



**E-Learning and Knowledge Management:
Siamese Twins Who Never Met?**

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Summary:

Beyond data storage and information retrieval: How to fit e-learning approaches into knowledge management structures

E-learning systems have frequently been treated as something different than knowledge management systems. Organizations tend to see both developments as separate issues with different responsibilities and tasks. Knowledge management is typically started in initiatives high up in the organization, often directly below the executive level while the responsibility for e-learning lies within the training department. The paper attempts to examine the links and similarities between e-learning systems and knowledge management systems. Coming from an information systems background many known structures reappear when looking closer at e-learning systems. Three different e-learning approaches can be identified, the instruction-oriented, the communication-oriented and the information-oriented approach. The latter two approaches share many similarities with the two approaches to knowledge-management, the people-to-people and the people-to-document-approach. The underlying e-learning systems are actually knowledge management systems. The differentiation between an e-learning- and a knowledge management-system can primarily be explained by different goals and the consideration of didactic aspects by e-learning systems. Since the systems are almost identical, companies could save resources and increase use and acceptance by joining the two initiatives.

Keywords: e-Learning, Knowledge Management, Knowledge Management Systems, e-Learning Systems, Performance Improvement Systems.

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1 FROM KNOWLEDGE MANAGEMENT TO E-LEARNING

Knowledge management and e-Learning have a similar focus: enhancing human knowledge and its use within the organization. While some see the knowledge management- and e-learning-approaches slowly merging, many organizations seem to treat both developments as separate issues with different responsibilities and tasks. Knowledge management is typically started in initiatives high up in the organization, often directly below the executive level while the responsibility for e-Learning lies within the training department (Back 2002). Due to this, e-Learning systems have frequently been treated as something different than knowledge management systems. At the same time, it appears that only few structured approaches to e-Learning systems exist while extensive classifications are available for knowledge management systems.

Coming from an information systems background many known structures reappear when looking closer at e-Learning systems. The paper attempts to examine the links and similarities between e-learning systems and knowledge management systems. It will also examine what differentiates e-learning- and knowledge management systems. Chapter 1 will look at the existing definitions and approaches in knowledge-management and e-learning. Chapter 2 will provide a three-layer model for the classification of e-learning systems. Chapter 3 will attempt to fit the existing e-learning approaches into a classification taking the underlying knowledge management system and the didactic aspects into consideration. Chapter 4 will summarize the results.

2.1 Development and Definitions

Knowledge management has gained rapidly in importance during the second half of the 1990s. “The knowledge creating company” by Nonaka and Takeuchi was first published in 1995. The ideas of knowledge management received contributions from organizational learning and information management. This explains the existence of fairly different knowledge management approaches, some focussing on organizational issues while others primarily focus on the underlying technology.

E-learning developed separately at around the same time. Yet, it was slower to pick up pace. The origins of e-learning can be traced back all the way to the testing machines in the 1920s. Tutorial systems were invented in the 1950s by IBM (Barker et al 1985). Many promising approaches in the 1970s, 80s and early 90s didn’t survive changes in technology (Rosenberg

2001). Only in the 1990s computers provided enough performance for multimedia applications and internet technology didn't reach the critical mass outside the university sector until the second half of the 1990s. The term e-learning was used for the first time in 1998 (Minass 2002).

Numerous definitions for knowledge exist. The simplest one is based on Plato: „justified true belief.” (Moser et al 1998). This definition from the epistemology mainly comprises theoretical knowledge. From an organisational point of view knowledge also comprises skills, experiences and values.

Knowledge management can be seen as the managed process of organizations' activities to acquire, store and utilize knowledge for the goals of the organization. This comprises the technological and the organizational aspects.

Learning is more than just acquiring knowledge. It is a process of acquiring knowledge and skills and changing behaviour. E-learning shall be seen from an information perspective. E-learning can be regarded as the enabling of learning processes using information and communication technologies. (Back et al 2001)

2.2 Knowledge Management Approaches and Systems

Looking at knowledge management activities and the underlying knowledge management systems two different paradigms can be identified within organizations:

- The *codification strategy* (also referred to as „people to document approach“) attempts to store the knowledge. Knowledge will be stored and subsequently made available in shared databases. The advantage is the availability of knowledge throughout the organization. Critics explain that only explicit knowledge can actually be stored and that this approach to knowledge management is simply plain information management (Empson 2000).
- The *personalization strategy* (also referred to as „people to people approach“) encourages the exchange of knowledge among the members of the organization. Information technology is supposed to support the exchange of knowledge by helping to find knowledge owners and by supporting communication among the members of the organization. The main challenge of knowledge management is identifying and retaining the knowledge owners.

The following table compares the two approaches to knowledge management:

	Codification strategy	Personalization strategy
Purpose	Store, distribute and reuse knowledge	Exchange and create knowledge
Application for	Explicit knowledge	Implicit knowledge
Role of communication and information technology	Providing information/knowledge, search and retrieval	Support and enhance communication processes between knowledge owners
Origin	Information management	Organizational learning

Table 1: Approaches to knowledge management (Mistele 2000)

Neither approach is normally used exclusively. Knowledge management combines purposeful information management with a culture of organizational learning (Rosenberg 2001). The main role of the knowledge management system can be derived from the knowledge management process:

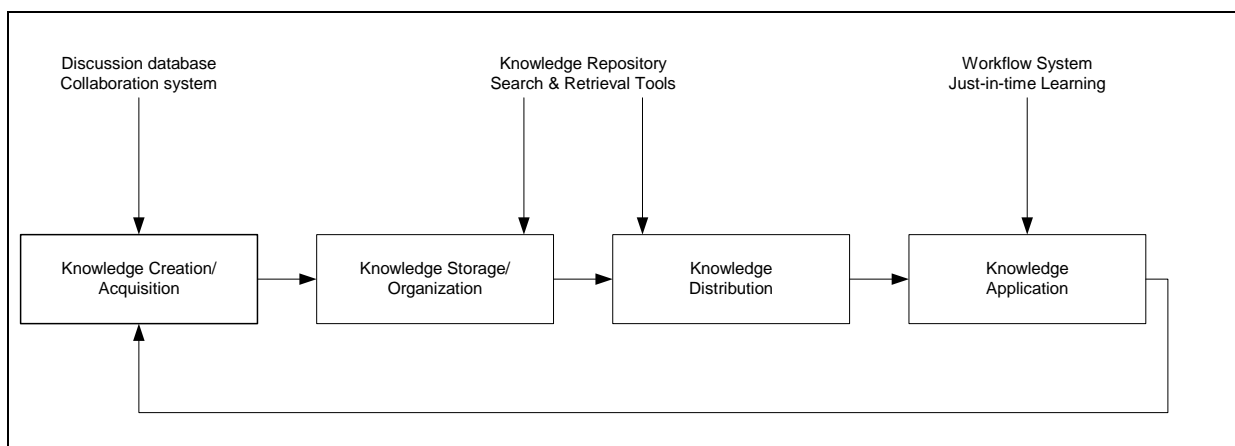


Figure 1: IT and the knowledge management process (Alavi 1997)

Systems in the knowledge management process might - depending on the focus - work as information- and/or communications systems. Computers and communications systems are good at capturing, transforming and distributing highly structured knowledge that changes rapidly. Thus, knowledge management systems are information- and communication-systems. Depending on the underlying knowledge management paradigm they may lean either towards the information system ideas (codification strategy, origination from the information management approach) or to the communications system ideas (personalization strategy, originating from the organizational learning approach).

2.3 E-Learning Approaches

E-Learning comprises numerous approaches to learning and teaching that are based on very different learning methods which in turn are all somehow connected to technology and the web. Some see e-learning simply as an “e-Terms” linking it to e-Commerce and e-Business. Sometimes (especially in the university sector) it is equalled with teleteaching. Other literature connects e-learning with web-based learning. For many firms e-learning simply consists of a number of methods, most widely used of which are “CBT/WBT, Virtual Classrooms, Teaching-Videos, Business-TV and Learning Management Systems” (Riekhof 2001). Yet, many “e-Learning-methods” are actually e-learning systems or plain products. The example (which was published in a German training magazine) shows the dilemma of the new discipline: CBT/WBT may comprise very different (self-study)-learning programmes with very different underlying learning methods. A virtual classroom is a learning-system providing a variety of services to facilitate collaborative teaching and learning while a learning management system can either comprise a learning platform or can be used to administer the learning process.

Classification attempts have been made by almost any discipline involved in e-learning research. They may be based on the underlying learning theories of the system, on the software products, or on the underlying learning method. This paper will strictly argue from the role of information and communication technology within the learning process. This role is based on the e-learning definition.

Within the learning process a system can have three different purposes. The system can either actually teach, it can facilitate teaching and learning within a group or it can provide the materials needed for the learning process. Using common metaphors and paradigms, information and communication technology can serve as a teacher, provide a classroom or serve as a library:

- *Instruction-oriented*: The computer/the web serves as a teacher. It will present the content and facilitate the learning process.
- *Communication-oriented*: The computer is a tool and medium that supports communication and collaboration and might also serve as a group memory. Collaboration and communication may take place among the students and between the students and the teachers.

- *Information-oriented*: the computer stores information and knowledge and supports the learner in problem solving activities. There are no formalized learning-processes; the learner will be supported in finding and structuring the information.

The following table shows the three different e-Learning approaches, the role of the Information and communication technology and the typically used software:

	Instruction-oriented	Communication-oriented	Information-oriented
Nature of the system	Learning or Teaching-System	Communication system	Information system
Role of Information and Communication Technology	Present knowledge	Support communication	Store knowledge
Underlying paradigm	The web as a teacher	The web as a classroom	The web as a library
Purpose	Teach	Exchange and communicate	Inform/find knowledge
Systems/Software	Authoring Tools	Groupware tools	Databases

Table 2: The basic concepts of e-Learning (Rosenberg 2001, modified)

Looking at the three different basic concepts of e-learning, the communication and the information-oriented approach share similarities with the two knowledge-management approaches. The e-learning-system requirements for the communication-oriented approaches resemble the requirements for the people-to-people-approaches in knowledge management. The information-oriented approaches share the requirements with the people-to-document-approaches in knowledge management. Yet, some of the e-learning methods appear not to fit into the knowledge management structures. The next part of the paper will examine how the various systems facilitate the learning process.

2 A THREE-LAYER-MODEL FOR E-LEARNING-SYSTEMS

The discussion about e-learning systems is characterized by a certain degrees of confusion. Especially the terms learning method, learning system and learning technologies are widely used and often considered to be synonyms. A multi-layer reference model should provide orientation and support decisions in the development of e-learning systems. Various authors have provided contributions. Back et al suggest a three-layer-model which distinguishes

between base-technologies, learning-technologies and e-learning systems (Back et al 2002). Based on those ideas we suggest a similar three-layer model combining learning technologies and e-learning systems. This model distinguishes between a concept-layer, a learning-system layer and a (base-) technology-layer:

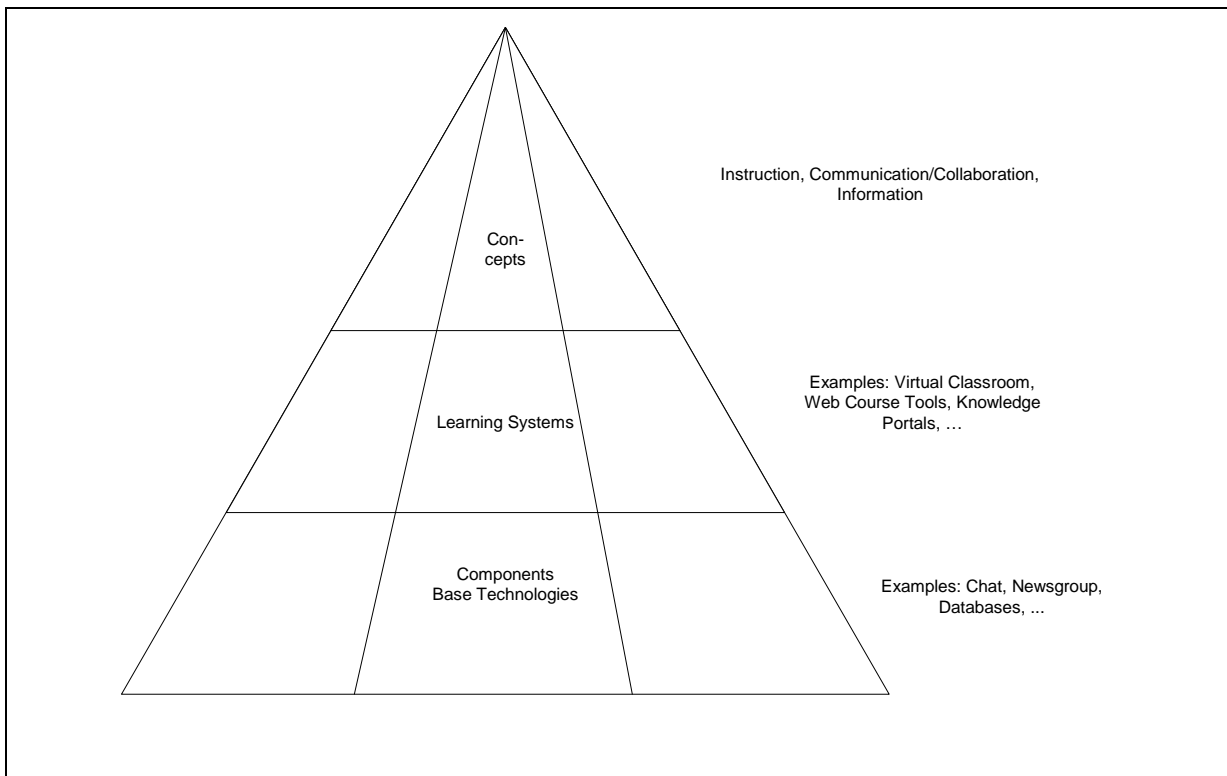


Figure 2: Three layer model for e-learning systems

3.1 Concept Layer

The highest layer describes the basic concepts on an abstract level. The concepts correspond to the e-Learning approaches and serve as a starting point for choosing a learning method without mentioning the underlying system. This corresponds to the authors' view that e-learning usually doesn't provide new learning-methods, but simply is new delivery methods for established learning methods. Most "traditional" training methods have their "e"-counterpart. Instruction-oriented approaches for example incorporate mostly self-study methods as well as some simulation based-learning methods. Two of the three e-Learning concepts have their direct counterpart in the knowledge-management approaches. Also, both knowledge management-approaches and e-Learning concepts might be mixed. The various concepts and the underlying systems will be discussed in chapter 3.

3.2 Learning System Layer

Learning technologies usually bundle different communication- and information technologies. They provide the functionalities needed to support the learning process. Corresponding terms are learning systems and learning applications. They bridge the gap between the concepts and the underlying base technologies. Typical design decisions in e-learning and knowledge management projects usually take place on this layer (Back et al 2001). Most e-learning products will actually be found in this category. Even though they are sometimes also called methods, they are actually a learning technology that might be the delivery method for one or several learning methods. An example is a virtual classroom that might be used for teleteaching or cooperative learning via the web. The learning technologies are not only used in the actual learning process, they can also support the development of courses and they might serve administrative functions. The following table shows some typical functionalities of a learning management system bundling several learning systems:

Administration	Content Development	Learning Process
Catalogue and registration	Management of learning materials	Web-based-training-modules
Reporting	Administration of Learning-	Simulations
System integration	content and Learning-objects	Resources (knowledge-
	Authoring-Tools	management)
		(Self-)assessment
		Virtual Classrooms with
		groupware functionalities

Table 3: Possible functionalities of a learning management system (Sauter et al 2002)

3.3 Base Technology Layer

While learning technologies carry methods, the underlying base technologies carry the actual content. Content might be available in many ways. It might have the form of plain text; it might be sound, pictures, video clips or a small simulation. The content might be authentic or didactically enhanced (Kerres 2001). The actual content is one of the biggest challenges in e-learning (Rosenberg 2001).

The use of internet technology has proven to be the biggest opportunity for e-Learning due to its interoperability. The basic internet-services such as e-Mail, telnet, ftp, irc, newsgroups and as a more recent service especially the World Wide Web serve as actual base technologies. The TCP/IP-protocol-based services already provide the basic functionalities needed for e-

learning and knowledge management. Still, the base technologies are nowadays hardly used in their plain mode, normally they exist in more sophisticated ways. Yet, they demonstrate some of the underlying principles and required functionalities:

Service	Function	Advancements
E-Mail (SMTP)	Electronic communication, Distribution of materials as a „Push“-approach	MIME-, HTML-Mails, File-Attachments
Telnet	Remote-operation of other computers over the web as a base for collaboration	Application Sharing
FTP	Exchange of materials, e.g. Up- and Download of teaching materials	Shared Workspaces with document management
Chat (irc)	(Synchronic) text based communication	Video- and Audio conferences
Newsgroups	Asynchrony Discussions, black boards,	Bulletin Boards, Blackboards

Table 4: Basic internet-services, advancements and their use in e-learning

Although rarely separately specified, databases have become the underlying base technology for e-learning applications (Baumgartner et al 2002). Even though the standard web technologies might fulfil the learning system requirements, practically all learning management systems have databases both for the administration and for the storage of contents. Surely the organization of a WBT module is possible by means of HTML-code, many of the expected functions (e.g. further processing, user Tracking and multiple use of contents) however, cannot easily be implemented without databases.

Standardization efforts also happen at this level. By using learning objects and related concepts users and developers are trying to guarantee a certain level of quality and are hoping to ensure the reuse of content (Schulmeister 2002). This fairly technical topic of learning objects shall not be elaborated upon here.

3 E-LEARNING APPROACHES AND KNOWLEDGE MANAGEMENT SYSTEMS

Looking at the three layer-models for e-learning, the question remains what distinguishes an e-Learning system from a knowledge management system. E-learning systems are also information- and/or communications-systems, thus knowledge management systems. The answer is simple: adding didactic considerations will turn a knowledge-management system

into an e-Learning system. By taking didactic aspects about the content as a new dimension into consideration, it becomes possible to characterize the various e-learning systems and their underlying learning methods. E-learning systems are not a different kind of system compared to knowledge management systems, they simply have different content and they might differ in a few minor functions. E-learning systems for example tend to offer little support for content (search and retrieval functions) beyond the structured training. The actual content stored in the system might also have different origins. Tutorial systems usually choose and prepare the content thoroughly for the role in the learning process. This content is didactically prepared. Other systems provide plain authentic content. (Kerres 2002).

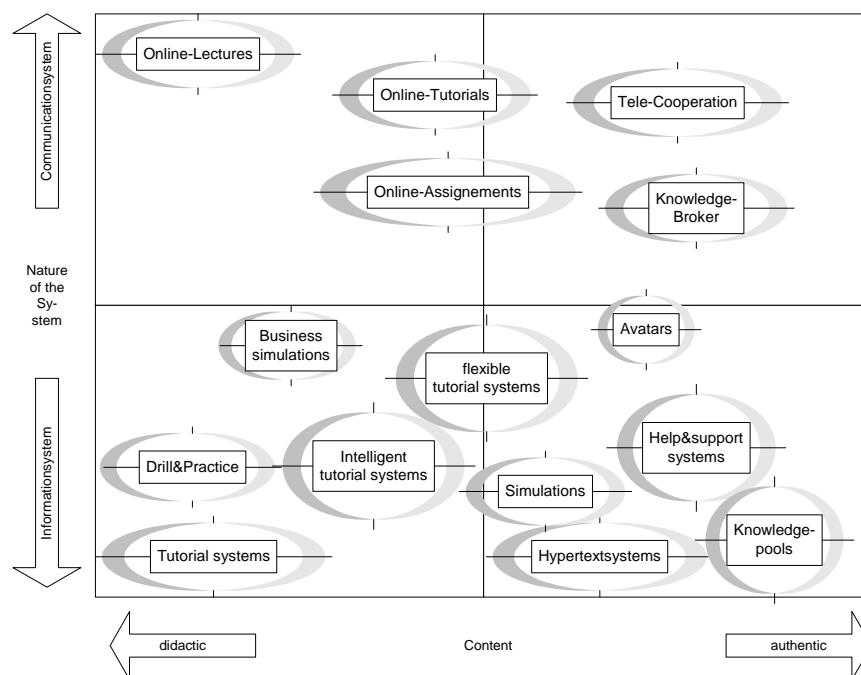


Figure 3: E-learning systems from a didactic and knowledge management system perspective

The other dimension besides didactic considerations for this base structure is derived from the role of knowledge management systems in the actual learning process. Like in the knowledge management approaches, the systems can lean towards an information system (“people to document approach”) or towards a communications system (“people to people approach”). Likewise e-learning systems simply store and organize the content and support its presentation and retrieval. Other e-learning systems provide the means for communication and collaboration. Most systems are somehow in between, facilitating communication processes and presenting information. The communication processes do not necessarily have to be between the learners.

4.1 Instruction-oriented Approaches

Instruction-oriented approaches can be characterized by a fairly high level of didactic enhancement and by little or even non-existing communication components. The main task of the knowledge management system is to store and organize content and to present it to the learner in a rather structured way that is optimized for retention. The interaction also tends to be very structured with little communication. Typical self-learning packages known as “CBT” and “WBT”-programs are usually found in this category. The actual underlying program-type varies and either belongs to one of the following categories or sometimes combines several approaches within one system for different activities:

- *Drill and Practice-systems* are the oldest kind of software in this category. They are system-oriented, displaying information and reducing actions of the learner to simple structured input. Their origins can be traced back to the learning machines of the 1950s and 1960s. (Rosenberg 2001). They are criticized for the low degree of interaction and the structured paths, yet there are still some applications such as vocabulary training.
- *Tutorial systems* (also tutorials) are used most widely. They are somehow more flexible, following structured paths in displaying information, but allowing for the learners' deviations.. More recent systems tend to make use of multimedia technology in displaying the content. The degree of individualization is still very low, typical learning goals are declarative knowledge and well structured procedures.
- *Flexible and intelligent tutorial systems* are supposed to offer a higher degree of adaptation and individualization to the learner in order to overcome some of the shortcomings of the tutorial systems. Flexible tutorial systems are supposed to allow an almost open interaction between the learner and the system. They should adapt to the individual learner. “Intelligent” tutorial systems are supposed to simulate a (human) teacher. An expert system serves as the knowledge base; a communication module will make a conversation with the learner possible. While at least some adaptation to the learner becomes more and more common, “intelligent” tutorial systems are only known for very special aspects. An example is an avatar that might be able to simulate a human teacher for a very limited scope of knowledge.
- *Simulations* are offering the content implicitly. They are usually complex (mathematical) models of systems. The learner can change different parameters and watch wanted and unwanted results. This offers the opportunity to learn from mistakes. Various kinds of simulations exist with different learning goals. Some (e.g. Business simulations) are used to train decision-making processes, some are modeling (social) behavior while others are

common in practicing the use of machines or software. All simulations have a high degree of interaction in common.

The following figure offers an overview of the most common instruction oriented approaches to e-Learning:

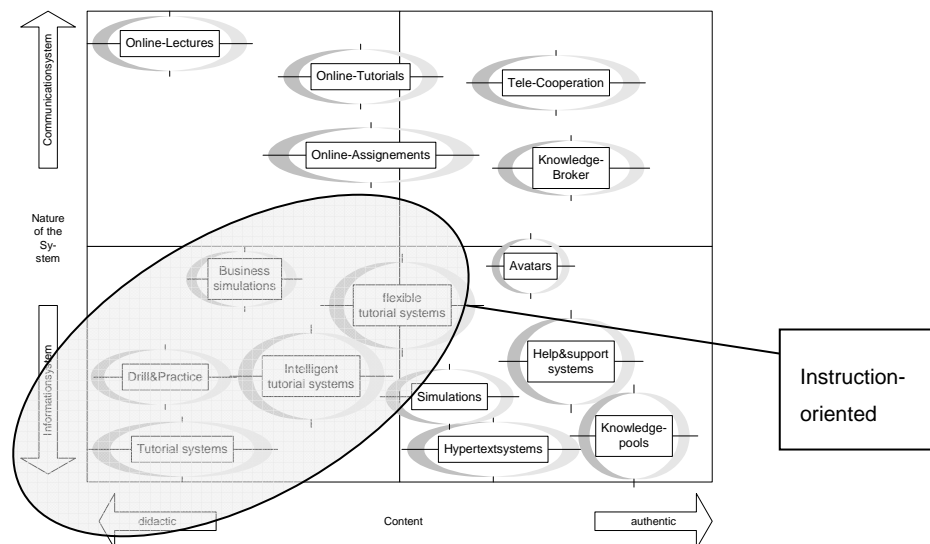


Figure 4: Instruction-oriented approaches

4.2 Communication-oriented Approaches

Communication-oriented approaches stand for communication and co-operation among the learners and between learners and instructors. The underlying knowledge management technology is primarily a communications system. The computer serves as a medium to overcome time and/or space as well as a tool to promote co-operation. The various approaches are characterized by questioning whether the actual learning-process is self-managed or facilitated by an instructor. This is directly linked to the didactic setup. The underlying learning methods can differ to a large extent. They range from the classical instructor-centered teleteaching approaches all the way to unmediated communities of practice on the web that will correspond to the people-to-people-approach in knowledge management. The underlying system may range from a simple video conferencing system, a virtual classroom system to classical groupware-tools. Some of the most frequently used communication-oriented-approaches are (Back et al 2001):

- *Tele-Teaching* (also: Online-lectures) is an instructor-centered approach, which basically brings a classical lecture on the web. The underlying system is simply a communication

system. Virtual classroom-systems offer more options allowing some degree of self-governance by the learner. The learner can participate in discussions, engage in a private conversation, access other resources and also view a recorded session of the lecture.

- *Tele-Tutoring* can be seen as a form of guided self- or group-study. The role of the instructor changes into a coach. Feedback is available, but it will come from an (human) instructor instead of an automated feedback by the system. Online-assignments, some case studies and web quests also fall into this category.
- *Tele-Cooperation* stands for an unmoderated approach of sharing and acquiring knowledge. This can be an exchange of knowledge in a community of practice or collaboration on a project. The underlying systems are usually groupware-tools offering support in communication and cooperation. The mode can be synchronous and asynchronous. A moderator might only help to ensure the quality of the process, the contributions and the results and he might facilitate the group processes. The activities correspond to the people-to-people approach in knowledge management.

The communication-oriented approaches of e-learning tend to change with the fading role of the instructor into a knowledge management approach. The following figure offers an overview of those approaches:

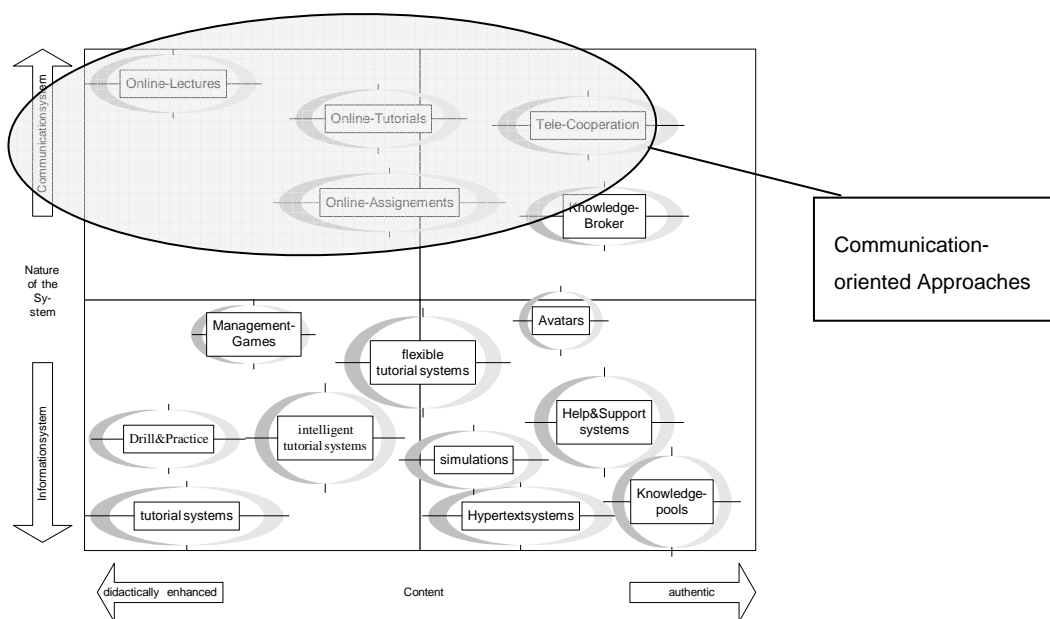


Figure 5: Communication-oriented approaches

4.3 Information-oriented Approaches

The main rationale of information-oriented approaches to e-learning is to provide quick support in solving task-related problems on the one hand and on the other hand to support explicit learning processes by providing secondary materials. Some refer to it as “just-in-time”-e-learning; another term is „knowledge nuggets“. Frequently it is seen as the convergence of self-governed learning and knowledge management in people-to-document-approaches. Empirical data is supporting this observation. Most e-learning sessions are rather short with typical sequences anywhere ranging from 5-10 minutes, a sequence of 30 minutes is considered to be rather comprehensive (Littig 2002). Those approaches may actually be the reason for the over-estimation of the potential of e-learning. The prediction that e-learning will replace traditional (classroom-) training might be wrong after all. Instead, just-in-time-e-learning will provide information over the Inter- or Intranet formerly found in (technical) periodicals, manuals and other collections of (formerly) printed materials.

Yet information-oriented approaches should not be reduced to an ad-hoc-source of information. „Performance Improvement“(Fuller et al 1999) focuses on the support of employees in doing their daily tasks and stands beyond the paradigms of classical training. Performance (from the perspective of the fulfillment of organizational goals) is not only influenced by the qualification of the employee, but also by having the required information and tools. Apart from the support for information search and retrieval, practice-suited instruments and tools are therefore needed for the subsequent use and processing of this information by the employees. Information oriented approaches can provide the following support:

- *Storage and retrieval of knowledge and information:* the main task is the efficient access to information and knowledge. The system administers the information and provides search and retrieval tools. Common metaphors are those of a virtual library or document-pools. Examples for possible contents are (process) documentations, quality management guidelines, FAQ-lists, glossaries, but also other content-objects such as videos or presentations. Product presentations, advertising clips or recorded virtual classroom sessions can also be provided. It should resemble a virtual library that is constantly expanding its pool of materials. Hypertext and help systems also belong to this category even though they have at least some degrees of didactic enhancements.
- *Knowledge and information gateway:* an information portal is an application that provides users with a single gateway to personalized information. Distinguishing between learning and knowledge portals seems to be arbitrary. The library is the classical gateway to

knowledge; the librarian can be an Information-Broker (Davenport et al 1998). One step ahead in interaction avatars and other knowledge-based systems. In this case their actual content is authentic (compared to the content in instruction-oriented approaches).

- *Individualized knowledge management tools* or „Performance Improvement Tools” (Rosenberg 2001) offer support in storing, retrieving and processing information and knowledge. Among them are bookmark-manager, recommendation-systems, personalized news- and information services and tools for visualization. Some e-learning arrangements and knowledge management systems are bundling those tools to a personalized workspace.

The following figure offers an overview of those approaches:

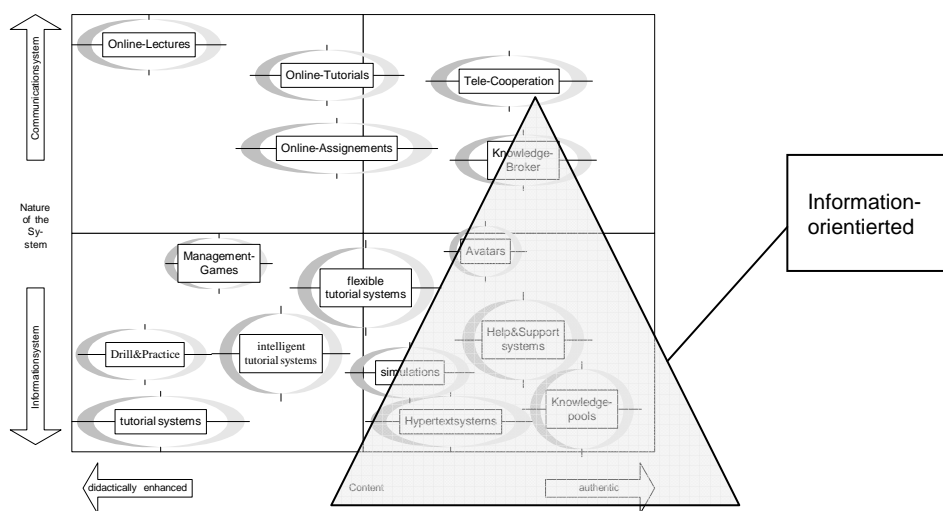


Figure 6: Information-oriented approaches

4 CONCLUSIONS

It was shown that e-learning-systems are very similar to knowledge management systems concerning their specifications. Still, firms are using different systems for those tasks. This can be explained by a number of reasons. Historically, the responsibility within the organization often lies within different units. At the same time, knowledge management and e-learning have spawned different software sub-industries, with few suppliers serving both markets. Also, even though the actual systems are similar they are used in different ways. The following table defines the different paradigms of training and knowledge management:

	Instruction	Information
Goal	Achieving competence	Satisfaction of (immediate) information needs
Purpose	Defined by the Training/HR-department	Defined by the user
Organisation of the content	Optimized for the learning process	Optimized for storage and retrieval
Nature of the content	Didactically enhanced	Authentic
Typical elements	Presentation, practice, feedback	Presentation, structure, retrieval
Relationship to daily work	Apart from the job and tasks	Integral part from the job and tasks

Table 5: Difference between instruction and information (Rosenberg 2001, modified)

Companies are well advised to join the different initiatives. The obvious reason lies in the almost identical requirements due to which the supporting infrastructures are often duplicated. This is not only a misuse of technical resources, but also a barrier to acceptance. Potential users have to get acquainted with two fairly similar systems. This competition for corporate resources and also attention of potential users sometimes even causes the involved groups to torpedo each others' initiatives. Also, many initiatives never reach the critical mass required to "take off". An operative system does not have any value as long as there are not enough people actually using it.

Successful knowledge management cannot be separated from (e-) learning and vice versa. This can be seen by looking at the process: technology alone will not start a community of practice. People have to learn how to use the systems and to become familiar with the systems. This has to do with learning. Providing access to knowledge management systems might on the other hand actually reduce the transfer gap after the learning process. E-learning and knowledge management are Siamese twins. They might have different goals, but they share the same roots and use similar systems.

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