence, “if knowledge is separated from ba, it turns into information, which can then be communicated independently from ba” (Nonaka & Konno, 1998, S. 41).

Knowledge Management According to Davenport and Prusak

Another popular school of thought is knowledge management according to Thomas H. Davenport and Laurence Prusak. The basis for the whole theory is established by ten general principles of knowledge management (Davenport, 1996).

1. Knowledge management is expensive (but so is stupidity!)

Figure 6. The knowledge spiral (Nonaka & Takeuchi, 1995)



2. Effective management of knowledge requires hybrid solutions involving both people and technology
3. Knowledge management is highly political
4. Knowledge management requires knowledge managers
5. Knowledge management benefits more from maps than models, more from markets than hierarchies
6. Sharing and using knowledge are often unnatural acts
7. Knowledge management means improving knowledge work processes
8. Access to knowledge is only the beginning
9. Knowledge management never ends
10. Knowledge management requires a knowledge contract

Getting more specific, the process of knowledge management is divided into three sub-processes: knowledge generation, knowledge codification and coordination, and knowledge transfer (Davenport & Prusak, 1998). These sub-processes have been carefully examined in a detailed study of over 25 international enterprises. Concerning the sub-process of knowledge generation, this process is divided into five modes: acquisition, dedicated resources, fusion, adaption, and knowledge networking. For the

sub-process of codifying knowledge, the authors emphasize the importance of basic principles and the consideration of different knowledge types. The sub-process of knowledge transfer however should be coined by priorities like the indispensability of a common language in order to share knowledge – not just everybody being capable of speaking a certain language, but also having a common background like “mechanical engineer” in order to understand each other.

In order to further clarify the whole process of knowledge management, attention also has to be paid to the different roles of knowledge workers. Therefore in “Thinking for a Living” (Davenport, 2005) a classification system to segment knowledge workers is developed. Transaction, integration, expert, and collaborative are the four categories of segmentation that should be applied.

These theories emphasize the significance and importance of knowledge workers concerning the organizational success. Since the knowledge workers are the center of these theories, they can be considered useful for the concerns of knowledge management for hybrid learning where, obviously, the learner should be the focus of efforts most of the time.

Knowledge Management According to Probst, Raub, and Romhardt (Probst, Raub, & Romhardt, 1999)

The theory of knowledge management according to Gilbert Probst, Steffen Raub, and Kai Romhardt seems most prevalent in the German-speaking world. The resulting model is a best-practice model that was developed in collaboration with many well-known, not only German but international, companies.

The theoretical groundwork is constituted by the following general understanding of knowledge and knowledge management. Knowledge and the creation of knowledge result in a continuum that exists between data and knowledge. Concerning knowledge management, Probst, Raub, and Romhardt state that “knowledge management can be applied to individuals, groups, or organizational structures” (Probst, Raub, & Romhardt, 1999, p. 37). Since this theory and model arose in the organizational environment, they aim at the improvement and increase of the organizational knowledge base. The organizational knowledge base though consists of individual and collective knowledge assets. Improvement of this base therefore enhances individual and collective knowledge which is why this model is described here.

The best-practice model pinpoints six core processes of knowledge management, describing and addressing the main operational problems: knowledge identification, knowledge acquisition, knowledge development, knowledge sharing and distribution, knowledge utilization, and knowledge retention. However, difficulties may not only occur due to direct operational problems, but due to the fact that knowledge management is not embedded within an overall strategy. Therefore, the two additional building blocks – knowledge goals and knowledge assessment – are added in order to turn the model into a management system with knowledge itself “(...) in the centre, as the sole structuring principle” (Probst, Raub, & Romhardt, 1999, p. 35). Figure 7 shows all as-

sets, and the resulting logical interrelationships between the single assets.

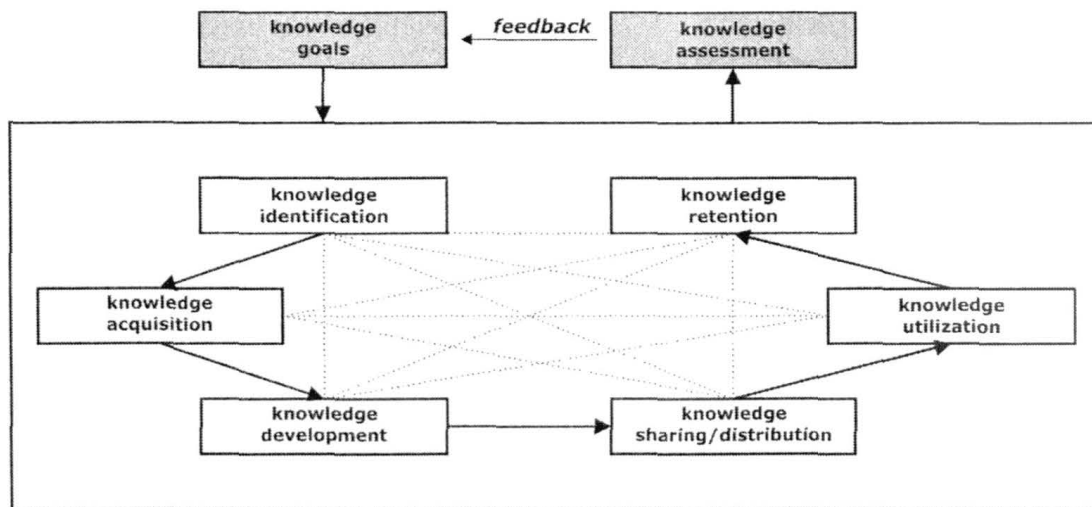
Other Schools of Thought and Contributors

There are, of course, many others that have also contributed and are still benefiting the area of knowledge management who cannot all be named and specified in appropriate depth. In order to nonetheless encourage a broad view of different directions that can and have been taken, a select few are characterized.

Peter Senge’s vision, theories, and work about learning organizations has for instance significantly influenced the area of knowledge management. According to Senge a learning organization is “an organization that is continually expanding its capacity to create its future” (Senge, 2006, p. 14). His book “The fifth discipline” (Senge, 2006), first published in 1990, identifies four disciplines – personal mastery, mental models, shared visions, and team learning – as central aspects of learning organizations. Since the four disciplines themselves are indeed distinctive but it is nonetheless vital that they are developed as an ensemble, Senge places systems thinking as fifth and most important discipline for successfully bringing a learning organization into existence. The four core disciplines, and the fifth discipline in particular, are described in Senge (2006), while Senge (1995) is meant to serve as a guideline for practitioners.

Another approach is defined by looking at knowledge management from an even more pragmatic side. The so-called “communities of practice” arose in the 1990s and their importance was – among others – already emphasized and approved by early publications by John Seely Brown, Paul Duguid, and Estee Solomon Gray. Brown & Duguid (1991) deduce the opportunities of communities of practice and how companies should envision themselves – as “(...) a community-of-communities, acknowledging in

Figure 7. Building blocks of knowledge management (Probst, Raub, & Romhardt, 1999, p. 34)



the process the many noncanoncial communities in its midst” – while Brown & Gray (1995) describe how companies such as Xerox and National Semiconductor are learning to foster and support communities of practice in order to facilitate the sharing of knowledge.

At a slightly later stage, communities of practice were significantly influenced by Etienne Wenger and his work. Wenger proposes “...a framework that considers learning in social terms” (Wenger, 1998, p.9) in his book “Communities of Practice”. Meaning, practice, community, and identity are the components that need to be integrated in order to apply a social theory of learning. The discussion of these components and implications of their connectedness set the seminal concept of communities of practice. Subsequently, the book “Cultivating Communities of Practice” (Wenger, McDermott, & Snyder, 2002) describes how to successfully develop and facilitate different kinds of communities.

A management strategy implemented in knowledge is business-process-oriented knowledge management which has, to a great extent, been examined by Peter Heisig. According to his observations and theories, the key success factor is minimizing barriers for efficient knowledge management, and therefore the integration of knowledge management tasks directly into daily

work tasks and the daily business process (Heisig, 2001). A model specifically designed for business-process-oriented knowledge management – the GPO-WM® – is the consequent result of his studies. The model includes a reference model as well as a procedure model and tools supporting analysis and finally the creation of solutions (Heisig, 2005).

As mentioned before, this section is meant to serve as a brief summary. There are different papers, like Alavi & Leidner (2001), providing a good overview and a broad literature review that can be used to delve into the subject.

KNOWLEDGE MANAGEMENT FOR HYBRID LEARNING

What e-learning has done is set a context for KM. (Barron, 2000)

The implications of knowledge management for e-learning are huge. Rather than simply relying on instruction, we can use well-structured information as well as productivity enhancing tools to help people learn and improve their performance. (Rosenberg, 2001, p. 109)

In contrast to other sections, this one starts with two quotations describing different views on knowledge management and learning.

First of all, these two brief quotations already reveal a minor problem concerning the area of knowledge management for hybrid learning. Publications dealing specifically with the integration of hybrid learning and knowledge management are hard to find. Most of the previous and current research issues concerning knowledge management and learning address e-learning in general and not hybrid learning in particular. Since our definition of hybrid learning was intentionally widespread, most of the findings can be considered useful for the particular area of hybrid learning as well. We therefore also use the term “e-learning”, depending on the origin and original subject of the work referred to. While selecting theories and results, we carefully analyzed the usefulness for and transferability to the area of hybrid learning. Additionally, we were trying to add thoughts and features referring to the special character of hybrid learning in contrast to pure e-learning.

Secondly, these two quotations serve as a first distinction of how knowledge management and hybrid learning can be integrated and combined. The first quotation by Clark Aldrich, the former research director of the Gartner Group responsible for creating and building the company’s e-learning practice, refers to learning in the context of knowledge management. It illustrates one direction of the relationship between the fields of knowledge management and e-learning or hybrid learning. Starting from the area of knowledge management, the main objective lies in delivering information and knowledge to people, as well as connecting people to each other. This goal is obviously accomplished when either self-paced or collaborative e-learning takes place (ITtoolbox, 2004). Hence e-learning can foster knowledge management and its objectives.

The second quotation looks at this relationship the other way round. The quotation cites Marc Rosenberg who is a management consultant,

writer, educator, and leading figure in the world of training, organizational learning, e-learning, knowledge management, and performance improvement. It describes a way of looking at knowledge management from the perspective of learning. The field of e-learning or hybrid learning also, by definition, involves information and knowledge. Obviously, every area dealing with information or knowledge workers can benefit from theories and findings in the area of knowledge management, especially if achieving the increase of information and knowledge of individuals or groups is the main objective, as it is for learning. Therefore, knowledge management can help to improve the experience and success of e-learning or hybrid learning for every concerned party. Since this whole book is concerned with hybrid learning, we adopt this view of initiating knowledge management from hybrid learning.

If we now rely on the definition and distinctions of knowledge presented earlier, the differentiation of tacit and explicit knowing becomes an important aspect, since similarities to informal and formal learning can be drawn immediately. Formal learning and explicit knowledge obviously seem to be connected, as well as tacit knowledge and informal learning. As soon as parts of the learning experience are self-paced and not formally defined, like in face-to-face parts of hybrid learning, informal learning becomes more and more important. The following quotation ought to convey the impression of these thoughts and their importance for hybrid learning.

I usually ask audiences at my keynote speeches about their experiences with e-Learning or On-Line Learning? When I ask how many people in the audience have recently taken an On-Line Course, the response is often between 20 and 30 percent. One day, my tongue got a bit tied and I asked the question with a few changes.

‘How many of you have learned things on-line recently?’

Suddenly, almost 98% of the hands in the audience went up. I was shocked until I realized how I had fundamentally changed the question. (Masie, 2002)

Since the process of knowledge generation is one crucial factor for knowledge management in any case, the presented findings employ an even greater importance of knowledge generation for the area of hybrid learning. First of all, knowledge generation is split by definition. On the one hand, information is transferred and hence knowledge is supposed to be created in the face-to-face parts of learning; on the other hand, the self-paced learning complements the face-to-face part and contributes additional information and knowledge. For one thing, this separation determines a variety of points of knowledge generation that need to be considered, and for another thing, the informal part of learning increases and the capturing of information and knowledge gets harder, since, in order to manage knowledge successfully by using tools or techniques, it has to be explicitly expressed in digitalized form. Special attention must therefore be paid to the generation of knowledge or more precisely the digitalization, formalization and revealing of existing information and knowledge.

In order to show possible solutions for these problems, the application of the knowledge management models presented in the previous section concerning the area of learning are examined and presented in the following part. This first part also takes into account more specific approaches to integrating knowledge management and hybrid learning.

The second part takes a closer look at the more practical and pragmatic aspects of this integration by introducing different techniques and tools already offering possibilities for actually implementing this integration, or at least parts of it.

Research Perspective

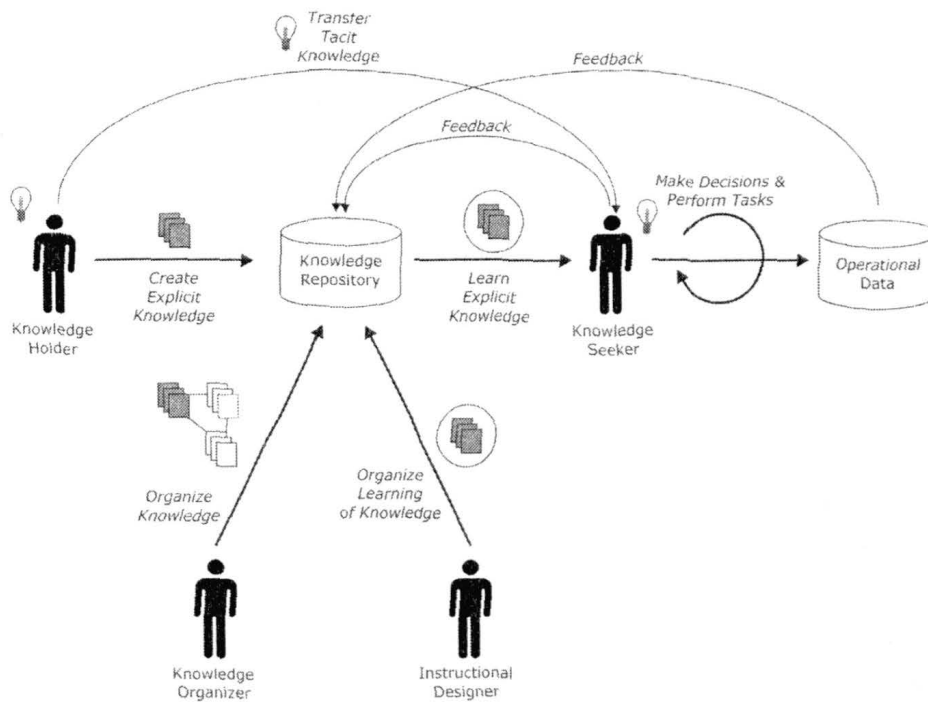
One way of trying to employ knowledge management for hybrid learning is to transfer existing knowledge management models into the context of hybrid learning. Hence the knowledge management models presented above will now be carefully examined and tested for their applicability and usefulness in the area of hybrid learning.

Woelk & Agarwal (2002), as well as Nübel (2005) transferred the SECI-model to a learning context. Woelk & Agarwal first enhance the SECI-model by a fifth phase – cognition – which is supposed to represent the application of knowledge that has been exchanged in previous phases to a specific problem and a sixth phase – feedback – embodying the evaluation of learners' progress. Figure 8 shows the results of these extensions plus the combination of knowledge management and e-learning.

The original phases of the SECI-model are assigned as follow: Socialization takes place when tacit knowledge is transferred from the knowledge holder to the knowledge seeker, since direct interaction is necessary in order to successfully transfer the knowledge from one person to another. Concerning hybrid learning, socialization happens in face-to-face-meetings on the one hand, or, on the other hand, in any section of the virtual part where questions are answered and different issues are discussed with two or more persons participating. Most important of all, socialization does not necessarily require a teacher, but can also take place between two or more students. Since socialization is one of the most important aspects to consider if tacit knowledge is examined, it is crucial for the success of hybrid learning to foster socialization, especially in the virtual parts of the hybrid learning concept, by providing a range of tools that allows a comfortable and intensive exchange of all participants and therefore represent at least parts of informal learning.

In contrast, externalization occurs if a knowledge holder formalizes knowledge that is stored

Figure 8. Phases of the SECI-model with e-learning enhancements (Woelk & Agarwal, 2002, p. 2)



in a knowledge repository. Speaking in terms of hybrid learning, knowledge can be explicitly formalized by creating lecture notes or by providing information of different kinds in the learning environment. Additionally, knowledge can also be represented or created by a participant that shares her/his insights by posting in a public forum or contributing in a collaborative task.

Combination in this model is supported by knowledge organizers and instructional designers. Existing knowledge can be structured according to superior aspects, or new aspects of knowledge can be abstracted from different single assets. In the context of hybrid learning, combination can again be performed by a single user or by a group of users – i.e. self-paced or collaborative. A group of users can, for example, rework the results of a face-to-face meeting and connect these results to previous parts of other sessions. Specialists can also process existing material with pedagogical techniques and take into account aspects of self-paced learning.

To complete a first circulation of the four phases, internalization finally takes place when a

knowledge seeker learns the knowledge existing in the knowledge base and hence extends his personal knowledge. For hybrid learning, this phase can be associated with traditional learning as well as self-reflection. The number of participants necessary to perform this task varies – generally the learner is the only participant needed, but nevertheless, she/he can be supported by a teacher or a group of other learners while performing this task.

It is obvious, that the boundaries of the different phases are smooth and that some activities can be assigned to one as well as another phase. This finding merely emphasizes the interdisciplinary and cross-linking of hybrid learning.

These results and considerations are confirmed in Nübel (2005). Nübel presents an application of the SECI-model as result of an intensive study including ten different companies. This application is shown in Table 2.

Obviously, communities turn out to be a core feature for successful application. This finding already combines two different models of knowledge management – the SECI-model, as presented above, and communities of practice as a second model.

Table 2. Phases of the SECI-model and corresponding possibilities for knowledge transformation (Nübel, 2005, p. 235)

Phase of SECI-model	Possibilities for knowledge creation and conversion
Socialization	Communities, face-to-face-meetings
Externalization	Exchange in communities by using forums, chats etc.
Combination	Exchange in communities by using forums, chats etc.
Internalization	Application of what has been learned to a specific context

An approach dealing especially with communities of practice is presented in Leblanc & Abel (2008). The environment introduced is called E-MEMORAe2.0 and is one of the successors of the initial project MEMORAe, a system fostering the capitalization of knowledge in the context of organizations. E-MEMORAe2.0 is especially designed to support e-learning; particularly “E-MEMORAe2.0 is an environment which enables learners to access, share, and capitalize knowledge” (Leblanc & Abel, 2008, p. 112).

The overall objective of this environment is to foster the access and exchange of information at any time. Hence the capitalization of knowledge on the three different levels of knowledge creation as provided by Nonaka & Takeuchi (1995) – individual, group-wise, and organizational – is the focus. Each level is provided with a memory and facilitated by the use of a shared ontology. The ontology can be used for navigation. Additionally, a vertical navigation employing topic maps is offered. Information exchange is fostered by offering the possibility to switch between the different levels of memories, of course the possibility to add resources and information on everyone of the different levels of memory, and finally by employing a special forum “(...) structured according to the knowledge to learn, allowing the students to communicate in a more contextual way: the learning activity that is carried out” (Leblanc & Abel, 2008, p. 111).

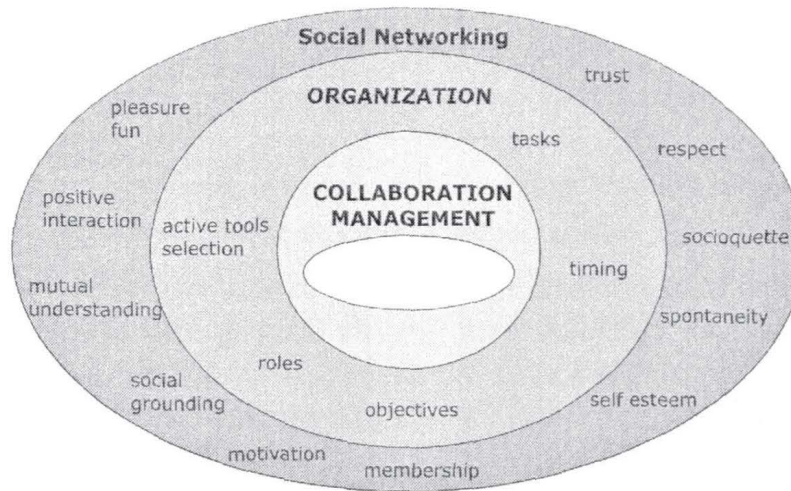
First evaluations have already shown that the transfer of different levels of knowledge cre-

ation to an environment has positive effects and increase the usability for students. Nevertheless, the authors are still working on improvements for a better integration of the forum, since students tend to not use the forum, probably because of the extensive face-to-face parts.

In contrast, Pettenati & Ranieri (2006) propose a reference model that employs communities of practice with an emphasis on informal learning. The presented model is framed by a social networking layer that is supposed to foster informal learning and collaboration. Moreover, this layer helps “(...) to create a social climate and a shared social grounding” (Pettenati & Ranieri, 2006, p. 349) that cultivates motivation and a group culture which both have been found to be indispensable for a high level of participation. The importance and usefulness of social awareness have also been examined by other authors such as Braun & Schmidt (2006). The inner layers organization and collaboration management are more specifically designed to support the activities of collaborative groups such as management of user, content, and communication. Figure 9 shows the reference model and its individual layers.

Similar deliberations concerning the use of communities of practice as a core concept of modern knowledge management for e-learning and hybrid learning are employed by various authors in different levels of depth. Varlamis & Apostolakis (2006) are developing a framework for building virtual communities supporting lifelong learning. As a special feature, they explicitly add a knowledge base that serves as memory of these communities.

Figure 9. Reference model for collaboration in distributed communities of practice (Pettenati & Ranieri, 2006, p. 351)



Although the SECI-model and communities of practice are indisputably the most dominant models when it comes to integrate knowledge management and learning, other models also offer opportunities that have to be kept in mind. The technique described by Davenport & Prusak (1998) especially takes into account informal knowledge and its formalization by dividing the general process of knowledge management into the three sub-processes of knowledge generation, knowledge codification, and knowledge transfer. In contrast, the Probst, Raub & Romhardt (1999) model can be employed to add an overall strategy to hybrid learning and connect this strategy with a clearly defined circle of knowledge integrated into the hybrid learning strategy.

As the combination of the SECI-model and communities of practice have already proven, a combination of different models seems to be the most sufficient way to integrate knowledge management and hybrid learning in order to meet the specific needs that every particular environment brings with it. The previous remarks have shown that there are models and techniques that integrate knowledge management and hybrid learning without explicitly naming it. Hence, the application of knowledge management models to the particular environment of hybrid learning is of

course not the only way to integrate knowledge management and hybrid learning.

In order to think about possible combinations or the integration of two different areas, a first step can, for example, comprise the outline of some important differences. Rosenberg (2001) compared training and knowledge management according to different viewpoints. Since training in this case is defined as classroom or online learning or a combination of both, the results can be applied to e-learning as well as hybrid learning. The specific results are shown in Table 3.

Adapted from his findings, instruction vs. information as the core essence seems to be the most crucial difference between training and knowledge management. So the enrichment of hybrid learning with opportunities to inform the user without strictly interrupting can also provide a useful integration.

The project “learning in process” (lip)² aims at this objective by adding context awareness (Schmidt, 2005). According to the project findings, the separation of e-learning and knowledge occurs due to “(...) their respective limited and isolated consideration of context” (Schmidt, 2005, p. 204). Hence the project aimed at “(...) integration of working and learning on a process level and learning management, knowledge management,

Table 3. Comparison of training and knowledge management (Rosenberg, 2001, p. 77)a

Training	Knowledge Management
Purpose is to instruct.	Purpose is to inform.
Requires the interruption of work to participate (even online).	Normally requires less work interruption than training.
Program dictates how the user will learn.	User determines how s/he will learn.
Goal is to transfer skill and knowledge to user.	Goal is to be a resource to the user.

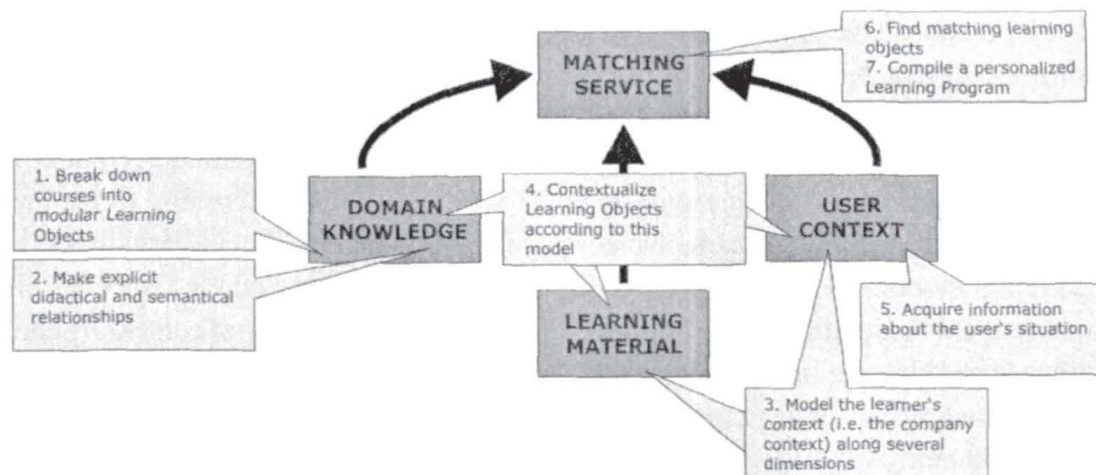
human capital management and collaboration solutions on a technical level” (Schmidt, 2005, p. 205). Briefly stated a matching procedure is employed to present context-specific information to the user. The complete process is shown in Figure 10.

Since this process takes into account the user’s context, information can be presented based on the competency and missing assets of the individual user. The entire approach is described in depth and summarized in Schmidt (2008). These thoughts have been continued with “APOSDLE”³, the advanced process-oriented self-directed learning environment. APOSDLE is based on “re-using a wide variety of knowledge artifacts within an organization (...) for learning” (Bonestroo, Ley, Kump, & Lindstaedt, 2007, p. 9).

Besides, there are also other authors dealing with context awareness related to e-learning and knowledge management, like Pedroni (2007), who is working on the development of special tools

for context management as an additional axis for learning environments. In addition to those project-specific and more pragmatic approaches, there are also contributions dealing with identifying barriers of this integration in general, as for instance Ras, Memmel, & Weibelzahl (2005). These authors identified eight different integration problems and provide possible solutions as well as future issues. The problems are problems on a conceptual level, problems on a technical level, problems of neglecting learning process, problems of the amount of guidance provided, problems of context neglect, problems of structuring and annotating content, problems of lack of interactivity, and problems of dynamic adaption, whereby some of them have already been addressed above and approaches to solutions have been provided. Further attempts to solutions can be found in Ras, Memmel, & Weibelzahl (2005).

Figure 10. LIP Matching process (Schmidt, 2005, p. 209)



Knowledge Management Tools and Techniques: State of the Art

As previously stated, we are now going on an excursion to the area of knowledge management tools and techniques suitable for the context of hybrid learning. Table 4 shows a general overview – tools for learning and knowledge management are presented on the one hand, and, on the other hand, tools supporting and fostering communication and cooperation that can be used for learning as well as for knowledge management.

Since these tools for communication and cooperation are considered in a separate chapter of this handbook, a further exploration of details is not provided here. General tools for learning and knowledge management are also skipped due to the fact that the named methods are rather general and have already been examined by various other authors and contributions such as Hoffmann (2001).

Hence, our strategy is to present different continuative approaches that can also be used for knowledge management. In addition, these approaches can be considered useful, especially in the context of hybrid learning, since most of them are related to the area of learning in some case. The presented approaches are assigned to two different categories – structured approaches and more or less unstructured approaches.

Representatives that can be assigned to this category are metadata models like the Resource

Description Framework (RDF)⁴ and the Dublin Core Standard (DC)⁵, which are often connected to the Semantic Web. On the one hand, annotations offer help detecting existing knowledge; on the other hand, these possibilities can be used to model and describe knowledge that was not explicitly formalized before. Techniques that can be used for similar purposes are Topic Maps⁶ and ontologies. Ontologies are used to define a semantic context for digital content. In order to set up ontology, a specific language like OWL⁷ is needed. Ontologies define relationships between different concepts, for example by using techniques like RDF or DC. Obviously – recalling the previous deliberations – representing context is one of the key concepts for integrating knowledge management and hybrid learning. Furthermore, ontologies are common throughout the domain of knowledge management as well as in the area of e-learning. The use of ontologies can therefore be very helpful. Ontologies are, for instance, used in (Leblanc & Abel, 2008) fostering the integration as described above. Another approach using ontology in web based learning is described in Sridharan, Tretiakov, & Kinshuk (2004). The framework, shown in Figure 11, using ontologies, represents the core of this approach.

The role of ontology is to support the effective knowledge acquisition and creation processes in the learning environment. Ontology plays the role of a binding factor that brings various knowledge

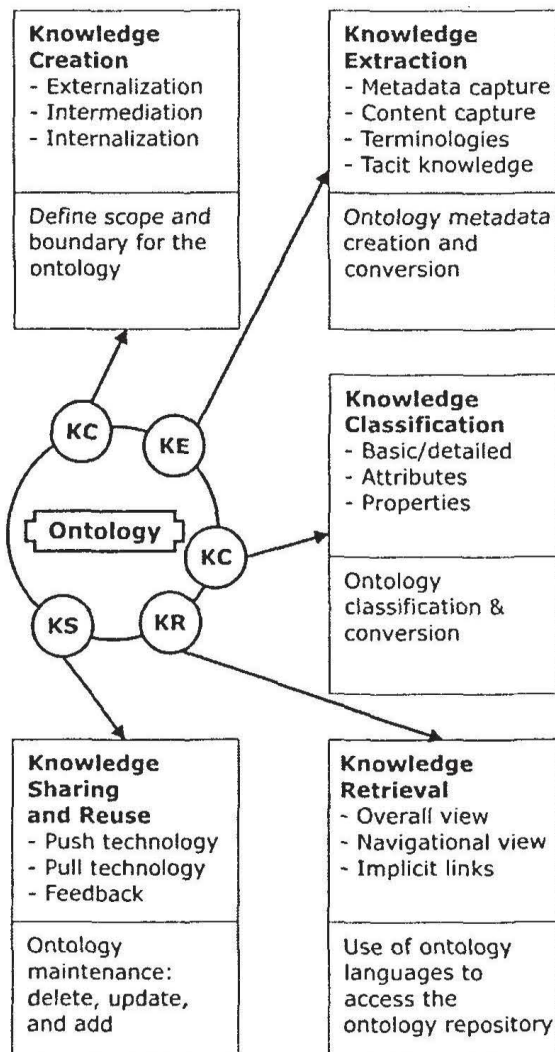
Table 4. Overview on common tools for learning and knowledge management (Nübel, 2005)

Learning	Tools	Knowledge Management
Online training material	Forums	Knowledge databases
Online courses	Chats	Expert databases
Web-based trainings	Bill-Boards	Yellow Pages
Glossaries	Virtual classrooms	Best Practices
	Groupware	Project reports
	Whiteboards	
	Application Sharing	

items and processes together to provide a richer and integrated view of the knowledge domain to the learners. It allows for interrelating, combining, and thus reusing standalone knowledge units. (Sridharan, Tretiakov, & Kinshuk, 2004, p. 664)

Topic Maps are, in contrast, an ISO-standard for the representation and exchange of knowledge that can also be used in combination with ontology. A Topic Map consists of different topics that are connected by a specified relationship and can therefore also be used to reason new knowledge. An approach showing the use of Topic Maps – a tool currently mainly assigned to the area of

Figure 11. Framework for knowledge management in web based learning (Sridharan, Tretiakov, & Kinshuk, 2004, p. 664)



knowledge management—is presented in Dicheva, Dichev, & Wang (2005). The toolkit TM4L⁸ was developed as an “ontology-based environment to complement existing TM editors and visualization tools for the area of e-learning” (Dicheva, Dichev, & Wang, 2005, p. 1).

Proceeding with the category of unstructured approaches, delegates of this section are methods like Mind Maps or technologies like blogging and tagging. All these methods are highly suitable to formulate knowledge that was gained by informal learning or in non-digital parts of hybrid learning classes.

Mind Maps are a semantic organization tool that has been used to foster learning and support visualization and structuring. In contrast to Topic Maps, Mind Maps do not require the representation of any semantic meaning symbolized by connections. A particular use case is described in Willis & Miertschin (2006). In contrast, Chacón (2003) shows a quite different approach of how to use Mind Maps for web based learning – Mind Maps are used to develop learning templates.

More recently, issues of social computing have been gaining interest in the area of knowledge management and learning. Collaboration tools like blogs and wikis are integrated into the learning environment in order to offer a more informal method of communication. Also, the technology of tagging can be used to structure existing knowledge. However, since all of these are text-based, they are mainly of use for supporting explicit knowledge transfer. The usability for covering more informal aspects of learning roughly depends on underlying models of usage.

There are various contributions analyzing the use of social software for the concerns of hybrid learning. An example of how to integrate social aspects has already been described above and was originally presented in (Pettenati & Ranieri, 2006).

FUTURE TRENDS & CONCLUSION

Since possibilities for integrating knowledge management and hybrid learning have now been outlined, this chapter must take a look at critical issues of this integration.

Firstly, there are critical voices concerning the externalization of implicit knowledge. The question of whether the nature of tacit knowledge has been understood at all is discussed and reasoned in detail by Tsoukas (2003). According to Tsoukas, Nonaka's & Takeuchi's interpretation of tacit knowledge is erroneous since "it ignores the essential ineffability of tacit knowledge, thus reducing it to what can be articulated" (Tsoukas, 2003, p. 425) and "(...) tacit knowledge cannot be 'captured', 'translated', or 'converted', but only displayed, manifested, in what we do". The main critique is that knowledge creation is not an organizational process but a process of socialization. Exactly that point is referred to in models adopting the SECI-model for the purpose of hybrid learning presented above.

Main progress and future development will have to focus on the improvement and spreading of technologies like ontologies or RDF employed for knowledge management in the area of hybrid learning. The concepts and existing work of those possibilities sound promising, but there are numerous technical problems and issues that need to be worked on.

This chapter has given a broad overview of the foundations of knowledge and knowledge management in order to allow a profound estimation of presented approaches for knowledge management in the context of hybrid learning.

It is obvious that the process of bringing knowledge management for hybrid learning into existence has only just started and that there are a lot of obstacles and problems that have to be cleared and solved. But what should also have become obvious is that the process has already begun and that there are a lot of benefits that this

integration can and will bring to both areas of knowledge management and hybrid learning.

At this stage of the process, critical issues and voices are easy to find but – to repeat Rosenberg's (2001) summary – there are at least some implications that knowledge management already delivers for e-learning.

Rather than simply relying on instruction, we can use well-structured information as well as productivity enhancing tools to help people learn and improve their skills. (Rosenberg, 2001, p. 109)

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KEY TERMS AND DEFINITIONS

Hybrid Learning: Hybrid Learning is located in the continuum of blended learning and therefore a mix of different forms of information and knowledge transfer.

Knowledge: Knowledge is information enriched with context and interpretation. Various distinctions for different kinds of knowledge exist and are used according to the associated purpose.

Knowledge Management: Knowledge Management in general is the process of gathering, maintaining, processing, and providing knowledge. There are specific models for knowledge

management – of a formal as well as a more informal character – that integrate knowledge management into complex settings.

Knowledge Management for Hybrid Learning: Knowledge management for hybrid learning is the integration of two separately developed branches that brings benefits to both branches and offers opportunities for an actually already existing connection – knowledge & learning.

ENDNOTES

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