

# TECHNOLOGY ENHANCED LEARNING IN EUROPE'S 21<sup>ST</sup> CENTURY

**Dipl.-Kfm. Guido Grohmann**

**Institute for Information Systems (IWi)  
at the German Research Centre for Artificial Intelligence (DFKI)  
Stuhlsatzenhausweg 3, 66123 Saarbrücken  
Germany  
E-mail: grohmann@iwi.uni-sb.de**

**Dr. Martin Wolpers**

**Learning Lab Lower Saxony (L3S)  
Expo Plaza 1, 30539 Hannover  
Germany  
E-mail: wolpers@learninglab.de**

***Abstract:** Recently companies discover their employees knowledge as one of the major critical resources they need to have for successful business. Advances in technology enhanced learning provide the necessary means by which companies and employers are able to maintain and grow their knowledge assets. This being recognized by the EU several main objectives have been identified and will be tackled in the network of Excellence in Professional Learning proposed in the 6<sup>th</sup> EU framework programme. The objectives are critical for advancing the state-of-the-art and ensuring the European leadership in technology enhanced learning thus will be pursued by integrating European research in the Network of Excellence.*

***Index Terms:** Technology Enhanced Learning, eLearning, Professional Learning, R&D, outreach to industry*

## I. EUROPE'S NEED TO RESTRUCTURE RESEARCH ON TECHNOLOGY ENHANCED LEARNING

The remarkable developments of the still-dawning Internet Age have left an indelible mark on modern business organization. In today's knowledge economy, information and human capability are as much required raw capital resources as land and machinery were during the agricultural and industrial ages. Technology Enhanced Learning and eLearning are the means that enable companies to prepare for and succeed in this challenge by providing their employees with the ability to constantly learn, discover, create, capture and exploit. The best way to successfully move an existing enterprise forward includes continuously creating and sharing new knowledge within

the organization.[1] Thus, at the heart of most innovations lie the two major activities collaboration and learning.

According to recent studies, up to now, the United States can be seen as a trendsetter of how fast eLearning as a new form of education will prevail. US enterprises already invest 20 percent of their budget (13 Billion US-\$ out of 66 Billion US-\$) for professional education in eLearning activities.[2] A similar trend becomes apparent for Europe, too. According to researches of the Gartner Group, the European market of corporate eLearning had a capacity of 829 million \$ in 2001, and it will grow to 7,4 billion \$ till the year 2004.[3]

In spite of the existing need that is shown by these figures, it has repeatedly been reported that the actual impact of R&D on learning technologies remains quite limited, leading to the situation that few R&D results are picked up in actual practice. One of the major reasons for unfortunate situation is that researchers in this field are scattered in isolated communities, with often a very limited awareness of each other. In order to really advance the state-of-the-art and to realize a substantial impact on the practice (especially in corporate settings), research institutions and individual researchers must exchange their results in a more effective and efficient manner – within the R&D community as well as with practitioners in the business world. This is all the more relevant as

Europe has a strong position in R&D in this area, as recognized by the numerous references some of the more successful US based initiatives include to initial European achievements. But this leading position in isolated R&D efforts is not translated in a strong impact on the field in general.

## II. AREAS OF RESEARCH

In order to fully capture the complex field of technology enhanced learning, the domain has to be split up into different working areas. Categorized into seven different areas, research within the next years will focus on:

- **Personalized Adaptive Learning.** Personalization is a key aspect in advanced technology enhanced learning environments to support ubiquitous, experimental and contextualized learning and virtual collaborative learning communities. Learning material of all kinds will be adapted to in order to satisfy the personal needs of the single learner.
- **Interactive Media.** eLearning can provide a much more interactive experience for the professional learner than the traditional book or training lecture. Learning is an interactive and constructive process and therefore has to aim at learning experiences that leverage the learner's interactions.
- **Online Experimentation.** Active working with artefacts and problem solving helps learners to acquire applicable knowledge that can be used in practical situations. Active learning by means of virtual and remote laboratories aims to provide distance education students and professional learners with hands-on experiences in first class experiments without the need to leave their workplace and travel.
- **Learning Objects, Metadata and Standards.** Another focus in research is the notion of reusable multimedia content components, called "learning objects". By developing and employing appropriate standards, the reuse of such components leads to important savings in time and money, and enhances the quality of digital learning experiences.
- **Brokerage Systems and Learning Management.** Today's technology enhanced learning landscape is characterized by a huge number of heterogeneous content and service repositories. The existence of brokers or marketplaces which integrate the existing repositories, thus creating completely new services, will be extremely beneficial for enterprises (especially SMEs) whose success relies on a workforce educated to the best-possible standards.

- **Business Models, Processes, Markets.** As the demand for access to E-Learning services is growing rapidly, it is increasingly important that sustainable business models emerge for market players, such as service providers, users, policy makers and market regulators. Also, the focus will be on reference models for organisations deploying technology enhanced learning. Those models address issues such as corporate learning strategy definitions, requirements analysis, integration processes, financing and allocation of funds (esp. higher education institutions), definition of learning scenarios, knowledge transfer and corporate learning.
- **Knowledge Work Management.** European companies depend more and more on their intellectual properties than on their physical assets, often specializing in knowledge intensive products. Work processes have to be targeted as enablers for professional learning. Also the knowledge community has to aim for learning arrangements taking into account both knowledge workers, organisational processes and appropriate infrastructures.

## III. OBJECTIVES

Activities in technology enhanced learning will consist of a set of 'horizontal' and 'vertical' working areas. The vertical dimension as shown in chapter II will have to advance the scientific understanding of each working area by carrying out research and development. By complementing the vertical dimension, the horizontal dimension has to support collaboration, exploitation, and dissemination of research results with and into corporate and educational institutions. The need for integration of research efforts within research and towards practice can be summarized under the three dimensions scientific, technical, and socio-economic objectives.

### A. Scientific Objectives

- **Objectives for Applied vs. Theoretical Science.** As it is essential in this field, the vertical working areas embody a mix of applied and theoretical science. For example, one of the theoretical scientific objective will be the development of new pedagogical models for e-Learning and mobile learning. However, this theoretical work must be implemented via a significant applied scientific advance in the interoperability and modularity of learning management systems together with a simplification of the authoring process.
- **Objectives for Technical vs. Social Science.** Alongside technological scientific advances, critical social and pedagogical approaches will also be emphasized. None of the technologically

focused work can advance the state of European science without a full understanding of the social and pedagogical context of its application.

- **Objectives for Public vs. Academy Science.** Scientific research results will have a major impact on society changing the way education will be carried out, thus are of significant public interest and will also have to be considered (e.g. the impact of electronic and mobile learning on society resp. specific target groups with different needs).

#### B. Technical Objectives

Research in the next years will improve access to knowledge and educational resources (including cultural and scientific collections) and generate new forms of cultural and learning experiences. The following technical issues will have to be addressed:

- The R&D on personalized adaptive learning, brokerage systems and learning management will contribute to the development of personalized adaptive systems and services for contextualized learning. Furthermore new systems for "learning" marketplaces will emerge enabling a simple and successful "trading" of learning material and services.
- Equally important is the application of knowledge-based approaches to realize the adaptation of the learning process to the end user. The main idea here is to enable different ways to "mine" the learning object space for those resources that are relevant to a particular user.
- The R&D on interactive media and educational laboratories will facilitate the development of rich content that will truly engage the learner and will support him in linking his conceptual models with realistic phenomena. True interactivity with real and simulated (virtual) feedback will provide realistic learning situations for learners.
- Through initiatives such as ARIADNE foundation [4] and others the development of an open learning object infrastructure will be extended. By actively participating in standardization committees at DIN, IEEE and ACM the European point of view will be significantly promoted.
- The notion of semantic interoperability between learning objects, repositories of such objects, the services, and the underlying technologies will allow for hybrid architectures to integrate more traditional client-server approaches in more novel and flexible paradigms that rely on advanced technologies like semantic web technologies and peer-to-peer. The emerging web services approach will be relied upon to reach this goal.

#### C. Socio-economic objectives

The rapid development in ICT is having a fundamental impact on employment, skills, work patterns and company structures within Europe. The field of technology enhanced learning is contributing to strengthen the investment in human capital by providing access to learning resources and services more cost effectively, efficiently and conveniently to individuals and companies. Workers and employees of enterprises and public organisations are considered the main user groups and also the final beneficiaries. This covers a large group of citizens at various stages of their lives.

For the European economy to be successful, the workforce must actively participate in life-long learning, the employees need to keep personal development plans because the needs are constantly changing and the employees need to be even increasingly multi-skilled. At the Lisbon European Council (March 2000), the EU strategy was designed to enable the European Union to regain the conditions for full employment and to strengthen cohesion by 2010. In order to contribute to the employability and adaptability objectives under the European Employment Strategy [5], research institutions will have to focus on new developments that rectify the shortage of skills associated with the new technologies and improve social inclusion.

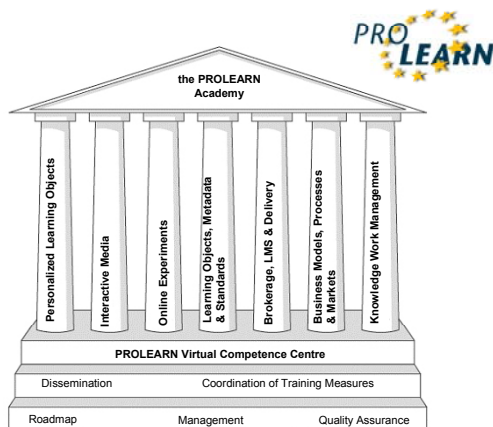
Current EC policy documents emphasize the danger of division of the Information Society in the information-rich and the information-poor citizens, also referred to as the „Digital Divide“. Availability of appropriate training for everyone helps to promote digital literacy and to overcome the risks of a societal splitting. The objectives of the various research activities are aiming at finding new solutions to the needs of all corporate workers and employing companies, not only the digital literate ones. The area of personalized adaptive learning for example is focusing on the different aspects on how to provide the right tools for the specific users.

#### IV. PROLEARN: A EUROPEAN APPROACH FOR INTEGRATION

Within the first Call of the European Sixth Framework Program the Learning Lab Lower Saxony (L3S) and the Institute for Information Systems (IW<sub>i</sub>) at the German Research Centre for Artificial Intelligence (DFKI) have proposed a Network of Excellence (NoE) for the integration of R&D and practice in Technology Enhanced Learning. The proposed network "Professional Learning" (PROLEARN) focuses on two key issues for future eLearning scenarios and contexts, namely state of the art technology enhanced learning resources and the use of these learning resources for professional training in SMEs and larger

companies. The network will advance the state of the art in learning resources in the key areas personalized adaptive learning and interactive media, with learning resources connected to real-world settings and reusable in different contexts. Furthermore, it will investigate and advance issues especially relevant for professional training in enterprises, including brokerage platforms and services, business models for specific markets, and advanced eLearning and knowledge work management arrangements.

To accomplish these goals, PROLEARN brings together the most important research groups in the aforementioned areas, as well as key organisations and users, thus bridging the currently existing gap between research and education at universities and similar organisations and training and continuous education that is provided for and within companies. Through the PROLEARN awards, best practice examples, show cases and workshops the network will advance European professional training in technology enhanced environments, and through roadmaps and policy guides it will chart and analyze future trends relevant for future professional training tools, environments and scenarios.



**Figure 1: Network of Excellence Professional Learning**

PROLEARN has set up a ‘Joint Programme of Activities’ that focuses on large scale research cooperation and coordination in the context of a PROLEARN ‘Academy’, setting up a virtual research center comprising all consortium members, as well as on exchange and transfer activities especially with industrial partners in the context of a PROLEARN Competence Centre. It will integrate existing and future activities of the NoE partners, and ensure the critical mass necessary for mutual complementary exchange of technologies, tools, experiences, and scenarios.

## V. CONCLUSION

As mentioned above the “Lisbon goal” of the European Commission for the next years is to become the most competitive and dynamic knowledge-driven economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion.[6] By means of various initiatives such as eEurope and eLearning [7] the European policy makers defined a number of strategic actions that are necessary to reach the challenging goal. One of the main Community levers for the implementation of the eLearning Action Plan is the IST program.

Apart from clear compliance with the IST strategic objective of “Technology enhanced Learning” PROLEARN is also very much in line with the EC policies and is contributing to the implementation of the eLearning initiative and thus in the broader context also to the eEurope initiative. The eLearning initiative, which was presented by the EC on March 2001 developed an action plan that clearly places emphasis on the deployment of content, services and learning environments which are sufficiently advanced and relevant to education in terms of both market and public sphere.

Summarizing the objectives in chapter III it can be concluded that the PROLEARN Network of Excellence will be actively contributing to the implementation of the goals of the Copenhagen Declaration adopted by the education Ministers of 31 European countries and the EC in November 2002.[8] The declaration has been developed within the perspective of lifelong learning and focuses on the design of common European tools to support the use of vocational training opportunities. Vocational training at the workplace, which has to be tackled by the research community, is one important aspect in the Bruges-Copenhagen process.

## REFERENCES

- [1] Schaffer, C.; Funk, K.; Cothrel, J.: Learning to Innovate, working paper of Cap Gemini Ernst & Young, Cambridge 2002, p. 1.
- [2] Corporate University Exchange 2000, <URL: <http://www.corpu.com>>, online: 14.05.2003.
- [3] Scierter, Bologna 2001, <URL: <http://www.scierter.org>>, online: 14.05.2003.
- [4] Ariadne is a European Association for knowledge sharing and reuse, eLearning, and international cooperation in teaching, <URL: <http://www.ariadne-eu.org>>, online: 14.05.2003.
- [5] European Council (ed.): Presidency Conclusions: Lisbon European Council, 23-24 March 2000, <URL: <http://europa.eu.int/ISPO/docs/services/>>

docs/2000/jan-march/doc\_00\_8\_en.html>,  
online: 14.5.2003.

- [6] The European Commission: eLearning, <URL: [http://europa.eu.int/comm/education/elearning/doc\\_en.html](http://europa.eu.int/comm/education/elearning/doc_en.html)>, online: 14.05.2003.
- [7] The European Commission: Enhanced European cooperation in vocational education and training - the "Bruges-Copenhagen process", <URL: [http://europa.eu.int/comm/education/copenhagen/index\\_en.html](http://europa.eu.int/comm/education/copenhagen/index_en.html)>, online: 14.05.2003.

#### BIOGRAPHY



**Dipl.-Kfm. Guido Grohmann**

works as a research assistant and PhD candidate at the Institute for Information Systems (IWIS) at the German Research Center for Artificial Intelligence (DFKI) in Saarbrücken, Germany. His scope of research activities concentrate on eLearning and collaborative and mobile business, especially within the research project "Education Network WINFO*Line*" which is sponsored by the German ministry for Education and Research (BMBWF).



**Dr.-Ing. Martin Wolpers**

has been a researcher at the L3S since 2001 after receiving his PhD from the department of electrical engineering of the University of Hannover. His current research interests focus on peer-to-peer networks, information systems, semantic web, adaptive hypermedia systems and knowledge management. Furthermore he is the project manager of the international WGLN project "Personalized Access to Distributed Learning Repositories".