

Methodology and technology Knowledge based approach for e-learning in the future networks of distance education

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ABSTRACT. E-learning is characterised by the latest forms of technology and methodology. The future development of e-learning will find its expression in the transfer to the knowledge based e-learning. Especially technology and methodology will influence the further processes by many innovations balanced with the improvement of the organisation and social life. The future development will be focused to the networking in order to be able to control the efficient solution of a very complex problem. The future networks for distance education will be driven by the latest methodology and technology and based on knowledge transfer for the e-learning in the framework of the systemic approach.

KEYWORDS: *e-Learning methodology, Knowledge based approach, Multi level cooperation, Networks of competence*

Introduction and state of the art

The e-learning is learning by using electronically means of communication and presentation. It is technology driven. The latest communication, information, and multimedia technologies are applied for the future kinds of education and training. The course and content development is planned in the framework of modular design and followed by the design of the separate modules. Recently the two main e-learning technologies are the Computer Based Training CBT (http://en.wikipedia.org/wiki/Computer-based_training) and the Web Based Training WBT (<http://de.wikipedia.org/wiki/WBT>), (Mayr, Seufert, 2002). Normally CBT programs exists as executable files distributed by CD-ROM, DVD or file transfer via networks. As usual the contents are not directly appropriable for clients in networks. The application is asynchronous, without direct contact to the tutors and mainly designed for the self-studies. Currently the CBT technology is replaced by the WBT technology. The WBT technology is based on the new opportunities of the internet, extranets, and intranets using LAN, MAN as well as WAN. The WBT programs are stored and administrated by web servers providing the access to the content online for the clients. The communication between lecturer

or trainer and student or learner can be asynchronous as well as synchronous. The WBT development is characterised by applying the latest technologies of web design, multimedia, and communication. Before the content is implemented as CBT or WBT it has to be developed as software by using special tools. The key issue is to install a software development environment for the standard development of integrated content software packages. The solution was the development and application of authoring tools as developing tools for the content production. Integrated authoring tools contain functions for the course architecture and navigation, the design of content pages, and the multimedia application including the streaming of the multimedia means. They are used to produce online courses by integration of different media for designing WBT learning units. Authoring systems support special e-learning standards, for instance the Sharable Content Object Reference Model SCORM (<http://en.wikipedia.org/wiki/SCORM>) or the Dublin Core Metadata Initiative DCMI (<http://dublincore.org/about/>). The content will be presented in Learning Management Systems LMS. LMS are complex planning and controlling systems for the learning management. They support the event and scheduling organisation, the tutor and learner administration, the content application, the learning communication, etc. The use of LMS is state of the art. The content development gets more and more the character of a serial or mass production. Therefore it is useful to implement special Content Management Systems (CMS). CMS are applied to support the production, reusing, reengineering, searching, improving, and delivering of the content units. (Fig. 1)

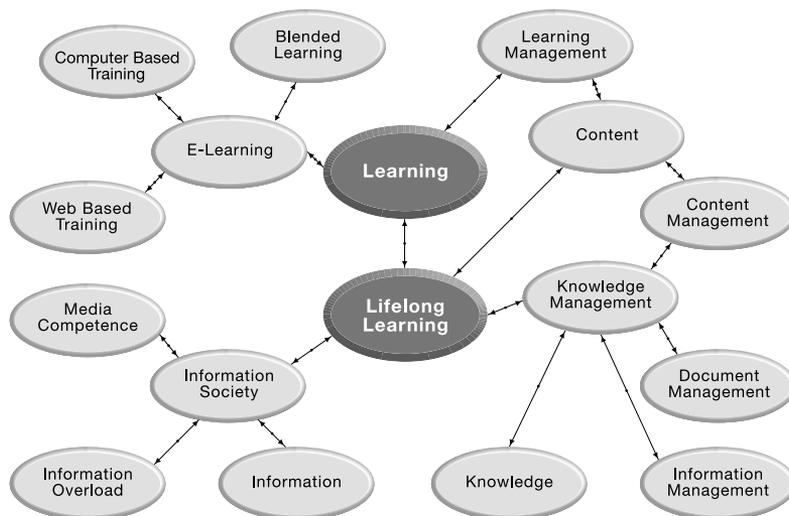


Figure 1.
The e-learning as a subsystem in the context of life long learning (Schumann, Grebenstein, Tittmann, Weber, Nöske, 2004). There are Learning Content Management Systems (LCMS) as integrated systems of LMS and CMS

Knowledge based approach as stimulus for the systematic e-learning

The e-learning is a special technological and methodical subsystem of the holistic system of the knowledge acquisition and absorption of human beings in the procedures of life long learning. It is characterised by space and time independence. The system term is used to describe a set of entities which interact. The e-learning is one entity in the knowledge absorption system supporting the information and knowledge transfer. But the holistic sense of the learning activities is the knowledge development, insuring the sustainability of the learning procedures (Brettreich-Teichmann, 2003). The system approach, concerning learning and knowledge transfer, bases on the context of data, information and knowledge. Bottom up: data become information by interpretation, information forms knowledge by learning. Top down: knowledge can generate new information and information can be coded to data. The knowledge is generated as individual knowledge by using information. Then the knowledge of the individual (the implicit knowledge) is evaluated in order to distribute and apply it as the knowledge of the organisation (the explicit knowledge). The extension of the system approach induces the upward development from the information and knowledge level via skill and competence level to the level of expertise (North, 2002). The trend is characterised by the following upgrades:

- information includes the semantic and the syntax as the meaning of characters and rules for creating complex language structures (for instance phrases and sentences);
- knowledge includes the information and the context as the coherence of information for the useful reflection of the reality;
- skill includes the knowledge and the application as the practical use of the knowledge in the processes changing the reality;
- competence includes the skill and the practice as the existence and the use of complex practical behaviour patterns for changing the reality;
- expertise includes competence, activity and efficiency as the opportunity to be active and efficient within the application of the complex behaviour patterns for changing the reality.

The learning and knowledge transfer procedures are essential for all levels. The superior level of application is the knowledge transfer. At first it contains the evaluation of the individual, in the

learning procedures acquired knowledge. Secondly it is used to distribute the knowledge in the corresponding transfer systems of the organisation. Learning Management Systems as well as Content Management Systems or Document Management Systems are the pre-systems for the Knowledge Management Systems. The Learning Management System, as software system, is a subsystem of the Knowledge Management System. It administrates the contents of a data base as subset which are available for defined learning activities in the organisational unit. In contrast to the objectives of the Learning Management Systems the Knowledge Management System, as information system, is more complex. It administrates not only the learning contents and processes but the knowledge of the organisation as a whole. The administration involves all processes of collection, preparation, and provision of the whole knowledge of the organisation inclusive of the e-learning contents of the Learning Management System. The knowledge management is part of the general information management system, and the learning and/or content management is part of the knowledge management system of the organisation. Therefore the systems approach effects that e-learning will be embedded in the knowledge management.

Different views as result of the system approach

The system approach for the e-learning and knowledge transfer requires a very complex consideration of the issue including the modular design of the system using the method of decomposition. It contains not only the direct aspects of the technology and the methodology of e-learning but also the tangent impact of the organisation and the socialisation of e-learning at the human beings. That is why different view points can be defined interrelated among each other. The main view points and their importance are:

- the technological view accounts that the e-learning as well as knowledge transfer were and are technology driven;
- the methodical view considers that the e-learning, in the comparison with the classic learning kinds, requires special methods for education and training (Schumann, Tittmann, 2004a);
- the organisational view is focused to the embedding of the e-learning in the organisational environment and the control of the e-learning technology and methodology interfaces to other aspects of technology, methodology, structuring, and processing (Schumann, Tittmann, 2005b).

The social view is characterised by socialisation of e-learning as part of the knowledge development and the life long learning of the human beings.

Regardless of the decomposition of the whole system by using different views, the system has to be performed as a complex solution in order to achieve synergy effects.

Technology and methodology as part of the system approach

Technology and methodology are important parts of the knowledge based system approach for the e-learning. Technology is the entirety of the techniques for producing goods and services. It is the entirety of techniques to support knowledge based e-learning by special software products and services, too. Currently relevant technological points of interest are Learning and Content Management Systems (LCMS), content development, Web Based Training Facilities, and software tools. Commonly professional LCMS, special software tools and hardware will be provided by specialised commercial companies. The more individual part is still to develop the content and to organise the web based training facilities. In the case of e-learning related to the knowledge of the single organisation it is necessary to create the special content based on the unique knowledge in the own organisation (Schmidt, 2000).

The development of content has to be transferred into frame work of serial or mass production in order to be cost-efficient, to guarantee high quality, warranty, and sustainability. This means the framework should be unified, flexible and re-usable; the content has to be individual, modifiable, and changeable. The developing guidelines are focused on relevant, technical and methodical key aspects such as:

- the change from CBT to WBT application including all relevant advance technologies of networking;
- the organisation of the content development processes as content production processes by using standard software developing tools based on unified pattern and templates for individual contents (Schumann, Grebenstein, Tittmann, Weber, Nöske, 2004);
- the standardising and the unifying of the content application interfaces and administration by special software tools such as authoring systems (Schumann, Tittmann, 2005d);

- the confirmation of the total quality management for the content production and application procedures (Schumann, Tittmann, 2005d);
- the change from the classic kinds of education and training including classic forms of distance education to blended learning based on knowledge based e-learning;
- the transformation of the monolithic content modules to granulated units embedded into an ontology described for instance by topic maps in order to achieve more efficiency by individualised granulated learning processes;
- the displacement of the classic e-learning by the knowledge based e-learning promoted by new kinds of the learning and content management as part of the knowledge management such as the special application like the knowledge brokerage (Schumann, Tittmann, 2005a; 2005c; 2004b).

The selected currently relevant key aspects have to be developed and optimised as separate application technologies and methods but always with the later integration in the whole system of knowledge based e-learning in mind.

Organisation, networking and procedure model as key issues for the future

Because of the complexity of the knowledge based e-learning the partner, involved in the system of life long learning and knowledge transfer, have to enter into different kinds of collaboration such as development, application, supply, or service collaborations. The organisational view includes on the one hand the processes of planning and realisation of defined projects and on the other hand the structural or institutional implementation of an organisational concept. Learning and training have a multilateral importance in a multilevel application characterised by such aspects as social, world wide spatial, life long, individualised, inter- and transdisciplinary etc. That is why one single organisation will not be able to cope with all the different detail problems of the knowledge based e-learning in a professional manner. The solution is to create networks of collaboration. In the past the collaboration failed or was not sustainable. The issue was the different level of technology, methodology, organisation, and socialisation or of knowledge, skills, competence, and expertise. Thus the networks of competence were developed as theoretical and practical solution for the network design based on the equalised competence level of the partners.

The general idea is that a competence cell is an object characterised by special attributes and behaviour for delivering a special performance in a network of services. For generating the performance the cell disposes of functions, resources, and competences. The cells are different in the competence field and the combination of competences but similar with regard to the competence level. Due to the existing competences the competence cells are single or multiple function-oriented and/or process-oriented. It is possible to combine the cells of competence in function or process networks.

The network life cycle is flexible. If any cell is not in accordance with the requirements of other cells of the network or of the whole network, it will be replaced by another one easily (Müller, Riedel, 2003). But there are complications for networks with weak or short-time fixation of the network relations. Especially, the long time development and warranty of the product or service quality is difficult in this case. Therefore, the networks of competence are the solution for a special class of services. They are characterised by a high-level flexibility but limited with regard to other objectives such as quality or after sales services. The answer for solving the problem is to develop networks of excellence with higher level of collaboration. Expertise is the key aspect for the transition from the network of competence to the excellent network of expertise characterised by knowledge transfer. But the networks can be transferred into clusters of competence or expertise with stronger fixation of the network relations and competence cells with a high-level expertise, too. The cluster is the realisation of the collaboration of a group of organisations exceeding the critical quantity in order to achieve the quality of an equalised level of competence or expertise (Töpfer, Barche, Seiwert, 2005). The networks or clusters of competence will be able to offer their performance and services in the framework of e-learning and knowledge transfer markets, respectively. The dimension of the networks could be local, regional, national, international, or global. The quality and quantity of networking is a key aspect for the further development of the knowledge based e-learning. By upgrading the knowledge level in the networks the quality and quantity of collaboration is increased faster and more sustainable. The context can be described with procedure models (Fig. 2).

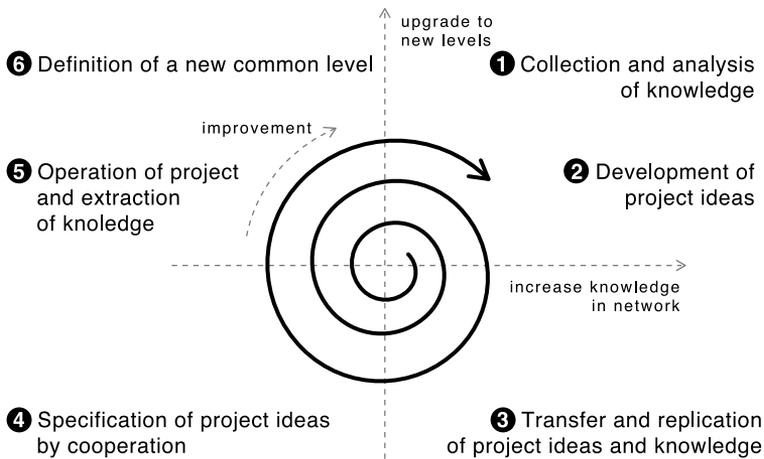


Figure 2.
Procedure model for competence upgrades in networks (Schumann, Tittmann, 2005b).
The knowledge upgrade in the organisations and networks is one of the main conditions for the system approach for the knowledge based e-learning.

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Sintesi

L'e-learning si va trasformando da semplice, nuova applicazione tecnologica per l'apprendimento e la formazione in un particolare tipo di gestione e trasferimento della conoscenza. Il cambiamento si realizzerà tuttavia tramite uno sviluppo graduale, poiché la stessa metodologia dell'e-learning dovrà prima essere migliorata.

L'e-learning, semplice immagine elettronica dell'educazione in presenza, verrà in una prima fase sostituita da metodi knowledge based, cioè metodi cognitivi, espressione di un'ontologia basata su mappe di argomenti per la gestione dei contenuti e su formule applicative per la formazione a distanza. Il secondo passo, connesso al cambiamento metodologico, sarà lo sviluppo di un corrispondente tipo di tecnologie per il trasferimento di conoscenza, quali la formazione basata sul web, coadiuvata da sistemi di knowledge brokerage. Al fine di sviluppare ed incrementare le nuove complesse metodologie e tecnologie per l'approccio cognitivo all'e-learning, sono stati già creati ed attivati i cosiddetti networks di competenza. Di recente, singoli networks sono connessi a soluzioni più complesse e configurati con gli ultimi mezzi tecnologici del web. Tipi differenti di networks sono pure collegati in una cooperazione a più livelli che inizia con il livello umano esperto degli insegnanti e dei discenti, passa attraverso il livello del metodo cognitivo per il trasferimento di informazioni e contenuti, ed arriva fino al livello del sistema web-based fornito dalla e-technology.

Lo stato dell'arte e le prospettive per l'approccio cognitivo all'e-learning verranno analizzate, sistematizzate, dimostrate dalle applicazioni sviluppate e incrementate dagli esperti della University of Applied Sciences e della Central German Academy for Further Education di Zwickau, istituti ed esperti già inseriti nella complessa rete di ricerca e business regionale, nazionale ed internazionale dei networks di competenza.