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Microlearning: Emerging Concepts, Practices and Technologies after e-Learning.

Proceedings of Microlearning 2005.
Learning & Working in New Media

Book Editors:
Theo Hug, Martin Lindner, Peter A. Bruck

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Media Research and Instructional Design at the University of Innsbruck (Forword)

Tilmann Märk

University of Innsbruck (Austria)
Vice-Rector for Research

Having been asked by the organizers of this conference it is with great pleasure that we provide this foreword for the Proceedings of the International Conference "Microlearning2005. Learning & Working In New Media Environments". Our special thanks go to Prof. Peter Bruck, the head of the ARC Research Studios Austria, and Prof. Theo Hug, Associate Professor of Educational Sciences at Leopold Franzens University Innsbruck (LFUI) ARC Research Studio "eLearning Environments", for bringing this important international conference to Innsbruck. We take this as a very positive sign for the work performed at the LFUI the past years.

The conference was organized in cooperation with our Institute of Educational Sciences. This is only one example of the collaboration between the Austrian Research Studios and the Leopold Franzens University of Innsbruck (LFUI), which has already generated innovative and competitive research results, which have had an impact on the national and international scientific community. The main goal of this collaboration is a close relationship between academic research and R&D that will lead to the development of products and services in the field of e-technologies, smart contents and new media.

The ARC Research Studio "eLearning Environments" , co-funded by the Tyrolean Future Foundation, is an important research unit for the LFUI in terms of generating new knowledge in the field of microlearning. This studio is part of a broader interdisciplinary research effort within a network to be founded called "Innsbruck Media Studies (IMS)". Prof. Theo Hug was essential in initiating and coordinating this LFUI based network. This future center of excellence has the aim to increase competences in the field of new media at all levels at the LFUI, including our research and teaching activities.

We believe that excellent education needs to be based on excellent research, thus one of our goals is to promote excellent research at our university. Universities worldwide

have a leading role in new research fields, and one of it is definitely in the field of eLearning and eScience. As the Vice Rector for Research I want to highlight some of the developments which are presently taking place at the LFUI in this field of eLearning and eScience.

In the last few years, at the LFUIs a number of media related research projects have been carried out. The research subjects covered include various aspects of

- media communication,
- media aesthetics,
- media critics,
- research methods which are supported by IT,
- questions of knowledge generation,
- new learning methods in the field of information and communication technologies as well as the design of geographical information systems,
- semantic web topics and
- quality engineering processes.

Moreover, it is interesting to note, that in summer 2004 the first ever "media day" took place at the LFUI summarizing and presenting all of those activities taking place in the media-related research fields. The significance and potential of the field of media research became apparent during this meeting. A decision was made to establish an integrated research field including a number of faculties. This new interdisciplinary research field called "Innsbruck Media Studies (IMS)" consists of partners from 11 different faculties with numerous research projects. This new interdisciplinary research field "Innsbruck Media Studies" can be divided into three main fields, that is,

- media and culture (e.g. literature and media, chat-communication, media and violence, learning cultures)
- media and society (e.g. political communication, e-tourism and e-commerce)
- media and technology (e.g. semantic web, tools for content analysis)

In addition to that, several projects in the field of media didactics and higher education are carried out (e.g. civil.law.online and civil.law.onlearn, "Basic Support for Educational Studies and Research" (BASES)) and you can find quite a few professional LFUI based archives online (e.g. Innsbruck Newspaper Archive, Documentation of Integration of Disabled, a huge database of historical pictures).

The IMS is focusing on the already existing strengths in the various fields, partial integration as well as theme- and problem-oriented cooperation. The heterogeneity of the different approaches is providing good opportunities for future oriented research performances.

A few of the goals of the Innsbruck Media Studies are the following:

- internal and external networking of media related research
- development and promotion of promising cooperations
- positioning of the LFUI in the media- and knowledge based society
- testing of new media related applications
- acquisition of third party funds
- support of media-related developments in the teaching field (eLearning, eTeaching)
- design of new curricula, programs, degrees and didactics (and therefore improving the occupational outlook for graduates)

To reach these goals the staff members of this network are collaborating with colleagues from all over the world. Among the partners and networks there are MediaWatch – Institute for Media analysis (Innsbruck); Digital Enterprise Research Institute (DERI) and it's partners: W3C, BIT, National University of Galway, FFG, Information Society Technologies, Tyrolean Future foundation; eTourism Competence Center Austria (ECCA) ; EC3 – E-Commerce Competence Center, Wien; Global Media Research Network (GMRN) ; Europaen Fund for regional development: INTERREG IIIA Austria – Italien; International Research group "Film and Theology"; Webplattform math online: Franz Embacher, Petra Oberhuemer (Vienna); and last but not least the Research Studios Austria (RSA) of the ARC – Seibersdorf research GmbH, Research Studio eLearning Environments (in cooperation with the transIT and Tyrolean Future Foundation).

So far I have mentioned our activities in terms of research. In concluding I would like to mention that also accomplishments in the field of "teaching" are already existing at the LFUI, as well as future plans have been established. A proposal for the development of new e-learning/e-teaching strategies at the University of Innsbruck has been submitted to the ministry of education, science and culture and has been recently approved. The use and integration of an e-learning system in the lectures and programs at the LFUI are of major importance. They will be integrated in the target agreements between the faculties and the rector and will be also incorporated in the development plan with the ministry.

The e-blackboard system (eCampus) is already used by all faculties at our university. At some faculties (biology, chemistry/pharmacy, engineering, faculty of education) over 60% of the lecture courses and seminars are supported by the blackboard system eCampus, and this number is still rising. Production of high quality e-learning materials is also an issue. Several study programs have decided to teach certain courses as distance courses or blended learning courses. A time schedule has been worked out to dis-

seminate the use of learning technologies as well as improve e-learning strategies at the university. The reason for the intensified implementation is to generate qualitative and didactical improvements for the future student generation.

Thus, the LFUI is giving a high priority not only to the field of ICT, but also on new concepts of technology-enhanced education and research on new media in general. In concluding, the Proceedings of the International Microlearning 2005 Conference impressively show that in the future unique and inspiring perspectives and ideas will come from activities bridging the borders between academia, technology and economy.

Innsbruck, October 2005

Tilmann Märk, Vicerector for Research, LFUI
Gerlinde Braumiller, Assistant to Vicerector for Research, LFUI

Micro-Learning in the Lifelong Learning Context (Forword)

Lynne Chisholm

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Institute Director, Professor

We have reached the stage at which e-learning is virtually synonymous with learning technology. In the rapidly expanding field of e-Learning, micro-learning is a new arrival on the scene. It responds to the urgent need to pay greater attention to e-learning tools and methods from an educational and not simply a technological point of view. Learning technologies as such are by no means a new invention – they reach back to the age-old chalk slate and beyond – but their effectiveness depends on the way in which they are embedded in the social construction of teaching and learning relations and processes. The more powerful and pervasive the learning technology, the more crucial and complex will be the pedagogic strategies and didactic methods devised and employed for and with that technology.

The pervasiveness of digital communication technologies in everyday life is indisputable, and is by no means limited to the advanced economies. Indeed, one of the most remarkable features of their take-up is the extent to which developing and 'tiger' regions have adopted, for example, the Internet and mobile telephones. The Web is already a core relay for learning programmes in Latin America, where there is a longstanding distance learning tradition using radio and television. The Philippines have the highest SMS usage rate in the world – an intriguing phenomenon, which reflects the intersections between a highly communicative culture, a history of emigrant labour, an island archipelago geography and, not least, the need to keep telephone costs down to a level that ordinary citizens with low average incomes can afford.

Such examples illustrate that cultures do not simply adopt technologies, they equally adapt them to suit their own needs and ways of life. This tells us something important about developing effective learning technologies: pedagogy and didactics must relate appropriately to the cultural, economic and social contexts and conditions of people's lives. This is clearly one of the key challenges for micro-learning, which seeks, in a variety of ways, to integrate learning into everyday life. One obvious consequence is that this situates the micro-learning agenda in proximity to that of non-formal and informal learning, a theme that has also seen a meteoric rise to the top of European education and training policy concerns in the past few

years. This has taken place in the context of identifying lifelong learning as the overarching paradigm for teaching, training and learning in knowledge societies, in the interests of not only employability but equally social cohesion, active citizenship and personal development in a democratic polity.

These may be fine words in principle, but turning them into positive practice means a great deal of hard work in research and development terms. This collection illustrates how some of that work is taking place – some examples are well developed, others are just starting out. And no collection of this kind would be complete without visionary accounts of what the future may hold. The combined outcome is stimulating and will generate readers' excitement about the potential of micro-learning. At the same time, it is all too easy to forget that e-learning innovations also generate new polarisations in learning opportunities and life chances: people need to be digitally literate in order to access digital learning tools, and they cannot participate in e-societies and e-cultures unless they have access to and know how to use digital information and communication channels.

It is still the case that the majority of today's Europeans – let alone those living in less developed world regions – do not possess basic digital literacy skills, and there remain significant social and regional differences in pure and simple access to the technological hardware. And even where citizens do largely use relevant tools – such as mobile telephones – levels of competence to exploit their potential are generally low. Those with low levels of education, those in low-level jobs, older citizens and those living in more isolated areas are especially likely to be 'digitally disadvantaged', and there is a striking digital gap between the north and the south of Europe in these respects. Given the combination between demographic transition to ageing European societies, structural change in the labour market towards higher-level skill and competence requirements, and cultural change towards a learning society as the basis for inclusion and participation of all kinds, it is abundantly evident that dismantling the digital divide is and will remain one of the most significant educational challenges for the coming decades.

Micro-learning can contribute to meeting that challenge, and in doing so it must invest ingenuity to design low-threshold tools and methods that can engage learners with low levels of basic skills – both traditional and digital – in ways that attract and encourage them, in ways that are relevant to their everyday lives and in ways that provide rapid, visible affirmation and recognition of what they have learned.

The Institute of Educational Sciences at the Leopold-Franzens-University of Innsbruck is delighted to have been associated with the conference that gave rise to this collection, and regards e-learning research as an important element of its academic profile within the newly-founded Education, Generation and Life-course Research Group. We look forward to continuing the positive co-operation with the e-Learning Research Studio that has been established in the context of this conference.

Microlearning: A New Pedagogical Challenge (Introductory Note)

Theo Hug

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Professor
RSA Studio eLearning Environments (Innsbruck, Austria)
Manager

The papers in this volume emerge from the conference *Microlearning2005 :: Learning & Working in New Media Environments,* held on June 23 - 24, 2005 in Innsbruck (Austria). This first international conference on microlearning was organized by the Research Studio eLearning Environments[1] in cooperation with the Institute of Educational Sciences at the University of Innsbruck. The conference aimed at creating a transdisciplinary, but clearly focused forum for exciting discussions between scholars and experts from quite different fields, like didactics and learning technology, academia and corporate training, instruction design, semantic metaweb technologies and studies in new media cultures. Academic perspectives on learning and pedagogy met market-oriented R&D approaches, heading for new concepts and applications. Both, contributors and participants accepted the invitation to build bridges, to bring forward cross-over orientations and to promote collaborations beyond common borders.[2]

So, what is it all about? What do "microlearning" and "microcontent" mean?

Looking at some spontaneous appraisals, there are optimistic and sceptical voices. When I spoke to some colleagues and e-learning experts last year, one said: "It's too late for microlearning, you should think of something new – we have had microteaching since the late 60ies." For those, who are not familiar with concepts of "microteaching" – it is a training concept that can be applied in various stages in the profes-

1 The Research Studio eLearning Environments is one of currently five studios of the Research Studios Austria. Its projects are supported by the Federal Ministry of Economy and Employment (Austria) and also the Tyrolean Future Foundation (http://ele.researchstudio.at). The Research Studios Austria are a sub-division of ARC Seibersdorf research GmbH, Austria's largest research institution for industrial research and development (http://www.researchstudio.at).

2 For further information and an online version of the proceedings see http://www.microlearning.org.

sional development of teachers. Basically, it means teaching a small group of peers for a relatively short period of 5 to 15 minutes and then giving and taking feedback on the performances. Microlearning in this context means the microteaching experience as a learning experience and a very effective method of learning for students, but also the counterpart process on the side of the pupils. Of course, there are more precise definitions and you can find many books on teacher training concepts in terms of microteaching. In my view, we can learn a lot from the experiences related to this field, but it would be a big mistake to reduce the question of microlearning to the questions of formal education, teacher training or pedagogical discourse horizons.

Another colleague said: "It's too late for a conference of this format because economy has not only gained the precedence over politics but also over education and research. The only areas that are still researched and taught are those that can be used commercially. As a consequence, a conference like this would have to be aimed directly and strictly at economy and the current market in order to be successful." And a third one thought that it would be too early, because the new forms of microlearning are just evolving and we would have to focus on a few very special learning cultures in order to say something serious about the topic.

Well, in whatever way one sees the thesis of the commercialization of knowledge and the maybe pre-paradigmatic situation: I believe that the present moment is most appropriate for the conference and the questions of microlearning, microcontent and microknowledge.

It's not a well designed paradigm we have as a starting point – it's rather bits and pieces from different discourses and practices we are starting from. Therefore, the conference has a semi-structured and hopefully exhilarating character. We are going to explore the field, figure out crucial topics, present work in progress and sound out the situation and perspectives of learning and living in mediated environments. The discourse backgrounds may refer to

- the process of medialization, mediation, transformation and order of knowledge (especially questions of fragmentation of knowledge, bricolage and micro-aspects of meaning and sensemaking)
- the relation of changing media and changing learning cultures
- the relation of new media and new markets
- challenges in the context of Lifelong Learning and e-inclusion policy
- anthropological dimensions (homo medialis) and the epistemological question of a "mediatic turn" (R. Margreiter) [1]
- and to other aspects and related dimensions.

Let's have a look at the microlearning discourse as it is represented currently. If you start a search, you'll find quite a lot of concepts and versions of microlearning. Here are some selected examples:

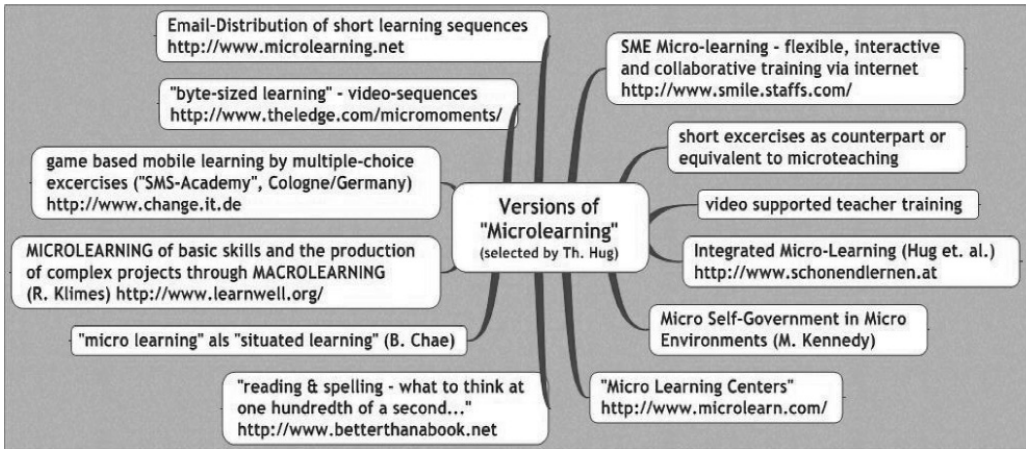

Fig. 1: Concepts and Versions of Microlearning – Mindmap

There is not one precise definition which covers all the different concepts. In my view there are versions which are brought forth by different interpretations of particular dimensions such as:

- *Time:* relatively short effort, operating expense, degree of time consumption, measurable time, subjective time, etc.
- *Content:* small or very small units, narrow topics, rather simplex issues, etc.
- Curriculum: part of curricular setting, parts of modules, elements of informal learning, etc.
- *Form:* fragments, facets, episodes, „knowledge nuggets", skill elements, etc.
- Process: separate, concomitant or actual, situated or integrated activities, iterative method, attention management, awareness (getting into or being in a process), etc.
- *Mediality:* face-to-face, mono-media vs. multi-media, (inter-)mediated, information objects or learning objects, symbolic value, cultural capital, etc.
- *Learning type:* repetitive, activist, reflective, pragmatist, conceptionalist, constructivist, connectivist, behaviourist, learning by example, task or exercise, goal- or problem-oriented, „along the way", action learning, classroom learning, corporate learning, conscious vs. unconscious, etc.

The various versions of microlearning can be analyzed by looking at the explicit or implicit comprehension of these dimensions and their interplay. This preliminary framework makes clear that the general term microlearning is used as a metaphor referring to a set of models of learning.
In addition to that, all these versions correspond with certain versions of meso-learning and macro-learning. For example, if single letters are part of the micro level, words and sentences may refer to the meso level and linguistic communication to the macro level. If the micro level is characterized by vocables and phrases, situations and episodes may refer to the meso level and socio-cultural specifics and complex semantics to the macro level.
It is similar with the term 'microcontent': It can refer, for example, to small, granular pieces of content, to simplex semantic units or to small-sized semiotic entities.
What are the challenges for pedagogy and educational sciences?

Let me give you a few examples:
- Developing a generational awareness with regard to new media cultures, technologies, and forms of knowledge and learning
- Investigating the interplay of symbolic and techno-material aspects of media in processes of learning, education and socialization
- Developing concepts and methods for the future of learning by integrating formal, non-formal and informal aspects and micro-, meso- and macro-levels
- Creating learning spaces in relation to cultural, historical, commercial, technological, networked and ludic spaces
- Rethinking knowledge and learning in the context of mobile devices, new global public spheres (I. Volkmer) [2] and metaweb developments (N. Spivack) [3].

Needless to say, that this selection of challenges is strongly related to societal and technological dynamics and that you will encounter more challenges when reading the papers in this volume.

Digital technologies and media institutions have transformed knowledge structures as well as processes of knowledge distribution and knowledge acquisition. In this situation, we have to rethink classical models of distributing learning and to investigate new learning spaces. Concepts of microlearning, microcontent and microknowledge offer flexible and dynamic alternatives which are needed in view of medial, societal and environmental changes. The following articles present a wide range of theoretical and practical options focussing on learning theories for the digital age, pedagogical learning and teaching models, approaches to learning with microcontent, frameworks for small learning groups, mobile learning environments, questions of interaction design, web-

based metadata repositories, and on rather new developments such as RSS feeds, Blogs and Podcasts.

Obviously, proceedings like these and also the conference on microlearning are products of many people working together. My sincere thanks go to

- the conference preparation-crew that has taken many hours to contact the presenters, prepare the programme, flyers and posters, the website, the organisation of the rooms etc., namely Martin Lindner, Silvia Gstrein, Christian Bablick, Claudia Kirchmair, Eric-Jan Kaak, Manuala Ruzicka, and the helpers from the International Centre for New Media (ICNM) in Salzburg (Austria)
- the speakers and presenters who have in some cases travelled far and who brought in their skills and contributed to animated discussions and learning processes and also to this volume
- again, Martin Lindner, for proof-reading, and Carmen Drolshagen for the print layout of the proceedings
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[1] Cf. Margreiter, Reinhard (1999): Realität und Medialität. Zur Philosophie des 'Medial Turn'. In: Medien Journal. Zeitschrift für Kommunikationskultur, Jg. 23, H. 1, pp. 9 – 18.

[2] Cf. Volkmer, Ingrid (2003): The Global Network Society and the Global Public Sphere. In: Development, Vol. 46; Part 1, pp. 9-16.

[3] Cf. http://novaspivack.typepad.com/nova_spivacks_weblog/the_metaweb/index.html; consulted: 2005-06-20.

Microlearning as strategic research field: An invitation to collobarate (Introductory Note)

Peter A. Bruck

Research Studios Austria (Salzburg/Vienna)
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Trading routine labour for freedom of flexible work: The need and pressure to learn

In today's working environments individuals are constantly challenged to learn, respond to new situations and meet new demands. In industry, small and medium sized businesses as well as public administrations, new information needs to be continuously acquired.

In the past, in both agricultural as well as industrial society people had to engage in lots of repetitive work. In the emerging information society all work which is performed according to specifiable routines is being bit by bit automated. Individuals are thus set free to do work which is "more interesting", i.e. which demands flexibility and still defies machine intelligence. For this they have to learn.

The need to act flexibly and to change and improve work as well as other purposeful activities implies a continuous necessity to learn. The adage that learning has become life long is a basic truism of the information society. It is the result of the victories of human invention in automating more and more routines. While liberating people from much toil, this generates also pressures for individuals to acquire multiple skills in how to learn.

The information society is the result of humankind's success in reducing ignorance and overcoming lacks of information. As the amount of information available increases, it has become a major field of human research and endeavour to master its use and acquisition.

Flipping from scarcity into abundance: Information richness and overload

The beginning of the information society thus also marks the end of two key features of human history: the fact that information was scarce and that communication was difficult has structured all past civilisations and given shape to systems of belief, has shaped the behaviour of peoples and their social organisations and has decided over the rise and fall of empires.

Today, we are part of a social transformation in which information has become abundant and communication is global. Both are more and more instantaneous, or 7/24, as it is called in the jargon of today's markets.

The increase in the pace of performance of information and communication technologies is continuing to accelerate. At the time of this writing, the Internet is less than 15 years old as a common medium of information presentation and communication exchange, but it has irreversibly penetrated all aspects of social and economic life in all developed countries.

The flip from information scarcity into information abundance is one of the main factors making learning an integral part of everyday activities. To be confronted with new information is part of the normalcy of life today.

An alternative to mega-information and macro-learning: Taking small steps

The need to improve on learning has thus become the key to coping and taking advantage of the opportunities present society offers.

Your are holding in your hands the proceedings of the first international conference "MICROLEARNING 2005" organised by the Research Studios Austria together with the University of Innsbruck. This conference was designed to deal with a quite new and maybe even alternative approach to coping with the above described phenomena and specifically with the ways of dealing with information abundance and the constant need to learn. Its basic premise is that people can learn better, more effectively and in an easier, more enjoyable manner if information is broken down into smaller units and if learning takes the shape of small steps.

Three aspects characterise this shift to microlearning:

1. The first aspect is to reduce the overflow and complexity of information and structure it into sequences and strings, into small and well linked units; this requires creating new architectures of information and makes an active engagement with the design of information necessary.
2. The second aspect is to undertake this reduction from the perspective of the person who needs to cope with big amounts of new information and who wants to learn; this requires new didactic models and makes inquiries into and redesign of learning processes necessary.
3. The third aspect is to allow individual learners to chose themselves time, place and pace of learning; this requires technology to support learners in their individual habits and needs and to offer personalised services, and it makes reducing the experience of overload, overdemand and underperformance necessary.

Microlearning thus uses continuous improvements in I&C technology performance. The constantly decreasing cost of technology increases the affordability of microlearning over all different platforms including mobiles. It assists organisations and individuals in dealing with the pressing issues of overflow of information and with the rapid pace of changes which require the absorption of new information.

The move to microlearning is also motivated by taking recent experiences with normal e-learning serious which show that individuals use available systems much less than expected. "Normal" e-learning does not seem to meet the demands of many people and organisations for continued learning. In organisations, the tracking of learning progress and the assurance of information reception quality together with consistency of understanding are also becoming increasingly critical issues.

Hard to get and difficult to manage: Creating time is critical for learning

Microlearning is also offering an answer to another of the key issues affecting learning: time. Having or making time is becoming one the most critical elements for learning and knowledge acquisition. Managing time productively is a key success factor and qualification for individuals and organisations. The failure to "make time" for learning is one of the most common reasons why learners do not succeed to meet their own expectations and to realise the goals which they set themselves or which are set for them by the organisations they work in. "Lack of time" often results in a strong

sense of frustration on the personal side and a continuous missing of targets in organisational development. The quality of an organisation as a successful learning group is the result of the individual's ability to "create time" for learning.

Microlearning allows a different way of handling time. Instead of delaying learning, it is done in small steps which take little time. Microlearning does not require the creation of a larger "time-space". It is enough to use the inter-spaces between different activities to take the small learning step. The power of microlearning results from the repeated use of "inter-spaces" over time. The assumption is that this allows individuals to manage their information acquisition and thus to meet their personal goals and those of the organisation they work in.

Microlearning as strategic research field: An invitation to collaborate

The conference "MICROLEARNING 2005" has allowed for presentation of investigations and conclusions and open discussion of new and alternative approaches where information is not "too big" and learning materials are not "too distant".

The Research Studios Austria want to work with scholars, researchers and practitioners who are interested in microlearning and micro-information.

We are interested in research on individual user's specific needs, experience patterns and situational perspectives to change the top-down "delivery" of info content and learning matter. We want to exchange views and share experiences with people who design micro-content environments for learning and information acquisition that use new ways of content distribution and cooperation. We want to understand how users can immerse themselves in a "learning flow" which accompanies other activities but sustains the acquisition of information and assists in applying information in work and other social activities. We want to better understand the motivational factors of learners and how to integrate information acquisition and learning for organisations into the ongoing flow of daily activities. And we want to see if one can demonstrate significant improvements in the speed and quality of, for instance, second language acquisition or professional-technical news-retention when using a micro-learning approach.

"MICROLEARNING 2005" is a start for the Research Studios Austria to network with scholars, researchers and practitioners from around the world on all issues relating to the issues and topics mentioned above. It will be an annual event for the foreseeable

future and I wish to extend an invitation to each and every reader of this publication to contribute and partake in the next and upcoming meeting.

Please respond and send us your input and suggestions, submit your papers and your research!

The website of www.microlearning.org is offered as a platform for staying in touch, exchanging research and preparing the next conference.

Thank you for your interest in collaborating!

Salzburg, September 2005

Prof. Dr. Peter A. Bruck
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Head of Division, ARC Seibersdorf research GmbH
www.researchstudio.at I www.arcs.ac.at

Quo Vadis, eLearning? (Introductory Note)

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Professor of Computer Science
Fraunhofer Institute for Integrated Publication and Information Systems / IPSI (Germany)
Director Emeritus

Martin Lindner
Research Studios Austria (Innsbruck)

Learning and Technology: Broken Promises

"People will believe anything if it's fantastic enough."
Petronius, in the film Quo Vadis (1951)

Welcome to the Cemetary of Learning Technologies and Promises: In the last century every new media technology promised to revolutionize our learning. Radio, Video, TV, Language Labs, CBT … In general, all those visions failed. And there was always one main reason: too simple a concept of "learning and technology".
Learning is not just sending messages with the help of advanced media technologies. Learning is a complex cognitive and social process. New forms of learning cannot be introduced just by the distribution of new technology. They have to develop organically out of media practices and media environments.
And not to forget: learning is always hard labour. There is no easy way to learn, despite the promises of new media and new utilizations.
So what about this conference? If Microlearning[1] is to mean more than just another buzzword, it has to be checked against the lessons learned in over 40 years of e-learning.

1 http://www.microlearning.org

Claimed Potentials of eLearning

What can technological enhanced learning do that conventional learning can not? The promises have always been similar: to be always accessible (anytime, anywhere …); to be more learner-centered (personalized, more individual choice); to save costs (fewer classrooms, fewer teachers); to increase quality by enabling wider access to knowledge and expertise; to increase effectiveness through better motivation and understanding.
Now we know that eLearning kept – in parts – its first promise, at least technically, since it is more and more based on the web. But the other claimed potentials are still far from being realized. And it is not even clear if some ever will: e.g. costs are not so much saved as transferred to other areas.
Up to this day, eLearning has not exactly been a success story. But on the other side, that is not the real point. There is no way back. In today's digital media environment there is no choice. People must learn, and because digital media have become ubiquitous, they must learn using digital media.

Challenges for eLearning and Microlearning

Microlearning is one of a number new concepts that aim at a new level of integration of learning with the rapidly emerging digital technologies and media practices. The real challenges for all new approaches to eLearning are basically known for a long time:

- Interaction that goes beyond "go to the next step";
- Personalization that is not hampered by predefined standards and methods;
- Integration of feedback/support into complex learning processes whose character is still not sufficiently understood;
- Social embedding of individual learning aspects into collaborative contexts and team processes;
- Flexible reuse of content, which is up to now restricted through monolithic,not sufficiently adaptable material;

And last not least the integration of eLearning into organizations: There are in many cases still incompatible organizational structures and little managerial acceptance of digital learning as a fundamental part of flexible and innovative organizations.

Current Trends in Lifelong Learning

Currently I see four main trends of Next Generation eLearning: Multimedia Learning, Cooperative Learning, Tutor-based Telelearning, Ubiquitous/Mobile Learning. Microlearning, introduced by this conference, is another, quite new one. So a look at its relations to the other four trends should be interesting.

Multimedia Learning: Driven by permanent technological improvements, the trend towards multimedia in learning is unbroken. The effects will be "multi" in different respects:

- multi-modal, addressing different senses and preferences of the learner;
- multi-layered codes, building on different media channels (textual, visual, audio, audiovisual), to create richer meaning;
- multi-perspective, enabled by dynamic metadata and learner models and personalized and experience-based content offered.

The crucial question for Microlearning is on how it will fit here: "Micro" in time and "micro" in the amount of information may mean a reduced level of multimedia richness. How can it still reflect a rich media environment?

Cooperative Learning: Another trend surely goes away from isolated learning experiences, towards cooperative learning in small groups, forming ad-hoc or long-term collaborations, and thus to new forms of digital mentoring, tutoring and teaching. One example is the Virtual Classroom project, developed by Fraunhofer IPSI (www.ipsi.fraunhofer.de). Again, at first glance, it seems to be difficult to integrate the Microlearning approach here. Obviously, one possibility is the integration of Microlearning into Blended Learning scenarios. Another, more challenging approach would be to experiment with new ways of "micro-collaboration".

Telelearning and Microlearning have in common the problem of deciding between pull- or push-approaches. A "micro-pull" would be too tiring: people will not want to decide all the time to take a microlearning step or not. But "micro-push" can easily be experienced as too intrusive, as the intervention of some mysterious "big brother"-like machinery. Finally, the close relation of microlearning and *forms of ubiquitous / mobile learning* is obvious: smart/small micro-units could well be delivered platform-independent through mobile devices. What needs to be discussed here is the interre-

lationship of the microlearning approach and the more technology-centered concepts of "mobile learning" or the still to come "pervasive learning". In what respects could microlearning be more than that?

Quo Vadis?

It seems that Microlearning is not a new technological or pedagogical concept in the first place, but a whole new perspective on Next Generation eLearning. The question arises: How can complex learning processes be put together and then held together, if they consist of large numbers of micro-steps, experienced not in a special "time for learning" setting, but along the routine activities of everyday digital life? Many will be skeptical about this. But again, as with eLearning itself, it can be argued that there is no choice: In today's digital media environment informations and knowledge already have started to become more and more fragmentized. People must learn, and in multitasking and micromedia environments that means that in some way or another they have to find some strategy of microlearning.

But it is also clear that this change of perspective will then have to result not only in new technologies or uses of technologies, but in new didactics and new pedagogical approaches as well.

Thus the proceedings of the Microlearning2005 conference stake the claim of a new field of technology-enhanced learning. This is quite a challenge, but the problems of the "knowledge society" we now face are not less challenging. And the contributions to this book show that the participants didn't take the easy way out.

If eLearning is failing again in the next decade, the consequences will be severe. A significant digital divide in learning represents the real danger that the world would further separate into a small digital literate class, that knows how to acquire knowledge, and the uneducated masses getting sedated with digital entertainment. New concepts like microlearning may help steering away from such a dystopian scenario.

The Challenge of Triggering Profound Processes of Understanding in Microlearning Environments. Theoretical Foundations and a Case Study for a "Microlearning Laboratory" (On Microlearning)

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Abstract: An epistemologically and cognitively founded pedagogical learning/teaching model tackling these goals is developed. Possible solutions will be suggested by developing a meta-model for learning/teaching processes in a stepwise manner. It turns out that philosophy of science concepts play a crucial role in these processes. Furthermore, the role of micro-learning and technologically supported (mobile) forms of teaching/learning in such a scenario will be investigated.
Keywords: collaborative scientific theory construction, double-loop learning, reflection processes, single-loop learning, virtual communities

1. Introduction and Motivation

1.1 The Primacy of Know-What over Know-How

Most approaches in teaching/learning both in the field of secondary education and of universities focus on the level of skills and competencies. From an epistemological perspective it can be shown, however, that these approaches do not really aim at what is the peak of human cognitive capacities: generally speaking, skills concern rather superficial knowledge on the level of functionalities, algorithms, "know-how", techniques, "systems", "recipes", guidelines, methods, etc. Yet, human mind is designed to penetrate much deeper into reality or into the phenomenon of our interest. Our intellect is not satisfied with being able to grasp the functional aspects of a phenomenon (e.g., the dynamics of a particular system) or to control certain aspects of reality. Rather, both our cognition and most complex tasks in almost every field (of science, economics, technology, etc.) call for a *profound understanding* of the object

being under investigation first; only then one can start making any decisions or taking action. So, what do we mean by the term to "profoundly and deeply understand" a phenomenon or a reality? In fact, this question is as old as philosophy and metaphysics and has a wide spectrum of possible answers. In general, one can summarize that what our intellect is interested in is the *meaning* and the deeper *sense* of a phenomenon. All of our intellectual efforts aim at achieving a profound answer concerning the understanding of the "what" (and the "why?") of a thing. Above that, we are capable of *reflecting* both on the understanding of the phenomenon itself and the processes having led us to that understanding. Only when we have reached this level of operations we can claim to have come to a kind of profound judgment on a particular aspect of reality[1].

Of course, the aspect of the "how?" or functioning of a reality is an important contribution for the process of understanding it. However, as has been well known since Ancient Philosophy and metaphysics [e.g., Aristoteles, 89], there is a clear (intellectual) p*rimacy of meaning* of and *understanding* a reality (e.g., "causa formalis") over having some idea about its functioning. One can only fully understand the functioning of a phenomenon, if one has reached some understanding of its meaning, of its "what?", and/or its finality. Remaining on the level of functioning means that one has not penetrated very deep into the phenomenon, because s/he has just arrived at some more or less basic pseudo-understanding of the dynamics and of behavioral patterns of the phenomenon under investigation without having a profound understanding of its meaning. This focus on the process of understanding (in its most profound sense) is a point having been almost forgotten in most educational approaches nowadays. Only, if one takes into consideration issues from epistemology or even ontology and metaphysics, the deficiencies of such a reduction to the functional aspects become evident. Hence, a profound pedagogical approach has to be based also on concepts from cognitive science as well as from epistemology and theory of knowledge [Peschl, 03; Swertz, 04].

Certainly, it is relatively uncomplicated, comfortable, and cost-effective to teach "recipe knowledge", skills, algorithmic knowledge, etc. This especially applies to the field of eLearning and virtual modes of learning and teaching. We have to admit that it is already an intellectual challenge for ourselves to understand a phenomenon in its profound meaning. Hence, it is even more of a challenge to "teach" this process of understanding! Transferring these processes into a virtual environment is an ultimate pedagogical challenge. One reason, why that is so difficult seems to be that "teaching the process of understanding" calls for a completely different approach to teaching/learning: the teacher is not the instrument for knowledge transfer any more; rather,

1 Of course, this does not imply that this knowledge is final—rather, due to the inaccessibility of reality the process of constructing knowledge and understanding is never-ending; compare [Pieper, 03].

he/she has to act only as a coach or as a *person accompanying* the student in his/her personal process of discovering the meaning and, by that, achieving some understanding of the phenomenon in question [Glasersfeld, 89; Baumgartner, 04]. Above that, the teacher has to be ready for conducting a structured process of *reflection* in which s/he her-/himself could be questioned profoundly. From that perspective it is interesting to discover that new learning technologies offer tools, which exactly fit these requirements (e.g., tools for collaborative knowledge construction, communication, knowledge negotiation, etc.).
When the student has not only become familiar with these basic intellectual operations of deep understanding and reflection, but also has achieved some sovereignty in this domain, it will be very easy for him/her to quickly learn particular practical skills or competencies.

1.2 Knowledge Illiteracy in knowledge society

That is why it seems essential to focus more on the processes of understanding and reflection; especially in our so-called "knowledge-society" it is crucial to be trained in *making an effort* to understand things in their deeper dimensions, their relations, their meaning, etc. The trouble in our "knowledge society" is not so much the question of the digital divide or digital illiteracy, but rather the problem of *"knowledge illiteracy".* I.e., due to the focus of our educational systems on the know-how, on skills, on fact-learning, on "recipe knowledge", and on portraying a rather limited view of the world (e.g., presenting only a purely positivistic or economic perspective) it becomes increasingly difficult to intellectually enter into the deeper dimensions of a given phenomenon (e.g., finding out its finality, its deeper meaning, etc.). Restricting education and learning processes to a rather limited class of knowledge types causes a highly restricted perspective and understanding of reality. Knowledge illiteracy seems to be one of the most critical problems which become apparent in our emergent knowledge society.
That is why a model will be developed in the following sections, which lays the theoretical ground for going beyond the classical scope of knowledge types and for reaching a deeper level of understanding. The questions we are going to tackle in the sections to come concern the processes of *understanding*, of developing a *shared understanding,* and *reflection*; more specifically, how these cognitive operations can be taught and developed in an educational setting. This means that we have to take a closer look at the following phases: the process (i) of accessing reality/a phenomenon, (ii) of constructing knowledge about that reality, (iii) of abstracting from particulars of that reality, and by that (iv) achieving a profound understanding of it. Finally, (v) this process itself has to be reflected. (vi) The overall question is, how these processes can be

realized in an environment going beyond the standard classroom setting; namely, how internet and mobile technologies as well as microlearning strategies can be applied in order to enhance these cognitive operations.

2. Learning to Understand a Phenomenon and to Construct Knowledge in a Reflected Manner

In the course of the following sections a theoretical foundation and model will be developed for the learning and knowledge construction processes, which are necessary for improving the cognitive operations of understanding, of making abstractions as well as how the resulting knowledge can be shared in a reflected manner.

2.1 First-Order Learning in a Single Loop process

Classical fact-learning ("drill-and-practice"), which is not very efficient with respect to the process of understanding, is a rather simple and linear from of learning. Whereas the focus of linear learning is on mapping more or less static and predetermined chunks of knowledge from one brain to another single loop learning or *first order* learning aims at emphasizing the *process of developing knowledge*. Knowledge is not predetermined, but has to be *extracted from reality in an active process of personal/ individual and collective construction*.

As is shown in Fig. 1 (internal loop) learning is embedded into a circular process: this epistemological loop is realized as a process of continuous interaction and feedback between the dynamics of the cognitive system's knowledge and cognitive structures and its external and internal environment. The goal is to construct structures of knowledge in such a way that they fit into the environmental dynamics. This is realized in a circular feedback process. Via processes of perception and primary construction knowledge structures are built up in the cognitive system. This knowledge is externalized as behavioural actions and it becomes evident whether the internal model/knowledge has been successful or not. The learner's knowledge has to be changed and adapted according to the level of success/failure and (mis-)match between the expected/desired results and the real environmental dynamics. This epistemological pattern is well known from the classical approach to knowledge construction in the natural sciences. It has been described by Popper (as the process of falsification; [Popper, 62]) or in the area of *constructivist* philosophy of science (e.g., [Peschl, 99, 01]). Abstractly speaking, this procedure can be interpreted as a kind of "epistemological optimization and adaptation process". While linear learning is driven by an external teacher and his/her pre-structured knowledge, single loop learning is an *internally driven* and *self-control-*

led learning process having the goal of producing *functionally fitting* knowledge (e.g., [Glasersfeld, 95]) being the result of an active interaction with reality.

Limits of Single Loop Learning

From an intellectual perspective, such an approach to learning is not really challenging. Nevertheless this is the major paradigm of theory construction in the "normal" [Kuhn, 70] natural sciences. Looking more closely reveals that—on an epistemological level—this mode of learning has several limitations:

1. It is a rather *conservative* process: instead of exploring new alternatives or taking the risk of new approaches this mode of learning tries to conserve the existing knowledge structures as long as possible; only if there is a crucial mismatch the cognitive system is forced to adapt and change his/her knowledge.
2. *Low/*no chance of *fundamentally new insights:* due to the predetermined space of knowledge ("paradigmatic space") there is very little chance that something completely and fundamentally new is discovered or learnt in this process.
3. *Low level* of *understanding*: due to the goal of generating functionally fitting knowledge the question of "what?" is of almost no.
4. Primacy of *projection*: the more or less consciously chosen premises and assumptions (a paradigm I the sense of [Kuhn, 70]) predetermine a space of possible "solutions", theories, knowledge and the learner only has to explore (in the sense of making explicit) this pre-structured knowledge space. As an implication of the predetermined paradigmatic space projections of these knowledge categories are more important than being receptive to the structure and dynamics of the environment in the process of knowledge acquisition. Thus, there is a high chance that completely unexpected or unwanted aspects of reality will be filtered out in this learning process.
5. Lacking *reflection*: single loop learning does not offer a possibility for reflection. There is no possibility to question the paradigm itself within this mode of learning.

2.2 Second-Order Learning and Learning to Reflect in a Double-Loop Learning Process

In order to overcome some of the limitations of single loop learning an extension is suggested: a second feedback loop is introduced which realizes a kind of *meta-learning strategy.*

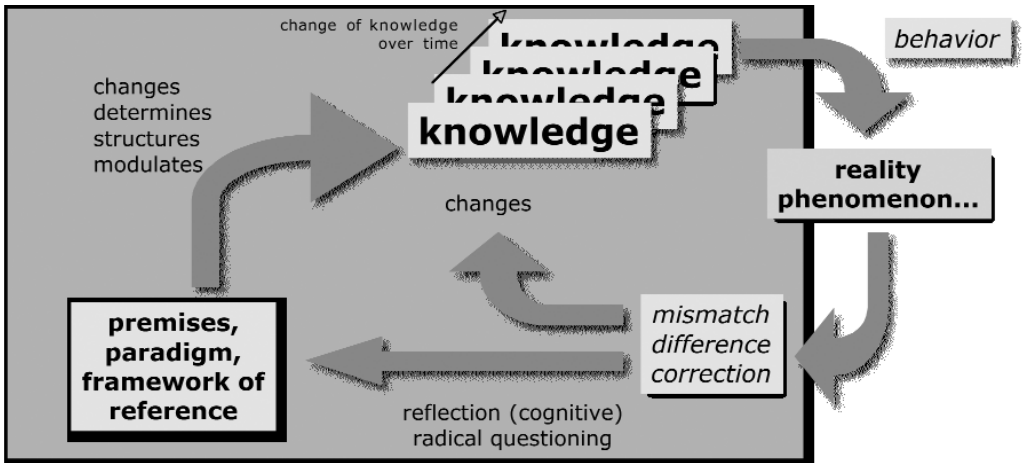

Fig. 1. Double Loop Learning. The internal loop depicts the process of single-loop learning.

This second feedback loop takes into consideration that any kind of knowledge is always based on assumptions, premises, or a paradigm [Kuhn, 70]. In general, knowledge always has to be seen as being embedded in and pre-structured by a *particular framework of reference*. Knowledge receives its meaning and structures from this framework of reference. Thus, *understanding* of a phenomenon can only be reached, if this framework is taken into account. As we have seen in single loop learning this framework of reference plays a key role in the process of learning, as it determines the structure of the space of potential knowledge and gives meaning to its basic dimensions – although the role of the framework of reference is never made explicit in the context of single loop learning. In double loop learning a second feedback loop (see figure 1) introduces a completely new dynamics in the whole process of learning: each modification in the set of premises or in the framework of reference causes a radical change in the structure, dimensions, dynamics, etc. of the space of knowledge. By that process entirely new and different knowledge, theories, interpretation patterns, etc. about reality become possible. In the context of science this process can be compared to what Kuhn refers to as scientific revolutions [Kuhn, 70].

The introduction of this second order dynamics reduces the problem of projecting always the same structure of knowledge on the phenomenon under investigation. Although it cannot be avoided in principle, it can be cut back by systematically applying modifications, variations, mutations, combinations, etc. (compare evolutionary operators; [Peschl, 99]) to the premises in the framework of reference. These systematic changes are exactly what is happening in this second feedback loop: the premises are modified and, by that, the whole framework of reference and the structure

of the body of knowledge changes. The method being applied in this process is basically the technique of *reflection*. It is a process of *radically questioning* and changing the premises and studying their implications on the body and on the dynamics of knowledge. Double loop learning has its roots in cybernetics, learning theory, in cognitive science, and in the domain of organizational learning [Argyris, 96; Senge, 90].

2.2.1 From Individual to Collective Double Loop Learning

The mode of double loop learning unfolds its full effectiveness, if it is performed in the milieu of a group or a team (under the assumption that the members of the group are ready and motivated to listen and learn from each other). Findings from organizational learning (e.g., [Argyris, 96; Senge, 90]) show that *collective reflection* is one of the most powerful instruments in the process of achieving both an individual and a mutually shared understanding of a phenomenon or of a problem. Apart from the double feedback loops of the double loop learning procedure, an additional feedback loop is introduced between individual and collective learning- and knowledge-processes. This additional feedback loop enables an even more radical process of questioning premises, as the space of possible perspectives and frameworks of reference is not limited to an individual, but to the diversity of the participants knowledge backgrounds. Apart from the readiness of the group's participants to listen to each other and to share knowledge an atmosphere of mutual trust is a conditio sine qua non for the success of such a collective reflective setting.

3. A Concrete Double-Loop Learning Setting

3.1 Individual and Collaborative Knowledge Construction in a Virtual Environment

How can such a deep understanding be achieved in a virtual learning environment? In this part of the paper a *concrete learning scenario* is presented in which the double-loop learning strategy is implemented as a (blended) *micro-learning environment* (see [Peschl, 05] for more details): students have to first individually and, later on, collectively develop a theory/model by making virtual experiments with a virtual organism (being realized as a non-trivial machine) in an interactive internet application. This process happens in *several micro-learning steps* and *loops* integrating the following processes:

- *Conducting virtual experiments:* learning how to design an experiment, how to observe, and how to collect data in an experiment

- *Individual theory/model construction:* learning how to generate knowledge by applying inductive methods
- Verifying/falsifying hypotheses
- *Presenting and defending* these hypotheses/models to the peer-group in the virtual domain (via discussion boards, chats, etc.)
- *Negotiating* these results and trying to find a collective understanding/model of the virtual organism
- Finding a *final form/visualization for presenting* the resulting model in a pedagogically adequate manner
- *Reflecting* the whole process of theory construction itself (both in the virtual domain and in the classroom)

Each of these steps can be (partly) completed in a time span of 3–15 minutes. Due to its interactive design (concerning both the virtual experiment dimension and the social dimension of knowledge construction) these learning processes can be carried out in an iterative manner going through several loops and repetitions of micro-learning steps in a double-loop learning style. Experience and feedback from the students has shown that a *continuous learning process accompanies* the learner over a period of 10–40 days.
The goal is not to learn something by heart (like in foreign language training or drill-and-practice learning environments), but to keep the learner in a *continuous active process* of thinking and *pondering over a single non-trivial problem over a longer period of time.* By that, she dives into the "deeper levels" of the problems concerning both the particular questions of the virtual organism and the process of theory/knowledge-construction (= meta-level). These thinking/learning-processes are supported by an additional stream of interventions: the dimension of virtual collaboration, negotiation and social interaction. These processes are minute steps of micro-learning which are implemented in continuous integrating feedback-loops. That guaranties continuous processes of reflection on an individual and collective level.

3.2 Implications for Processes of Collaborative Knowledge Construction and Knowledge Sharing

Making double-loop learning the foundation of a microlearning strategy has turned out to be a highly efficient learning strategy in the context of learning how to achieve a profound and deep understanding of a phenomenon, a reality, or a problem, and how to share this knowledge between the participants of this collective knowledge construction process; this is due to the fact that the learner is forced to *step back* and *take* an *external perspective* on the original (single loop learning-) task of simply trying to adapt

to the environmental dynamics and construct mechanisms generating the observed regularities. Above these construction processes, he/she has to reflect (a) *what* it is he/she is investigating and (b) on which foundations and framework of reference this process of theory construction is based. Here is exactly the point where philosophical and philosophy of science concepts turn out to be highly relevant in the process of *knowledge construction, understanding* as well as *knowledge sharing*. The key for successful knowledge construction and sharing seems to be the factor of systematic individual and collective processes of *reflection* being realized in the external feedback-loop of the double-loop learning model (see Fig. 1).

Conducting double loop learning not only on an individual level but also in a group/team-environment of cooperative knowledge construction has amplified the effect of the learning and knowledge sharing process. Due to collective processes of reflection completely new and unexpected spaces of understanding and solutions have opened up both on an individual and on a collective level. Mutually revealing one's knowledge and premises to each other induces a completely new dynamics and opens new aspects and sometimes dimensions in thinking and cooperative knowledge construction and understanding. It was due to the continuous microlearning based learning strategy slicing the learning tasks into small peaces and being supported by methods of virtual knowledge sharing, knowledge construction, and discussion that these processes have been highly successful and satisfying for almost every participant (as well as the teacher).

Apart from this microlearning course-design, one of the main conditions for such an emergent process is an atmosphere of openness and trust in the group of participants. It is the responsibility of the teacher or moderator to establish such an atmosphere, which facilitates these processes of developing shared understanding, shared meaning, and perhaps shared vision.

What are the goals and some of the basic implications having been reached by embedding the mode of double loop learning into a microlearning strategy (in the context of knowledge construction and knowledge sharing)?

1. Blind spots, ideologies, unconscious and perhaps unwanted assumptions, prejudices, or biases are uncovered and become evident in such a process of radical questioning and reflecting.
2. Due to changes in the realm of premises the range of possible knowledge spaces and knowledge dynamics explodes exponentially.
3. Reflection is used as a "weapon" against single minded and mono-disciplinary approaches and learning processes.
4. Double loop learning does not only encourage inter-/transdisciplinarity, but makes a multi-disciplinary approach a necessity.

5. The *profound understanding* of a phenomenon is supported in this process. By systematically taking different positions and by reflecting these positions the "what?" and "why?" of a reality is revealed in a radical manner. The learner is forced to go beyond pure functional descriptions and penetrate into deeper layers of reality.
6. *Focusing on and Sharpening the Cognitive Capacity of Perception and Observation.* Due to a rigorous process of questioning and reflecting the capacity of one's perception is constantly trained as well. One is forced to take new perspectives on the same phenomenon; by that multi-perspective approach blind spots are uncovered, but what counts even more, new dimensions and new categories are discovered. Not only categories concerning the particular phenomenon under investigation, but new categories of how to observe, perceive, and interpret reality in general! This is extremely important for almost every process of knowledge management/sharing, as a multiple perspectives and their reflected consolidation are the foundation for every process of shared meaning and understanding.
7. *Meta-learning.* Double loop learning forces the reflection of the learning process itself and, by that, allows a critical perspective on the learner's own processes, assumptions, and habits of knowledge construction and knowledge acquisition.

4. Conclusions and Perspectives for (Mobile) Microlearning

What are some of the implications from the concepts having been presented above? What are the insights for a technology based learning setting, more specifically for a mobile learning scenario as well as for the application of a microlearning strategy?

4.1 The Concept of Enabling in Face-to-Face and (Mobile) Virtual Learning Settings

One of the implications of double loop learning concerns the role of the teacher; it has radically changed in such a setting of learning/teaching: His/her primary task is to provide a "pedagogically augmented environment"; furthermore he/she is responsible for creating an atmosphere of collective reflection (e.g., via drawing attention to the importance of openness and trust). Beyond the role of a coach [Baumgartner et al., 04] the teacher has to act as a facilitator or *"enabler"* for the (individual and collective) processes of double loop learning rather than transmitting knowledge.

4.1.1 Integrating Mobile Technology and Microlearning

Apart from the teacher's role as facilitator *mobile technology* and microlearning as well has to be recognized as a *catalyst enabling* processes of individual and collective under-

standing. Normally, mobile technology is seen as a means for communication only. The (intellectual) value of these technologies can be increased by magnitudes, if they are extended and explicitly applied in the context of a (collective) double-loop learning setting. As has been shown above these settings are based on *highly interactive* processes in a twofold manner: (i) interaction between environmental structures/dynamics and the learner/user and (ii) interaction between learners/users. Both interaction types can be supported by mobile technologies:

Interaction type (i) concerns mostly processes of single-loop learning: whereas classical e-learning technology offers rather static and predetermined chunks of knowledge (perhaps providing variations in knowledge types or paths through that space of knowledge [e.g., Swertz, 04]) both microlearning strategies and mobile technology can be used to enhance learning processes by providing "augmented reality" features being adaptive and sensitive to concrete real-world situations (e.g., by utilizing location based or RFID services in combination with personal and public knowledge bases). Of course, the process of understanding has to be carried out by the learner him-/herself; however, it is supported by mobile technology providing the "raw material" (i.e., basic information/data and knowledge) for a particular (micro-)learning situation in a mobile context. Personal data, personal knowledge profiles/bases, personal interests and learning preferences, etc. can be combined with location based (public)/RFID data and the user's/learner's particular questions. The challenge is (a) to integrate these huge amounts of knowledge and data, (b) compute them into a result, and (c) transform these results into a visual and multi-modal representation that supports the learner's process of understanding (on the fly).

Type-(ii) interaction mostly is present in the context of double-loop learning. Beyond classical one-to-one, one-to-many, or many-to-many communication mobile technologies have to be developed towards supporting, structuring, molding, and shaping these communicative settings in the sense of double-loop learning processes having been developed above. I.e., the task is to provide a structured *virtual space enabling* efficient and successful processes of reflection in a microlearning design.

These processes go beyond classical knowledge sharing—the objective is to create a kind of (virtual) "knowledge market" as a place where meaning and understanding of knowledge/reality is *negotiated* in the sense of double-loop learning: i.e., a space where it is possible to share, to make explicit, and to make accessible/visible every participant's premises, background assumptions, paradigm, or (implicit) framework of reference. Normally, this is not a process which can be accomplished within a relatively short period of time-rather, this is a procedure typically taking many little steps (of negotiation, presentation, discussion, etc.) which can be split up in a microlearning style process.

The goal is to use such a space of shared reflection for arriving at building a community of shared meaning and understanding and, by that, perhaps at developing a joint

vision of a group (e.g. [Scharmer 01]). In other words, these processes could improve both the individual and the collective understanding. On the one hand mobile technology is challenged to provide the means for supporting these processes of shared reflection. Here are some examples:

- An instrument for supporting the process of making visible and making comparable diverse "knowledge perspectives" (e.g., via shared knowledge maps, topic maps, etc.);
- An instrument for structuring and shaping this communication and interaction process;
- An instrument for supporting this socio-epistemological process of negotiating and consolidating the meaning and understanding, etc.

On the other hand, microlearning strategies and designs will have to be developed in order to bring these learning processes to a successful end. Mobile technologies offer the advantage that double-loop learning is not restricted any more to a particular physical space, but can be carried out in a distributed manner without interfering too much with the constraints of collaboration. It has to be clear, however, that mobile technology cannot completely replace face-to-face communication – this applies especially to the rather sensitive area of the reflective processes of double-loop learning. Progress in virtualization of learning processes increases the demand for high-quality face-to-face communication/dialogue [cf. Scharmer et al. 02]. Nevertheless, mobile technologies in combination with microlearning strategies play he role of an *enabler* for supporting the virtual and, as an implication, the face-to-face quality of knowledge construction.

4.2 (Mobile) Microlearning Laboratories

As an implication of the points having been made above as well as of the concepts of double-loop learning one could think of developing "Microlearning Laboratories" which could act as virtual spaces explicitly dedicated to learning processes in microlearning style. Such a Microlearning Laboratory acts as an interface between reality, cognition, learning processes, and the creation of new knowledge. The strengths of the *"microlearning laboratory"* approach clearly lie in the following points:

1. The integration of different modalities of learning, knowledge construction, and interaction;
2. The *integration of various forms of knowledge:* the approach having been exemplified above follows a radical knowledge-oriented strategy. This implies that all aspects of reality/knowledge are taken into consideration and integrated in an overall perspective the full range of know-how (in the process of theory/model construction), know-what (process of questioning what this organism is about, what are its goals,

etc.), meta-knowledge (reflection on the process of theory construction);
3. Slicing the learning tasks into micro-tasks which can be accomplished in a manageable period of time and
4. at the same time trigger a *continuous cognitive activity* being focused on a single complex problem (vs. learning of more or less disconnected facts) by providing a continuous stream of interventions;
5. Breaking through the superficial levels of knowledge (e.g., the functional aspects of a phenomenon) and accessing "deeper" dimensions (such as the meaning or the finality of a phenomenon).
6. Supporting the processes of understanding (on the level of the particular problem as well as on a general level), reflection (meta-level), and knowledge construction in an effective and sustainable manner.
7. Above supporting processes of understanding the microlearning laboratory approach can be applied as a highly effective tool in the processes of applying knowledge in the context of design, art (inspiration), building technology, etc.

As a near future perspective mobile collaboration/communication plays a central role in this *"microlearning laboratory"* approach: It acts as a permanent "companion" for individual and collective processes of knowledge construction and shared understanding in a kind of ubiquitous learning and shaping process.

4.3 Outlook – "Ubiquitous Individual Cultivation"

As a final step of our learning model one could imagine the introduction of a third learning loop, *"triple-loop learning"*; this loop concerns the most fundamental level of the person(-ality): his/her values, being, etc. and their role in understanding, learning, and the person as a whole. On that level microlearning in combination with mobile learning plays a central role: it acts as a continuous "companion" for *individual cultivation* in a kind of ubiquitous and permanent learning and shaping process of the person. Whether this is a desirable application of microlearning technology remains to be answered.

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The Complementary Character of Microlearning (On Microlearning)

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Abstract: From the application of microlearning, two striking distinctive features arise. Firstly, it is a new way of information access for the learner, which is an expression of a new learning environment. Secondly, a complementary character becomes self-evident from many different points of view. It is this second aspect that this paper is taking a closer look on. It is the object of this article to make aware the manifold and complementary character of microlearning and to identify the resulting implications for specification, implementation and utilisation of e-learning propositions.

1. Introduction

The well-known quotation by Laotse "A journey of a thousand miles must begin with a single step." does also apply to microlearning. Too many projects are not realised, because people encounter obstacles that let us flinch from realising them. Microlearning, in contrast, makes us go step by step in the right direction.

Quickly the question arises, in which areas this could be helpful. In this connection, one thing is especially remarkable: the complementary character in many areas. On the one hand, completely new forms, areas as well as markets of learning can be opened up; on the other hand, it also becomes apparent that microlearning alone is often not sufficient.

From which different directions are complementary characteristics evident?

A. Complementary from the environmental situation of benefit
B. Complementary for the information landscape
C. Complementary in education
D. Complementary in specification, implementation and application

Below, these four areas will be specified in detail.

A. Complementary in situations

It is important for the acceptance of e-learning and, in particular, microlearning to select a precise catalogue of questions and contents. In this connection, it is made use of the situation context of the user, i.e. by taking into consideration particular situations, in which the user is situated, the information to be communicated is controlled with regard to the target group. Especially in microlearning, this precision is of particular importance, specifically since the considered user contexts open up new markets for e-learning. For instance, the following examples can be discussed in this framework:

- Utilisation of waiting time
  People want to avoid waiting time. Where this is not possible, means for microlearning can be provided in order to use this time in an expedient way. One example would be the waiting time at a petrol station during fuelling: the operation of the air pressure device by the user sheds light on the current environment (e.g. tyre pressure is too low) and is an appropriate device for user input.

- Education of women in household and family
  Due to their situation, women with multiple responsibilities do not have much time for monolithic learning programmes. Moreover, the need to integrate the computer into the common daily life rises further. This aspect will be discussed below.

- Utilisation of transport-related passive phases
  The further rising penetration of computers in means of transportation and, at the same time, the rising automation of the journey itself provide for the further utilisation of microlearning during the transport time. The exploitation of location information plays an important role within this domain. First of all, public transport comes to mind (journeys by train, etc.); in the future, automated individual transportation will surely play a role as well.

- Exploitation of location information
  The information itself of the location of the user provides for a high precision with regard to the contents of microlearning. This refers, for instance, to tourist offers (foreign language offers, information on places of interest, etc.).

Women in household and family. Three examples for this area of education of women in household and family show the enormous scope and potential of microlearning.

In the household and the family, women very often perform tasks, which inherently are composed of active phases and phases of waiting:

Example babysitting. Most of the time, children have to be looked after. This time can be used for microlearning. Depending on the place (= children's room) and the time (e.g. in the afternoon) and the saved profiles of the persons involved, learning and laughing together with the children can be achieved in a playful way, since it is by all means possible to combine microlearning with entertainment.

Example cooking. It takes hours to cook the roast in the oven. However, the cook cannot leave the kitchen for a longer period of time. In this situation, waiting time occurs increasingly, which should be made use of. Depending on the place (= kitchen), the time (e.g. at noontime) and the saved personal profile, it is possible to learn new things by way of deserts without leaving the environment. Appropriate input and output devices ensure adequate means of communication (display on refrigerator, etc.).

Example exercise machine. Most often, the exercise machine stands unused in a corner, since the use costs quite an effort and is not very stimulating. During training, appropriate topics can be presented. Depending on the place (= training room), the training situation (duration, heart rate, etc.) and the saved profile, precise questions can be asked.

Generally speaking, one has to be aware of the fact that everything the user does actively or passively on a device, each button that is pressed, constitute more information, to which people can respond in an appropriate way. The example with the exercise machine makes this very clear. Current biometric data, like for example the pulse beat, of the user are known. In this way, the learning programme can even give feedback in the sense of bio-feedback.

B. Complementary in information environments

Corresponding to the ever rising rate of availability of information during the last years, the offers of information media are also becoming more sophisticated. This applies also to e-learning propositions. It is now possible that microlearning can further promote the availability of information by the exploitation of user conditions in particular situations, at the same time enhancing the quality of the information by the potential precision.

Microlearning can also supplement non-linear information accesses, like for instance encyclopaedias. This is also one of the means to close the gap between knowledge competence and implementation competence further.

Information is made available to the user in manifold ways, but most often also to a too large extent. The offer forms a wide information landscape with only few sign posts. Therefore, the decisive challenge is to obtain the right information at the right time. The user can respond to this challenge with the application of microlearning.

Microlearning takes on an active role in the filtering and the supply of information. With the help of the knowledge about the learning context of the user, microlearning can offer and initiate interesting information.

The precision of questions can also be enhanced by providing the user with possibilities of intervention. This makes it possible for the user to respond accordingly to imprecise questions. The programme is always learning and the hits are becoming more precisely.

In this way, current information of the present information landscape is used and linked to the context information about the user and the learning situation and is subsequently presented in an appropriate way.

However, one danger has to be mentioned here: with this kind of approach, only a suboptimum can be created for the user. Even though further optimisations are possible in the framework of the known context, but modifications of the user profile, for instance, could be hard to reproduce. Therefore, it is nearly impossible to implement the will of the user, if the user has not (yet) selected his/her preferences. Most often, users are looking for something and do only know what they were looking for when they have found it. In these cases, conclusions by analogy for other topics have to be tested on relevance on an ongoing basis.

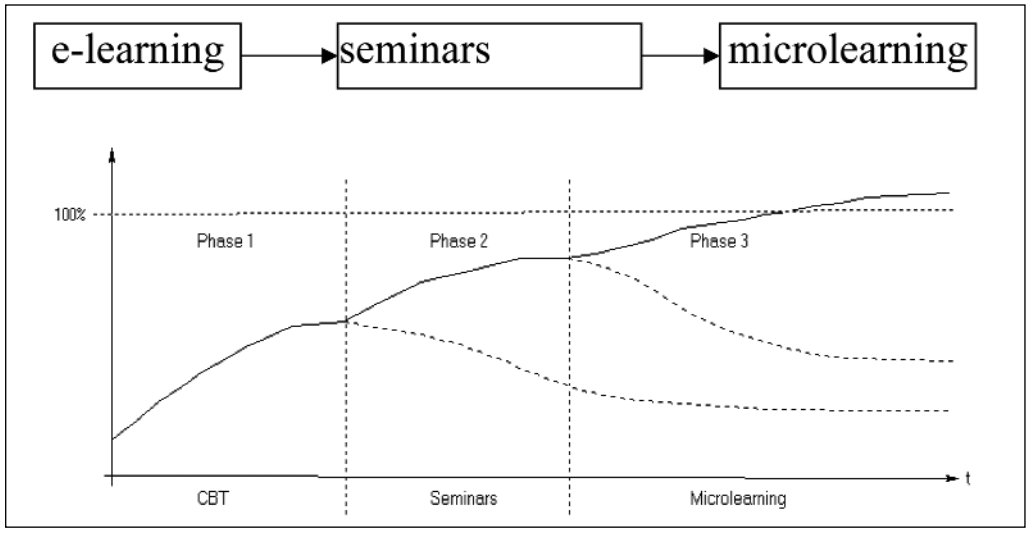
C. Complementary in education

Microlearning can supplement existing education systems in many areas. It ranges from presence seminars, which gain a persistent character by microlearning, via supplements for professional journals to school and university, where the implementation competence is especially promoted. Here, it becomes evident that microlearning alone is not sufficient in most of the application cases.

One example for the complementary character of microlearning is an extended form of blended learning. The originally harmonic interaction between conventional e-learning and presence seminars is supplemented by the component microlearning.

This results in a structure with three levels. Each level is characterised by different objects. One classification could be the following: conventional e-learning is applied in phase 1 to introduce the learner to a field of knowledge, to level the basic knowledge and to make particular difficulties visible. Subsequently, further knowledge is imparted in presence seminars, in which the results of the first phase are further developed. Until this point, the first phase creates basic knowledge and the second phase creates "main knowledge".

3-level structure of blended learning with microlearning:



Depending on the learning efficiency, the learner has acquired enough knowledge of the topic by the end of phase 2. Naturally, it cannot be expected that all participants know 100% of the learning matter. Furthermore, how many percent of the learning matter are considered sufficient depends on the domain. Moreover, the knowledge will disappear slowly after the seminar, unless it is repeated and practically applied. A consequent aftercare is seldom pursued. This results in a situation in which much of the acquired knowledge disappears again and in which the relation between learning effort and benefit is very poor.

This is where microlearning comes in. Based on the results of the conventional e-learning phase and the presence seminars, the learning matter can be repeated continuously. Gradually, the knowledge curve will rise to 100% and the knowledge will stay in the learner's memory.
Microlearning can be seen as one form of e-learning aftercare as it were. The curve can even rise above the original 100%, if the persons responsible for the context are able to integrate further knowledge in the aftercare phase.
Naturally, this kind of aftercare does also work in combination with conventional e-learning without presence seminars.

D. Complementary in specification, implementation and application

The specifications of traditional e-learning projects are characterised by a low extent of formalisation. Microlearning contents, on the other hand, are predestined for frameworks formalised to a larger extent. Frequently, a dynamic model is necessary to generate the contents and put them into a framework, which has more static characteristics. As a matter of fact, the supplementation with microlearning contents results in great modifications in both project implementation and utilisation.

Specification

A number of different ways of characterisation is suited for the specification of e-learning contents. [Ei04] A wide arc can be described from methods with a rather low extent of formalisation, like user stories and requirement lists, to methods with a rather large extent of formalisation, like formatted specifications or even formal specifications. Whereas forms like user stories and requirement lists are better suited for conventional e-learning, these specifications can be supplemented in microlearning by formal ways of characterisation. Kappel assess the suitability of different ways of characterisation with the characteristics precision, easy to test, effort, suitability for laypersons, and scalability. [Ka04] We will follow this system here:

- *Precision.* With regard to the necessary precision, they correspond more to the needs of microlearning.

- *Easy to test.* Concerning the testing, it has to be mentioned that even though the validation of individual micro steps may be trivial, the awareness of the whole knowledge landscape, i.e. the interrelationships between the individual "knowledge atoms", is rather complex. Suitable visualisation and validation tools are indispensable.

- *Effort.* The effort for the content preparation can vary considerably for each domain. Generally, the effort is notably less than with conventional e-learning applications, though.

- *Suitability for laypersons.* A special advantage of microlearning with regard to the content specification is the particular suitability for laypersons, i.e. professional experts can contribute their knowledge to the content without having to have special design or programming knowledge.

- *Scalability.* Another advantage is the very easy scalability of the contents.

In conclusion, one can say that the specification of microlearning contents is more formal than the specification of more conventional methods. Specifications can also be carried out with high precision and little effort by professional experts. An additional advantage is the high scalability of the content. However, the difficulty of validation remains virulent.

Implementation

In contrast to other application implementations, the implementation of traditional e-learning contents is also characterised by the fact that persisting data is already created in the development phase of the application and not only after its utilisation.
In microlearning, on the other hand, the time span in which the contents are implemented is extended. On the one hand, contents are still created during the development phase, but on the other hand, it is possible and intended to integrate further contents in the content stock also after the completion of the application. The point in time for the creation of contents tends to be relocated towards the direction of utilisation again and supplements the creation of conventional e-learning contents very well with regard to the time flow.

Application

The application of microlearning is probably the greatest difference with regard to traditional e-learning forms. This aspect is part of the peculiarities of the compatibility described under A-C and therefore the reader is referred to theses sections.

Conclusion and outlook

In conclusion, one can say that the complementary character appears in so many ways that the additional benefit becomes apparent. IVG Data, for instance, is testing at the moment in how far microlearning is suitable for the aftercare of highly interactive application trainings, since it is not yet clear how highly interactive contents can be transferred to the reduced presentation possibilities of microlearning.
One disadvantage of the complementary character lies inherently in the fact that microlearning is not sufficient in many application areas. That is why the limits of microlearning have to be shown precisely so that this access to e-learning can be applied in appropriate cases.

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The Design of MicroLearning Experiences: A Research Agenda (On Microlearning)

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Abstract: In this paper we focus on the interaction design properties of microlearning experiences to outline relevant research directions and main challenges of the field. We start by analyzing current efforts in the area of educational technologies in terms of their support of anytime-anywhere access to learning resources, which is a core property of microlearning environments. We also overview learning theories that are relevant to address the lifelong dimension of informal everyday activities of knowledge acquisition. From this discussion a set of design requirements and evaluation issues are derived to inform future investigation and experimentations in the microlearning area.

1. Introduction

Technological innovation has made our society a knowledge intensive one, where successful performance of individuals or groups heavily relies on the acquisition and use of relevant information contents and suitable communication means to achieve task objectives. Microlearning is a new research area aimed at exploring new ways of responding to the growing need for lifelong learning or learning on demand of members of our society, such as knowledge workers [6][11]. It is based on the idea of developing small chunks of learning content and flexible technologies that can enable learners to access them more easily in specific moments and conditions of the day, for example during time breaks or while on the move. In this paper we analyse, from an interaction design perspective, which are the core requirements, as well as some main challenges, in the design of microlearning experiences. We start by focusing on the spatial and temporal dimensions of learning to identify possible differences and synergies of microlearning with other current approaches to educational technologies. In section 3 we briefly discuss learning theories that are relevant to inform microlearning environments, while in section 4 we list a minimum set of requirements that should be met by this type of learning contexts. Section 5 suggests possible methodological

approaches for the designevaluation of microlearning concepts and scenarios, according to the requirements listed above. It also raises a number of issues, such as the evaluation of lifelong microlearning experiences, that seem to have been particularly difficult to tackle by learning studies till now [1]. We conclude the paper by sketching some interesting areas of inquiry for microlearning that should be part of its research agenda.

2. Anytime-Anywhere Access to Learning Resources

Microlearning activities, by definition, rely on access to learning resources which may happen at the time of breaks or gaps in learners daily work/life activities. Since these gaps may take place in many different space locations and moments of time, microlearning is definitely the most typical form of anytime-anywhere learning. Also, research literature has shown that much learning in life is often informal, in fact "opportunistic and strictly under the control of the learner" [10]. Marchionini and Maurer say that learners take advantage of other people, technology, and the context during informal learning. Some research also indicates that informal (science) learning outside the formal class setting significantly contributes to the motivation to learn [17]. It is rather interesting to note that nearly 85% of students_ time is spent outside formal classroom settings [3]./

In Fig. 1 we compare different typologies of educational environments and technologies that might support informal learning by taking into account their temporal-spatial dimensions. Pervasive learning environments, for example, are characterised by the presence of embedded technologies and a series of small devices like tags, sensors, badges etc., that are dedicated to detect, observe and build dynamic models of the environment and learners' activities, so as to adapt to (and possibly support better) learning processes [11]. Among interesting applications of pervasive technologies, we mention mixed realities environments for learning [12], that recently have been developed to transform or augment traditional learning activities carried out indoor (classroom) or outdoor by designing innovative interfaces between the physical and the digital world [13][14]. However, the complexity of design and dedicated nature of these environments make their use quite limited and localized in terms of time/space dimensions [11].

A more desktop-based type of experience is provided by Computer Assisted Learning Environments and Web-based applications on which most of eLearning systems and activities typically rely on. In some way, the large availability of desktop computers and simple network connections in everyday environments (like home, work etc.) increases the level of anywhere/anytime access to eLearning by its users. However, a pos-

sible disadvantage of this conditions is that the devices and learning contents typically used for eLearning are not particularly easy to move or transfer from one place/device to another, neither specifically suitable to be accessed while on the move. To remove this problem mobile learning environments are more appropriate to use, since they are based on portable devices like PDAs, cellular phones etc., supported by wireless network connections to enable a flexible and seamless accessexchange of learning contents anytime and anywhere. This is particularly important for microlearning experiences, that due to their ubiquitous emergence and lifelong duration, need to integrate the mobility capabilities of these devices with the computational power and support provided by pervasive/ubiquitous environments. This would be expected to effectively support learners in their access and transfer of learning resources across different surroundings, as microlearning requires. Moreover, it has been observed that in mobile computing user activities tend to be implicit, opportunistic, and informal. Mobile users tend to rely on (or indirectly take advantage of) the context, including aspects such as: location, infrastructure/resources, environment, time, and other people. Considering the previous observations reported in [10] [17], mobile computing does therefore afford a great opportunity for supporting (micro)learning [7].

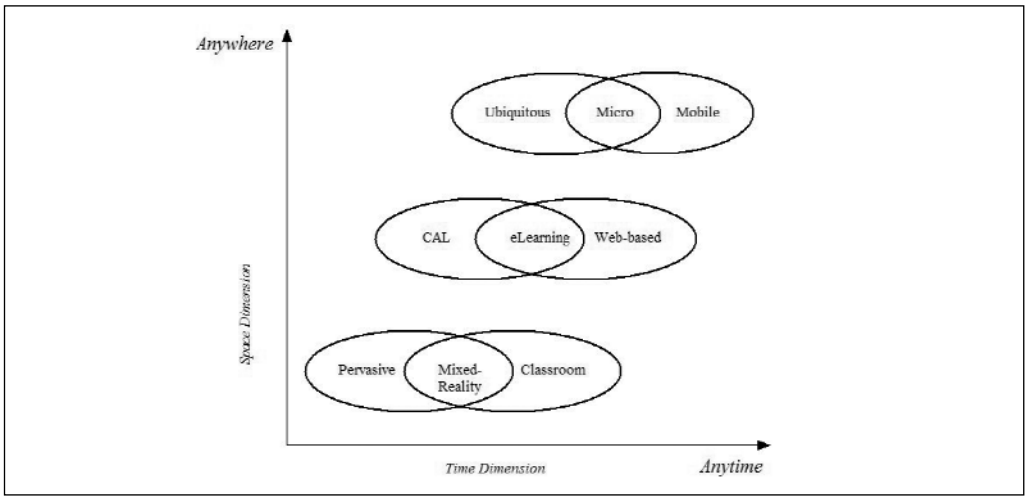

Fig.1: Types of Learning Environments according to Temporal-Spatial Access

3. Learning Theories for MicroLearning

All the learning environments mentioned above share the same foundation on constructivism and/or social cultural theory as a common understanding of knowledge acquisition [4][5][20][21]. Microlearning makes no exception to that, but can also be informed by a range of more recent learning approaches, projects1 and studies, that have focused on investigating the characteristics of adult learning during lifelong activities [8][18]. A main observation from these studies has been that most adult learning happens outside formal education. It often responds to the need for a personal/professional growth of individuals that dedicate part of their (informal) daily activities to the acquisition of new competences or to an updating of their knowledge, motivated by changing conditions or circumstances in life (for example getting prepared for a new job).
Also, informal learning typically is based on task specific activities, where learners are interested more to access very specific pieces of information instead of a complete body of knowledge, in order to support decision making or the acquisition of a certain skill [18].
Mobile and ubiquitous technologies are particularly indicated to support this type of learning; in the case of microlearning they should be designed to enable a natural blending of it within the flow of everyday activities carried out by learners.
It is also worth mentioning that these technologies are suitable to support both intentional and unintentional types of learning; the former are characterised by intensive and deliberate efforts to acquire new knowledge by a learner, the latter consist of not deliberate learning experiences derived from conversations, observations in the world, accidents etc., that cannot be planned in advance, but are potentially enabled as unexpected outcomes from the informal learning activities [8][18].

Microlearning is thus to be considered a contextual lifelong learning process, that according to [15] is most effective when it can enable activities such as:

i) the construction of knowledge, by means of finding new solutions to problems or creating connections between past and current experiences,
ii) conversation with both the socialphysical world and with oneself (like in reflection, experimentation in the world and interpretation of results) as well as,
iii) learner control over any continuing cycles of experimentation and reflection.

1 See, for instance, some results of the MOBIlearn EU Project "Guidelines for Developing Mobile Learning Deliverable"

4. Main Requirements of MicroLearning Experiences

In the light of the microlearning properties discussed above, we now provide a list of requirements that should guide the design of both technologies and contents for microlearning experiences.

According to our analysis, they should be:

1. highly transferable and unobstrusive of the learner's activities, so that learners can easily download and upload the didactic materials they have been provided from one device to another. This should also enable learners to work always on the most updated version of the learning material wherever they are, by using the most appropriate device according to the specific conditions in which they happen to carry on learning activities. This would also entail the study of natural interfaces for multimodal interaction with the learning system to support the learners in situations such as: multitasking, hands-free or eyes-free interaction, exposure to possible distractions (noise, interruptions, etc.) from the surrounding environment.
2. Easily available and user-friendly, enabling anytime-anywhere access to it, supported by the use of mobile phones, PDAs or other wireless communication devices connected also by Local Area Networks (LANs). Usability aspects of microlearning technologies and contents should be analysed carefully, in such a way to enable the most intuitive and straightforward interaction with them by people with different levels of expertise with technologies.
3. Persistent, meaning that the learning environment including all the modifications operated on it by a learner in a lifetime, should be independent from its physical instantiation on a certain device, thus easily accessible at anytime through the specific technology at hand. The use of a persistent user profile may enable the learner freedom in accessing her same profile from different devices, settings and for different services.
4. Useful, especially through enhancing the different activities contributing to the achievement of the learning goal(s). This is only possible if technologies are able to present an adequate and simple image of the learning environment to the user, no matter how complex its inner organization might be. For microlearning, appropriate system metaphors, especially 'off the desktop' ones, should be uncovered and studied in order to fulfil this requirement.
5. Individual as well as sharable, so that they adequately support individual learning activities but also enable learners to get or provide support from/to peers, tutors or other experts by the use of communication technology.
6. Adaptable and/or adaptive to learners' needs, so that different interaction styles can be selected by learners according to their preferences or skills (for instance,

their level of expertise with the learning environment) or automatically suggested by the system according to specific learner profiles or models developed during lifetime interactions with the microlearning environment. Personalization features should be carefully designed to avoid making user interaction more complex or running against principles such as transparency, predictability, control etc.. By contrast, the aim of this requirement is to support a more natural and consistent interaction of the learner with digital (learning) resources, according to the opportunities and affordances provided by everyday environments.

As far as microlearning contents are concerned, below we mention a number of meta-requirements that, according to the theoretical approaches cited in section 3, should be fulfilled. In particular, they should:

1. promote the acquisition of basic skills such as flexibility and adaptability in learners, making them aware of the very rapid and changing nature of knowledge in everyday environments,
2. foster the development of creativity skills, as well as problem solving and managing competences,
3. capitalize on learners communication abilities as a way of supporting the social production and reconstruction of knowledge during learning and working activities and try to improve them by providing learners ways of analysing their own communication styles as recurrently practiced in the field.

5. Design and Evaluation Approaches

So far we have discussed possible suggestions for developing effective microlearning experiences. However, due to the early stage of work in this field much experimentation at the level of design and evaluation of microlearning environments is required. If we analyse research in innovative design areas such as ubiquitous computing, we can observe that participatory design approaches or observation of users' activities in authentic everyday settings have been the most appropriate methods applied to generate relevant data to inform design [12][16]. We claim that adopting this approach would also be key for microlearning, due to the need of uncovering original and effective combinations of microcontent with natural interfaces to support learners during their lifelong knowledge acquisition. Ethnographic observations, as well as participatory design techniques, may provide interesting hints for developing design concepts to be tested in microlearning scenarios of use. Previous studies have demonstrated how technological possibilities, if appropriately presented to users within meaningful

and (possibly) authentic scenarios, can be of inspiration for developing creative and useful design solutions that would hardly be found by following more traditional design approaches [12]. As we mentioned before, new metaphors beyond the ones currently used in distant education should be devised and investigated to present a more appropriate microlearning system image to its users. This should be founded on indepth and longitudinal analyses of learners actions and interactions with the physical world and with microlearning resources as they are experienced and reused for knowledge acquisition.

Evaluation studies on microlearning would also be key to inform a better design of these systems. For what concerns evaluating microlearning technologies, usability approaches could inform the analysis of microlearning concepts and scenarios. However, assessing usability of cutting edge technologies for which usually only proof-of-concepts or early prototypes are available, might be particularly difficult. This is because task centric evaluation techniques are not ideal to be applied for studying informal everyday activities and also because it is unclear how it would be possible to apply quantitative evaluations or controlled experiments to assess lifelong learning processes. For the evaluation of more advanced and robust microlearning systems some adapted usability techniques may turn out to be useful, for instance, recent efforts towards developing usability heuristics for the evaluation of mobile environments/applications (such as [9], [19]) and shared environments (such as [2]). Somewhat problematic would also be measuring the effectiveness of microlearning experiences in terms of the learning objectives achieved. Specifically, a main challenge would be to assess achievements at the level of metaskills acquired by the learner through a life long assimilation and personal (re)interpretation of the contents provided. This is an area where currently more investigation is required. If microlearning research will undertake this challenge it is likely to provide interesting insights for a better understanding of learning activities as instantiated within everyday informal settings.

6. Conclusion

This brief excursus in the field of microlearning theory and technological development has shown that there are several areas and opportunities for future inquiry that promise to advance the state of the art in microlearning and also to bring relevant results to the HCI community interested on educational technologies. To summarize, some main directions to be included into the microlearning research agenda are the following:

- Experimentation into the design of anytime anywhere access to digital learning resources by devising ubiquitous computer interfaces and suitable interaction metaphors enabling flexible use of microlearning environments by learners during informal lifelong learning activities.
- The development and application of different combinations of HCI metodologies for a better analysis and understanding of lifelong learning practices within authentic scenarios of use, by means also of iterative and participatory generation of design concepts and solutions, suitable to match learners' needs.
- The design of cutting edge technologies and prototypes responding to the list of microlearning requirements mentioned in section 4 and possibly to an extended list of them as informed by current and future research on everyday use of ubiquitous/mobile technologies.
- The study of more suited evaluation methods for microlearning environments that would properly take into account the lifelong dimension of learning, as well as any future advancement of teaching methods and models more specifically addressed to match the emerging requirements of informal learning activities.

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Customized Learning Sequences (CLS) by Metadata (On Microlearning)

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Abstract: Computer technology as a medium requires a special form of knowledge organisation, which allows learners to go individually and in a reflective way through the content (Customized Learning Sequences), thus requiring teachers to produce individually navigable hypertexts. Individualization does not mean offering "pure" self-directed learning, as learning presupposes instruction by others. We have to aid teachers in reorganizing knowledge to hypertexts that allows individual navigation. Supporting learners in finding their individual path is also a crucial factor.How to aid teachers and how to set up meaningful navigation aids will be discussed in four steps: 1.) Theoretical considerations; 2.) First step of Web-Didactics: Decontextualisation; 3.) Second step of Web-Didactics: Recontextualisation; 4.) Research. Which theoretical considerations are eternal for Web-Didactics?

1. Overview

As Meder (1998) and Swertz (2000) demonstrated in a theoretical analysis of the media structure of computer technology, this medium requires a special form of knowledge organisation, which allows learners to go individually and in a reflective way through the content (Customized Learning Sequences), thus requiring teachers to produce individually navigable hypertexts. Individualization does not mean offering "pure" self-directed learning, as learning presupposes instruction by others. We have to aid teachers in reorganizing knowledge to hypertexts that allows individual navigation. Supporting learners in finding their individual path is also a crucial factor.

1.1 Books

It is difficult to write a theory about media, since writing a theory on media presupposes the use of media. Therefore a medium could only be reflected in the relation of media (on pluralism see Fromme 1997). Comparing computer technology to books shows certain differences in the physical dimension of the medium: Books consist of colour on paper. The paper is tied in numbered sequences.

The colour is most often used to form letters. Letters are dominantly used in books, in doing so matching the arrangement of the tied paper (McLuhan 1992). This arrangement is characteristic for the production of equal copies: Books require knowledge to be arranged in linear sequences that are reproduced in equal copies. This well known structure of books requires a certain style of instruction: The idea of „everybody learns the same thing equally" (Comenius) and the idea of an single perfect learning sequence were reflecting the equal copies of books.
These ideas change when another medium gets culturally predominant. How could computer technology be understood from this perspective?

1.2 Hypertext

Today computers are built as electrical digital universal Turing machines. Usually keyboards and mouses are used as input devices and screens as output devices. Key attributes of this medium are the possibility to use algorithms during the presentation of knowledge to alter the presentation of the knowledge and the limited space on the screen.
The application of algorithms during presentation substitutes the equal copies; an individual presentation becomes possible. From this point of view individual learning has to reflect the physical structure of computer technology. This individualisation is connected to another granularity: Screens only show a small part of computer memory – everything not shown is detracted from sensual reception.
As we know *Hypertexts* (Iske 2001) are best suited for the specific structure set by computer technology – but in practice we often find continuous texts in on line learning environments (as on this CD).
How could the question of individualized Hypertexts be answered by didactics?

1.3 Navigation

The key problem is the navigation aid: How does a learner find the next step? How could the available knowledge be opened up? How has a hypertext to be arranged to support individual navigation, self dependant learning and a individually chosen didactical model? To solve these problems we have to offer navigational aids allowing the learner to move around efficiently, and we have to offer a variety of didactical models. Web-Didactics does not offer a single instructional design model (e.g. Problem Based Learning, Tasks Oriented Learning) but a choice of didactical models, that where approved in the educational tradition. These models were specified concerning the granularity of the computer screen. The aim of Web-Didactics is a systematically and therefore clearly structured knowledge base that takes concern of different didactical

models, therefore allowing individual learning. Self-directed learning and dependent learning are aligned.
How should learning material be prepared to allow individual navigation?

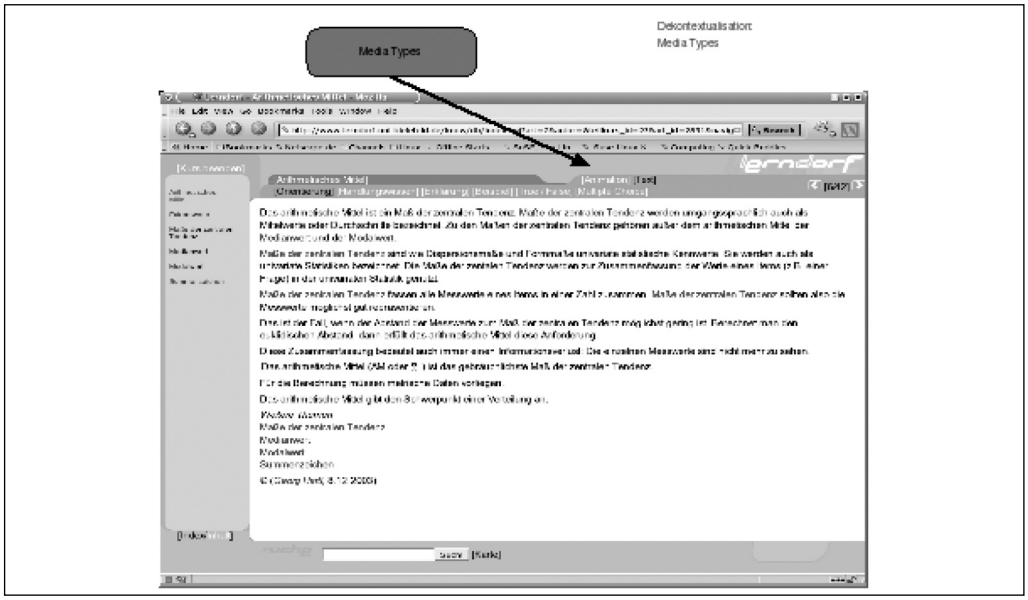
2. Decontextualisation

Preparing content for learning requires two steps:

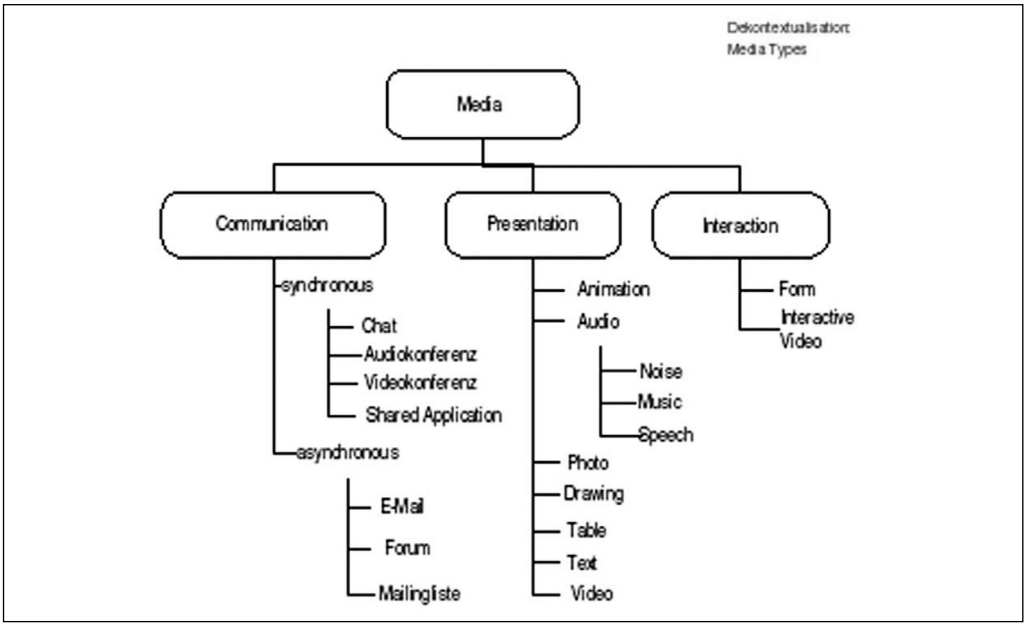
1. The content has to be decontextualizied. It has to be derived from existing sources and transformed to the required granularity. That leads to an knowledge base being organized accordingly to didactical principles.
2. The produced elements must be recontextualisised to map them into learning time. (for de- and recontextualisation see Flechsig 1991).

Decontextualisation means building up a dicaticaly structured knowledge base. Knowledge is derived from existing contexts and is prepared for the learning process. Web-Didactics draws a distinction between four levels. The lowest level is the screen page. Which attribute is relevant on the level of the screen page?

2.1 Media Types



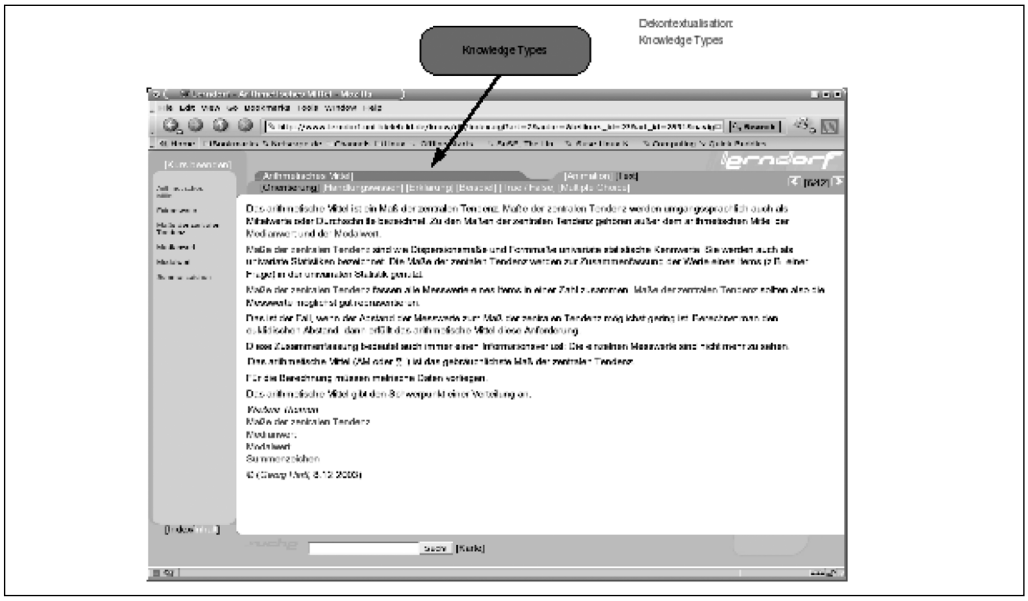
The key attribute of the screen page is the media type. The media type of the shown page from Lerndorf (www.lerndorf.de) is „Text".
Using different media is an old didactical principle that applies to hypertexts accordingly. Computer technology offers varied forms of presentation: Pictures, drawings, videos, sounds etc. thus opening different didactical options. Which media types have to be considered from a didactical perspective?



The graphic shows the Media Types specified in Web-Didactics. The idea is not to produce every media type in every learning environment, but to guide authors to a systematic production of different media types. Crucial is the variation of media types.
For navigation different media types have to be combined with a knowledge type. Which knowledge types have to be considered?

2.2 Knowledge Types

Knowledge Types are the second level in decontextualisation. The screenshot shows the navigation between knowledge types. In other words: The knowledge types are used as a navigational aid for self-directed learning.



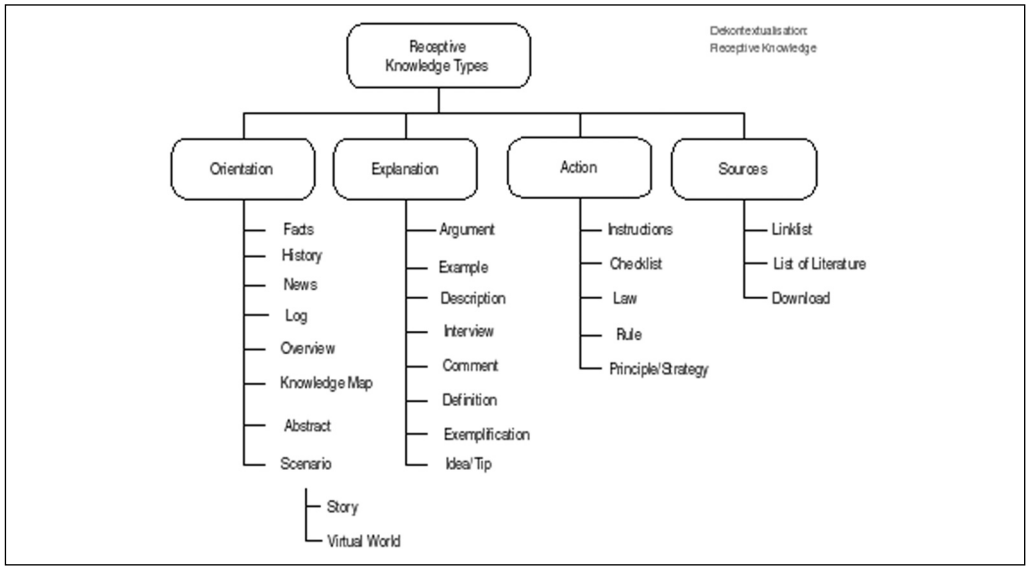
Web-Didactics draws a distinction between to classes of knowledge types:
- *receptive,*
- *interactive* and
- *cooperative* knowledge.

Receptive Knowledge is passively perceived, interactive knowledge offers interaction with the computer and cooperative knowledge means communication with other people. The distinction was made concerning the didactical models to be realised. We chose knowledge types that occur in didactical models mentioned in literature. The compilation is therefore derived through a heuristic approach and has in so far to be proven by empirical studies. The compilation could be modified if needed.

2.2.1 Receptive Knowledge

Beside perceiving the knowledge learners stay passive while using receptive knowledge. The diagram above shows the systematics of receptive knowledge types. The distinction of orientation, explanation, action and sources is derived from a concept suggested by Flechsig (1990).

Orientational Knowledge mentions objects, places them in context without detailed explanations or giving instructions on how to use them. One possible composition



starts with by accessing previous knowledge („As you may know...“), places the knowledge in context („... belongs to ...“) and mentions relevant concepts („Important concepts are ...“).

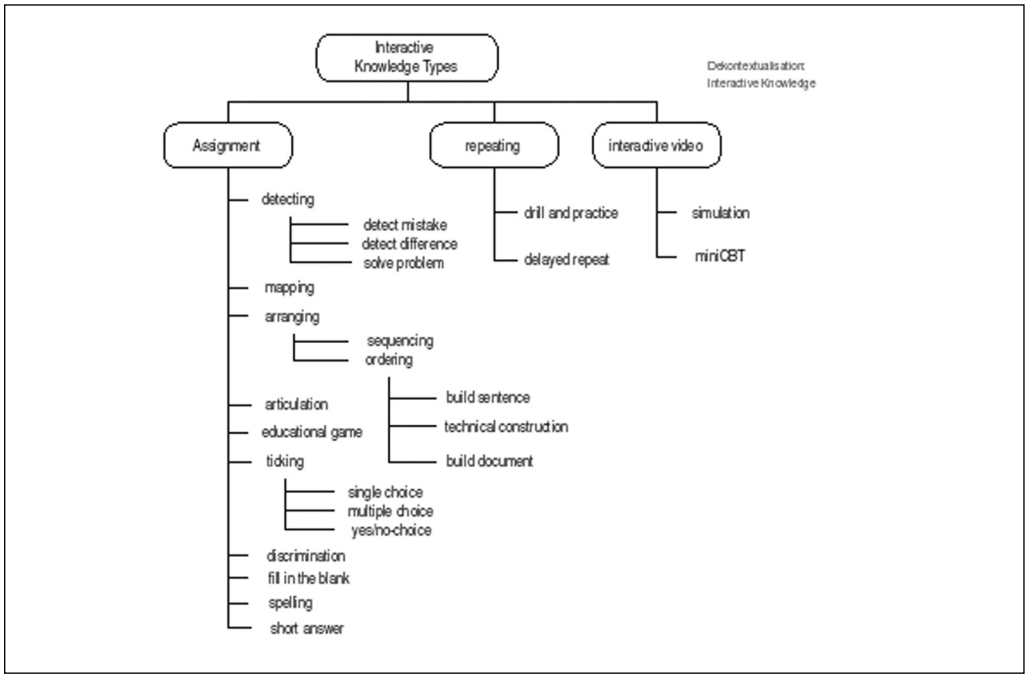
Explanational knowledge offers reasons why something is in the was it is or why something is looked upon in a certain way.

Instructional Knowledge tells you what to do and how to do it.

Source knowledge indicates places where more informations could be found.

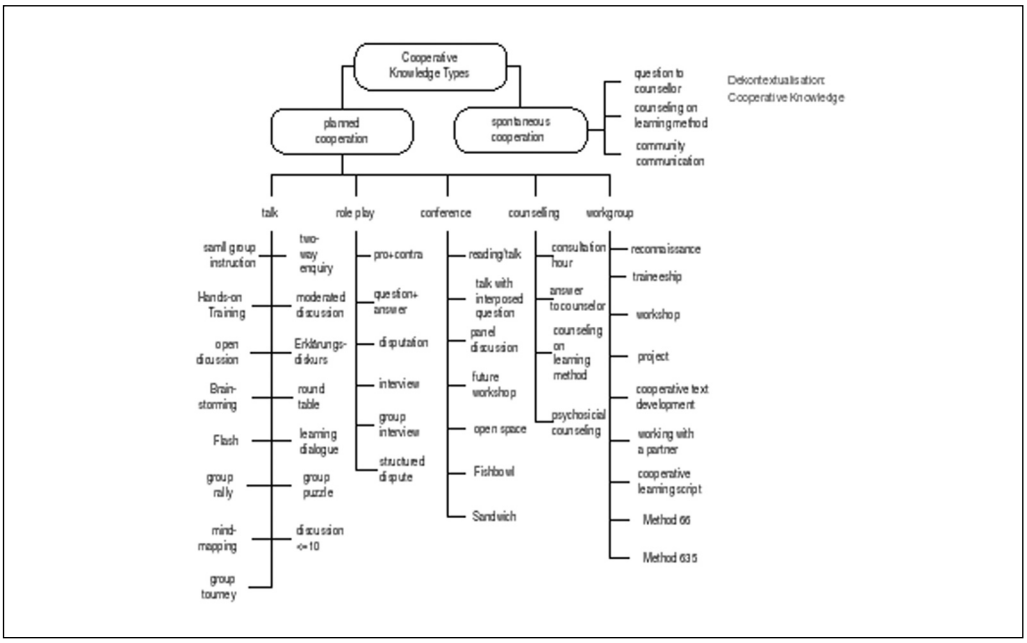
2.2.2 Interactive Knowledge

Interactive knowledge means that learners interact with the computer. Interaction with the computer takes place in assignments where the answers could be automatically evaluated and in simulations. Assignments that require cooperation with a teacher or other learners belong to the cooperative knowledge types.
Simulation is a versatile genre that could be used from social behaviour to technical controls. Most often the association with cooperative knowledge is sensible:



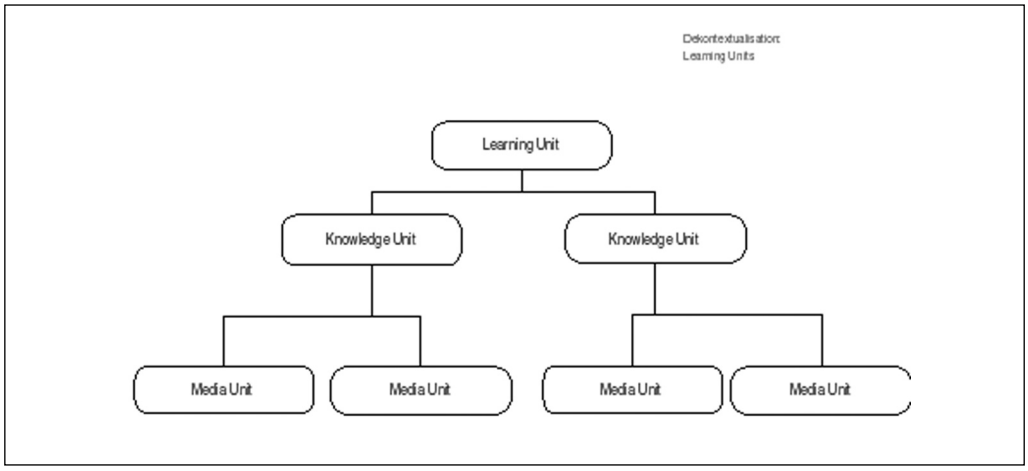
2.2.3 Cooperative Knowledge

Within cooperative knowledge learners communicate with other learners or teachers. We distinct spontaneous cooperations that could happen at any time from planned cooperations that are planned at certain point in a didactical model.
Planned cooperations are classified by group size. Consultations take place between two persons, learning conferences are planned for several hundred participants. The mentioned models are all well established and we already specified software requirements, but implementation only exists rudimentary. Empirical prove for the mentioned cooperations is therefore still a desideratum.
5-10 receptive, interactive or cooperative knowledge units are combined in a learning unit.



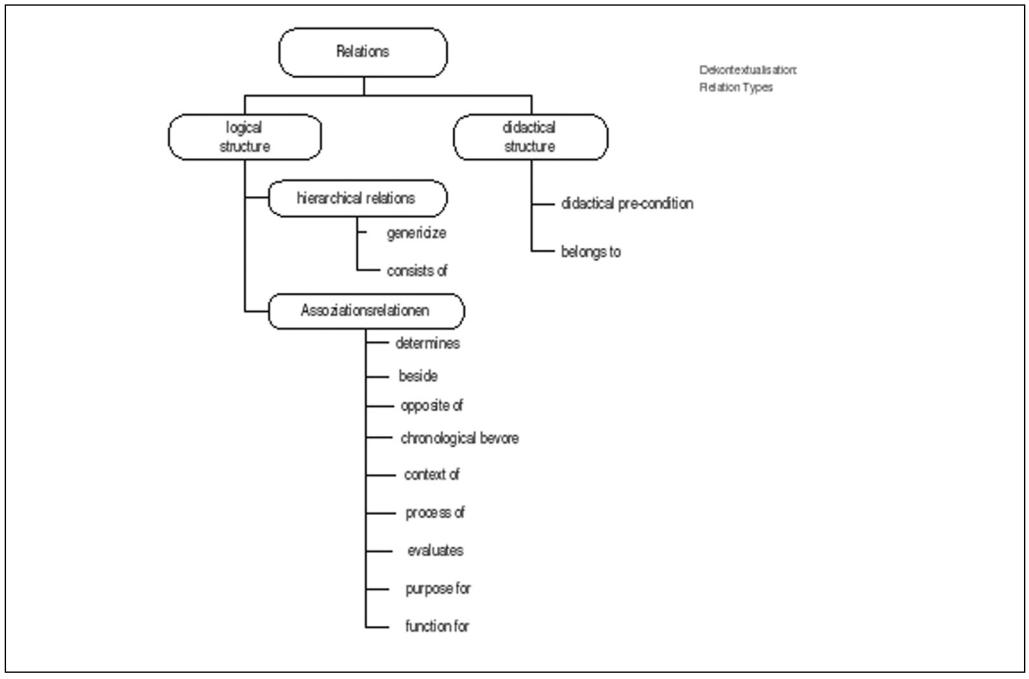
2.3 Learning Units

Learning units are the third level of decontextualisation. Learning units are defined by concepts. The navigation within concepts is highlighted in the drawing.
The distinction of media types, knowledge types and learning units makes up a hierarcical structure:



Learning units consist of knowledge units. Knowledge unit consist of media units. The network structure, that is typical for hypertext, seems to be missing. The network emerges from the following structure: The concepts of the learning unit are understood as thesaurus terms. A thesaurus term has to be unique, that is a term that occures only once in a knowledge base. The terms are linked not by a hierarchiy but through typed relations.
Terms linked with typed relations make up a knowledge network that consists of local hierarchies of knowledge types and media types. Relations make relevant concepts accessible within a media unit, when a concept is mentioned but not explained within a media unit. In this case the concept has to be made accessible through a relation to keep the coherence of the hypertext.

Which relation types have to be considered?



Relations Types are taken from thesaurus standards. Within thesauri hierarchical and associative relations are distinguished. Hierarchical relations reproduce concepts that are subordinated. Associative relations reproduce concepts that are co-subordinated.
Relations are used to map the logical structure of concepts. As the logical structure is often followed by didactical models logical structures could be used for didactical

design. Only in rare cases didactical steps are made across the logical structure In this cases didactical relations are used.
Relations make up the forth level of Web-Didactics and they are the last element for decontextualisation. We can summarize:

Web-Didactics as an ontology to prepare knowledge for learning by decontextualisation differentiates media types, knowledge types, index terms and relations. These types could be used as a vocabulary for meta data systems (e.g. IMS-LD). The graduation is orientated an the granularity of the screen.

A knowledge base that allows for varied individual navigation paths is set up by a systematical variation of media types, knowledge types and relations. How could didactical models be applied to such a knowledge base?

3. Recontextualisation

Recontextualisation is implemented by
- media models,
- micro models,
- macro models and
- course models.

3.1 Media Models

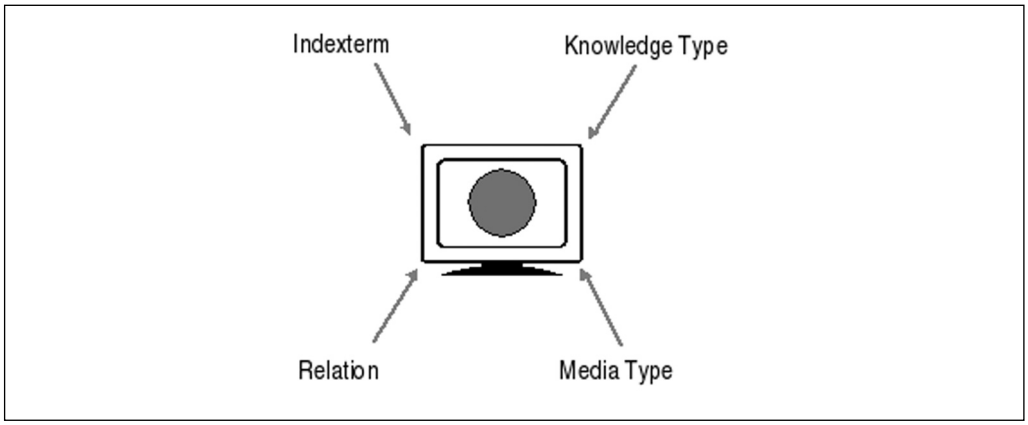
Didactical models are used for recontextualisation, that is the arrangement of screen pages within a didactical hypertext. As self-directed learning and dependent learning are necessarily aligned (Litt 1964), we have to take care for both ideas. Web-Didactics integrate self-directed and dependent learning by offering media-types, knowledge-types and index-terms as navigation aids. These navigation aids avoid cognitive overload and lost in hyperspace problems through their systematic structure. Thus learners are offered the possibility for self-directed learning.

For dependent learning the screen pages are arranged by applying didactical models to the meta data. How could this sequence be presented to learners?
Recontextualising screen pages by didactical models means to fix a certain sequence. This sequence can be offered to learners at the same time as the navigation aids, thus integrating self-directed and dependent learning.

The sequence leads by simple forward and backward buttons through the media types, knowledge types and learning units. In the screen shot above the backward button leads to the screen page containing an animation.

Didactical models are specified for every level of decontextulisation in Web-Didactics.

Which didactical models have to be taken into account?



Media types are ordered according to media models. There are two media models: from concrete to abstract and from abstract to concrete. The first model goes from concrete to abstract since fewer and fewer qualities of the object are represented: The word „tree" does not show much of a real tree, while a picture of a tree shows more qualities of the real tree.
In practice hardly every possible media type is produced. In most cases only one ore two media types are presented for every knowledge type. So how are the knowledge types sequenced?

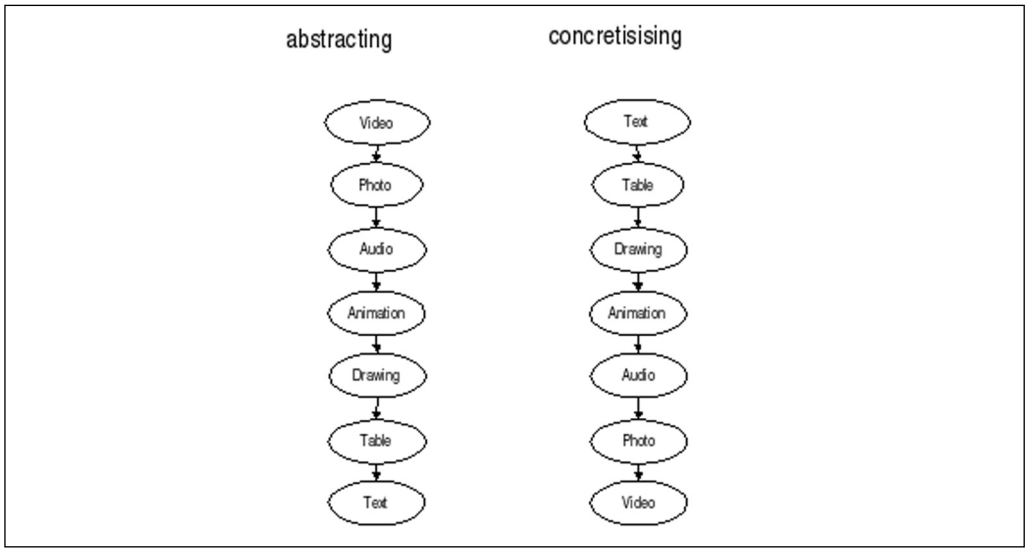
3.2 Micro Models

Knowledge types are sequenced by micro models. The next knowledge type is called if every media type within the knowledge type has been presented to the learner. Micro models are:

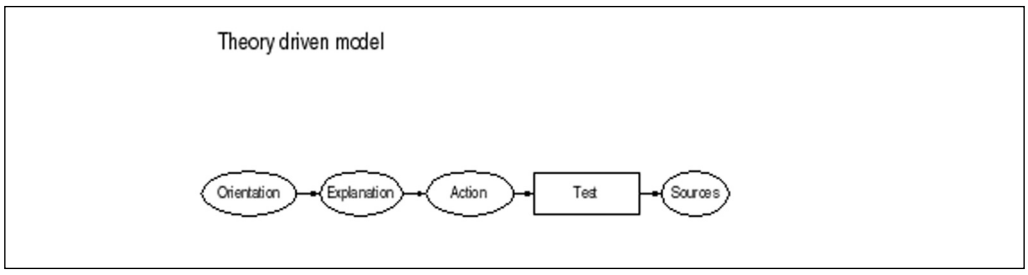
- example oriented models
- models according to Herbart
- learning by discovery
- task oriented models

- role based learning
- theory driven
- action oriented
- problem based learning

I will show the last three models exemplary:

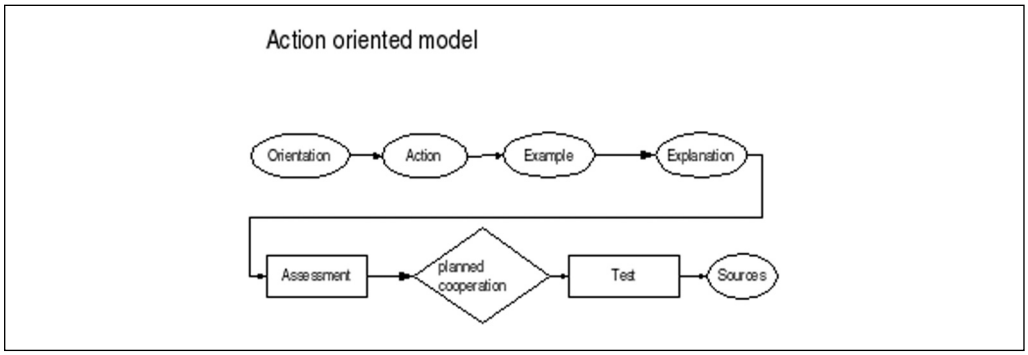


3.2.1 Theory driven



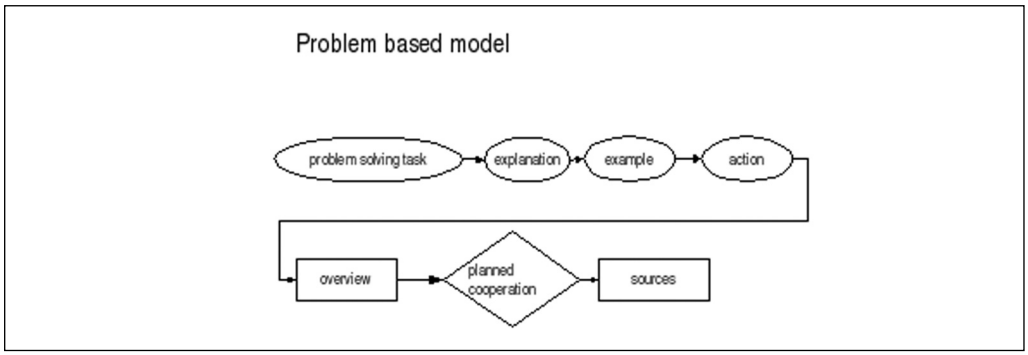
The drawing shows the theory driven micro model. The core is explanatory knowledge that contains the theory, understood as justification for knowledge. This model does not contain cooperative knowledge. It thus matches the requirements of the lonely learner.

3.2.2 Action oriented



The core of the action orientated micro model is action knowledge, that is to say it is placed early in the learning sequence. This model shows advantages derived from decontextualisation: By organising knowledge to media types, knowledge types and learning units it is possible to offer different didactical models without rearranging all of the knowledge for every model. As explanatory knowledge is used in the theory driven model and in the action oriented model the same knowledge unit will be presented to the learner. This allows for an effective reuse of knowledge units. This can also be seen on the problem based learning:

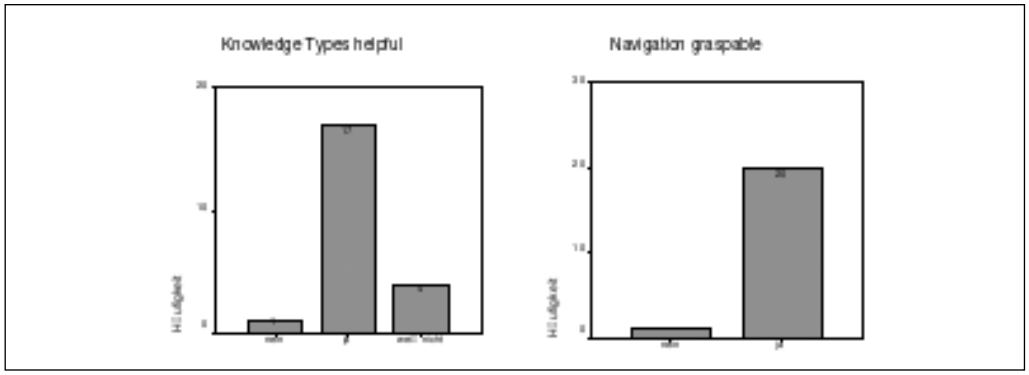
3.2.3 Problem based



The core of problem based learning is the task to be solved. Hence the task is presented at an early stage within the learning unit.
Problem based learning shows another thing to consider while using Web-Didactics: Learner do not need to complete the learning sequence: If learners are able to solve

the tasks without further knowledge, they can answer the question and skip to the next learning unit.
The presented micro models gave evidence that a great variety of didactical models could be realised by different sequences of media types, knowledge types and learning units. If the possibility of altering the media types, knowledge types and relations is considered too, the complexity of didactics shows up. To develop varieties matching the requirements of different cultures is an interesting task that requires empirical research.

3.3 Macro Models



The third level of decontextualisation covers the sequencing of learning units. The next learning unit is called if all media units and knowledge units within the learning units are passed through. Which didactical models can be differentiated on the third level? Didactical models on the third level are referred to as macro models. As micro models use one knowledge type as a key type, macro models use a relation type as a key type. Macro models that have been specified so far are (key relations in brackets):

- deductive model (hierarchical relations) with the varieties depth first and width first
- inductive model (hierarchical relations) with the varieties depth first and width first
- goal based bottom up (hierarchical relations)
- spiral model (context-of)
- constructive model (used-for)
- network model (all types)
- guides tour (didactical before).

As an example the drawing shows a simple hierarchy of learning units. The inductive model with width first sequences the learning unit as 4-5-2-6-7-3-1. The deductive model with depth first sequences the learning units as 1-2-4-5-3-6-7.

In bigger learning environments the learning units can be combined to courses. Between courses only the relations "generalize" and "beside" are used, accordingly only inductive and deductive strategies are used.

4. Empirical Studies

By decontextualising knowledge to a knowledge based on considering different didactical models it is made sure that different paths for individual navigation are available. At the same time the recontextualisiation enables the single learner to choose his own didactical model, as the application of the models to the metadata can be done by algorithms.

What do empirical studies show about the Web-Didactic?

One point we use quantitative studies for is to test the satisfaction of learners with knowledge types and navigation aids. The diagrams show results from a small seminar in a University (n=21). We asked learners if they feel that the knowledge types are helpful („Knowledge Types helpful") and if they fell they understood the navigation aids („Navigation graspable").

Results show that the knowledge types are accepted and the navigation aids where judged as helpful (Ja = Yes). Critical points where that we do not offer off line versions and that the content could not be downloaded at once.
For qualitative research we asked learner to use the platform while thinking aloud. We used a screen cam to record the visible screen and the verbal expressions. We analysed the recordings taking account for usability, navigational behaviour and knowledge reception.

Our analysis shows that learners understand the navigational aids very fast – even without any introduction (we gave learners just the task to learn something about a certain concept and the URL) the navigational aids are used intuitively. While learning learners use very different strategies for navigation. That shows that the aim of Web-Didactics, to support an individual navigation, is reached.

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Precise and Succinct Yet Interlinked Requirements for E-learning in the Workplace (On Microlearning)

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Abstract: The goal of the study 'Learning for Production' is to develop a concept for an E-learning system in collaboration with the workers. The workers are interested in small learning units; these units should also show the connections within the working process. They would like to learn theoretical knowledge and they asked how experience could be a part of the E-learning system. The paper focuses on the relation between these expectations and the necessary consequences for computer-aided learning systems with regard to the possibilities of micro learning.

0. Introduction

"Precise and succinct yet interlinked." This statement neatly summarizes the repeated demands made by skilled workers at a paper mill when interviewed about the design of E-learning modules during our study on "Learning for Production" (LfP).[1] This demand fits in very well with the idea of microlearning. Picking up on it, one could immediately start to develop small learning units, but that would be tantamount to taking the second step before the first.

In my opinion, too much emphasis has usually been placed on aspects of technology when developing E-learning systems, and not enough attention has been paid to what knowledge is required in specific learning and working situations and how this knowledge has been traditionally acquired. This information should affect the way knowledge is presented in E-learning programmes. The probable consequences of ignoring these factors are learning systems which do not correspond adequately to the requirements of the specific learning situation.

1 Head: Univ.-Prof. Dr. Christina Schachtner; Coordination: Mag. Gabriele Frankl; Colleagues: Angelika Hoeber, Ewald Rommé.

In this paper I would like to deal with this deficit by firstly looking at fundamental aspects of the constitution of knowledge in the workplace. I will then discuss the requirements for E-learning against this background. My remarks are mainly based on the study I mentioned at the beginning, the aim of which was to develop computer-aided learning software for initial and further in-house training programmes. In addition to an analysis of production processes in the paper industry, thematically structured interviews were carried out with the skilled workers in which they described what knowledge they require to carry out their work routines and to master critical situations. Finally, the skilled workers attended a workshop at which the various findings were discussed, clarified and evaluated. The situation-oriented participative research approach which was chosen starts from the assumption that precise knowledge of the circumstances in which the systems are to be used is required to design computer-aided learning software and that this knowledge can only be acquired by working together with potential users of the learning system.

1. What and how?

Generally speaking, it is the task of employees in production industries to ensure that production is trouble free (cf. Böhle 2004, 17), that any problems that arise are solved as quickly as possible and that quality is maintained. What knowledge do they need to achieve this? The reason why I asked that question is that the answer has to create the foundations for computer-aided learning software.

1.1 Theoretical knowledge and experience

All of the skilled workers interviewed in the paper factory agreed that the theoretical knowledge acquired during their apprenticeship was very important. They characterized it as background knowledge about the fundamental connections between various aspects of paper production. Theoretical knowledge includes information about work routines and general trouble-shooting. It is explicit, systematized, standard knowledge and thanks to these properties it can be integrated in a text-based learning system relatively easily. However, as the workers pointed out, theory alone is not enough to ensure qualified work on the shop floor. While theory tells you about the "road signs" or the general rules, additional knowledge is required to know how to react in concrete situations, and this knowledge is called experience. It is not only in this study that interviewees insisted that experience is indispensable. Similar results have also been obtained in other studies in the paper industry (cf. Krenn/Flecker 2000), in the metal producing industries (cf. Böhle 2004), in connection with project management (cf.

Porschen/Böhle 2005) and with doctors (cf. Schachtner 1999) and nursing staff (cf. Benner 1994).

What does experience involve? Amongst other things, experience includes a good feel for materials and machines, a good ear for the noises made by machines, lightning reactions to what is going on, knowledge of the "bugs" in systems and machines, foreseeing faults and the right instinct for sources of technical trouble (cf. Böhle 2004, 18). Knowledge of this nature is essential in order to recognize looming problems in production processes at an early stage and to intervene to deal with them; experience helps to interpret situations in all their complexity. As one skilled worker explained: "You always have to take account of so many factors, and just how easy that is for you largely depends on how much experience you have" (stock preparation worker, LfP).

According to Fritz Böhle's findings in the metal producing industries, skilled workers are able to diagnose and predict processes without stopping to analyse them (cf. Böhle 2004, 20). What is going on at any one point is interpreted by experienced workers in the light of what has happened previously. That hones their prediction skills: "You just have a feeling that something is going to happen" (quoted in Böhle, ibid.). An important facet of experience is knowledge of how things interact in situ, as illustrated by a skilled worker's comment analysing a crack in the paper: "You look at the web. Are there any indications of where the crack might have started? Is there any sedimentation? I'll be able to see it in the paper. Is there anything else I can see? Is there a clump somewhere on the edge? Then it'll crack at the edge" (foreman, LfP). Knowledge based on experience is founded on a close relation between worker and machine. "He (the worker) has to slowly build up a relationship with the machine" (LfP), a foreman explained. The intimacy required here demands a differentiated, emotional and sensorial relationship to the machine. It is not enough to follow standardized parameters in order to operate the paper-making machine successfully: "I have to be able to use my eyes. It doesn't make sense to tell you what speed I set the machine at. I have to take a look at it or sense it. That's what makes a machine operator with experience stand out" (foreman, LfP). Alongside looking, listening to the noises made by the machine is also important, as is the sense of smell, e.g. when the bearings overheat, and the sense of touch, e.g. when assessing the quality of the paper. Building up a relationship with the machine, as the foreman put it, means becoming sensitized to the peculiarities of the technology, being able to identify changes and setting the machine code to cope with changes in the raw materials. Experts operating the machine see a situation and know what has to be done; they act intuitively, backed up by their experience.

1.2 How has experience-based expertise been acquired to date?

When I know something about how expertise is acquired, I can draw conclusions relating to the didactic design of an E-learning system. Generally, the paper workers recommend learning on the job, in front of the equipment, either by observing or by being trained by experienced workers: "To start with the apprentices get to know the general surroundings, where things are and what things are happening (...) and then you have to tell them how you can influence certain things" (1st assistant, LfP). On the basis of this knowledge, which can be defined as basic knowledge, the apprentices have to make their own experiences with what is going on. Learning by doing is stressed as the most important way of appropriating knowledge: "I have to do it myself and then I know, aha, that's how it works" (1st assistant, LfP). Seen from the point of view of learning, when a mistake is made, it forces learning to take place, as was repeatedly emphasized. "Pushing the wrong button is the best way of learning" (1st assistant, LfP). Mistakes initiate learning processes with lasting effect because people are emotionally involved in what they have done wrong; they are annoyed, embarrassed or frustrated.

The high status accorded to experience by workers in the paper and metal industries as a way of acquiring knowledge is confirmed in the educational approach formulated by John Dewey: "The analysis and rearrangement of facts which is indispensable to the growth of knowledge and power of explanation and right classification cannot be attained purely mentally – just inside the head. Men have to do something to the thing when they wish to find out something; they have to alter conditions" (Dewey 1949, 359).

2. Gearwheels which mesh: How to integrate theory and experience

Just to pose the question again: What is the relationship between theory and knowledge when performing tasks at work? The answer to this question provides clues on how to combine both forms of knowledge in computer-aided learning software.
Knowledge from experience is object oriented and work related knowledge; in contrast to theoretical knowledge, it is geared towards particularities. It is implicit knowledge in the form of feelings, premonitions and hunches; it is holistic knowledge imbued with sensorial perceptions, emotional impressions and thought processes.
Just because I am giving more space in my paper to experience as a form of knowledge and a skill than to theoretical knowledge, does not imply that theoretical knowledge is less important. It is rather more a question of combining both pools of

knowledge when dealing with work routines, or as a worker in the paper industry put it: "It's like when one gear meshes with another, you need both of them". The expertise of a skilled worker consists in putting general theoretical knowledge into practice and in making flexible use of this knowledge, as one worker explained: "I can't say which switch has to be operated when a red light goes on as it's not always the same switch. Once it's this switch and once it's that switch, and that's why I need experience so that I can be flexible" (1st assistant, LfP). It is experience which allows skilled workers to be flexible.

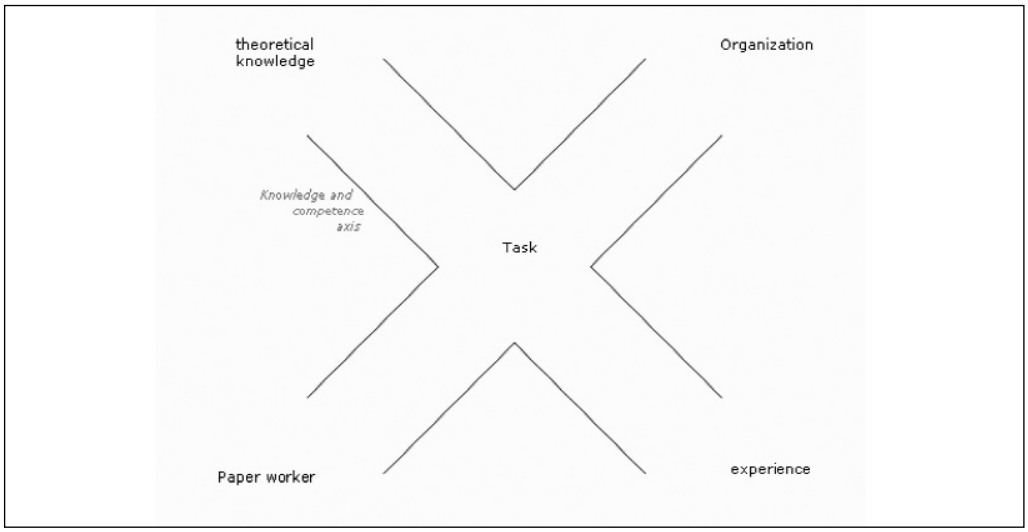

Illustration 1: Gearwheels which mesh

Thus knowledge born of experience has just an important function as theoretical knowledge when acting and reacting appropriately in the working process. Irrespective of this function, experience tends not to have been appreciated very much so far in industrial science and in practice. The extent to which a task or job is considered qualified depends on the extent to which theoretical knowledge and abstract thinking are required. Occupational qualifications are based on a model of scheduled-rational actions while feelings and impressions, the senses and the body are classified as contributing less to knowledge (cf. Böhle, 2004, 18). This failure to recognize the importance of unfolding "subjektivierendes Arbeitshandeln" (one's subjectivity in the working process), as Fritz Böhle defines it, is the same as reducing the workers' opportunity to build up an sensorial relationship to a machine, as production processes become increasingly encapsulated.

E-learning systems also follow this trend, particularly when they reproduce the dominance of theoretical knowledge over experience with the help of computer software. This is to be expected as it is extremely difficult to develop software which takes vague, implicit, physically and sensorially related experience into account as software developing is dependent on knowledge being explicit, nameable and unambiguous. Nevertheless, it is imperative that the knowledge from experience is not ignored, unless E-learning is "pre-programmed" to fail.

3. E-learning as integrated learning

I would now like to discuss two possibilities of taking experience into account when designing computer-aided learning software: on the one hand, experience can be integrated in the learning units and on the other hand learning situations can be created which combine online and offline learning. I would like to fall back on suggestions which were developed during the "Learning for Production" project, without restricting myself just to these suggestions, and finally I will look into the possibilities of micro learning.

3.1 The integration of experience in learning systems

One way of integrating experience into learning systems is to transfer the logic of learning from experience into the system. This can happen in the form of learning paths which can branch off time and again. This gives the learner the possibility both to gain deeper understanding of specific aspects of a production process and to gain insights into how this operation relates to other operations. The learner has to make decisions as to which learning path is chosen.
Learners have the opportunity to acquire closely connected knowledge because the work process is reproduced more realistically than with a linear structure. Having the potential to branch off at any point, the learning paths follow the typical networked logic which constitutes the acquisition of experience on the job based on the interaction between the individual and the machine. A second opportunity to include connective logic in an interactive way is in the form of experimental action based on simulations, something which Gabriele Frankl will deal with in her paper in more detail.

3.2 Blended learning

The second possibility to allow enough space for acquiring experience in the context of computer-aided learning is so-called blended learning. A concrete example of this is

writing experience journals in the form of weblogs, which particularly give apprentices and workers the opportunity to record observations on the job during training phases, e.g. when inspecting the machinery, in critical situations (cracks in the paper) or during repair and modification work. Recording their observations helps trainees to hone their skills of perception offline, to become more aware of what they have seen or heard by having to express it in writing and to profit from the observations of others. The experience journal has a communicative component which is typical for the acquisition of experience on the job. Discussion forums offer another possibility to exploit communication for the acquisition of knowledge in that experienced workers can provide the answers to questions posed by the apprentices. This online dialogue between the generations can even help preserve knowledge for both individual workers and the company as a whole which would otherwise be easily lost when older employees leave the company.

Research in industrial science has shown that story telling, or simply talking about work and machines, is an informal yet central component in experience-governed cooperation (cf. Porschen/Böhle 2005). It takes place during breaks and often even begins at the breakfast table, once again illustrating that the acquisition of knowledge is closely associated with communicative settings. Story telling in the company is a further starting point for blended learning, for example by retaining niches offline and extending them into virtual space, in the form of regular chats under the title of "Talking about Machines" (Orr 1996) in which everybody can take part who has the time and desire to do so.

3.3 Microlearning

Microlearning using small handheld computers extends the possibilities of learning on the job and communicative learning in the production process. Trainees could use portable computers to display explanations about how the machine works, while they are standing by the machine. The computers could also be used as digital advisors to help repair faults. When the small computers have communicative applications, they could be used to consult experienced colleagues who are not available on the spot but who have expert knowledge. It is not, however, clear whether the use of portable computers while working on a machine contravenes safety regulations. In any case they could be used for training purposes. Apprentices could be given the task of inspecting the machinery and finding out more about the machine and its functions online while being able to look at the actual machine. It is also conceivable that trainees could follow a recommended learning path or select what they want to learn themselves, thus encouraging individual learning.

Something mentioned by the interviewees that I referred to right at the start was small, precise units. This wish reflects the intentions of micro learning in an ideal way although I do see a contradiction in the demand for short learning units with the demand for emphasizing interrelated themes. Maybe this dilemma can be avoided by not even attempting to precisely describe a process or alternative ways of acting on the screen but by deliberately choosing concepts which require interpretation, i.e. which appeal to experience.

In conclusion, I would like to emphasize that E-learning and microlearning can provide new impulses for learning on the job. They only gain this innovative strength, however, when the starting point is the complex knowledge required in the work process and the specific forms of acquiring knowledge and not the technical possibilities.

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Snips & Spaces: Managing Microlearning (On Microlearning and Microknowledge in a Microcontent-based Web)

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Abstract: Radically lowering "barriers to publish", wikis and weblogs are rapidly gaining acceptance as simple and hassle-free ways to share and link information in a community of interest (or overlapping communities of interest). Based on a working definition of microlearning as learning from microformats, we discuss the characteristics of both formats and outline problems that may arise in a microlearning context. We propose that by combining both formats to form an integrated whole, those problems can be largely solved. This is complemented by a description of several aspects of Vanilla, a system based on this idea.

1. Microlearning

We understand microlearning primarily as learning from microcontent[1] – from *"small pieces, loosely joined"* (Weinberger 2002).

Microlearning as a term reflects the emerging reality of the ever-increasing fragmentation of both information sources and information units used for learning, especially in fast-moving areas which see rapid development and a constantly high degree of change.

While in the past a single authoritative work (or even a single authoritative teacher) may have been all that was necessary to sufficiently acquaint oneself with a given topic of interest, this is increasingly untrue, especially as the necessity to (quickly) learn (a lot) extends into almost everyone's work life.

Books, magazine articles, a multitude of web resources (like online books, tutorials, encyclopedias, forum and weblog postings, emails and comprehensive teaching mate-

1 As defined by Nova Spivack: http://novaspivack.typepad.com/nova_spivacks_weblog/2003/12/defining_microc.html (accessed Jun, 2005)

rial collections as produced by MIT's OpenCourseWare[2] project or the Connexions[3] effort hosted at Rice University) form essential ingredients of the source mix of almost any non-institutionalized learning effort – and, increasingly, of many institutionalized efforts as well.

Fragmentation of sources has both positive and negative aspects. From a producer's standpoint, information fragments are much easier to create than larger works. Furthermore, disaggregated content – theoretically – can be re-aggregated to optimally suit an individual learner's preferences (instead of the needs of an idealized common denominator). The other side of the coin is that a significant fraction of the consolidation and organization effort is shifted towards the learner.

It will increasingly be the task of microlearning management systems to assist the learner (or group of learners) to consolidate information gleaned from such disparate sources into a coherent whole. We see personal knowledge mapping as enabled by combined wiki/weblog software as a first step in that direction.

Based on our working definition of microlearning, a microlearning management tool should assist an individual learner or a group of learners in
- stating a plan of learning,
- representing recognized concepts and the relations between them,
- attaching relevant information to those concepts,
- and, ideally, guide further exploration.

2. Weblogs

2.1 Introducing Weblogs

In only a couple of years, weblogs have gone from fringe to mass phenomenon. The format of reverse-chronological short articles with lots of links has existed since the earliest days of the web, but only in 1999 the terms "weblog" and "blog" gained traction; one of the effects was a surge in self-awareness (some might say self-obsession) of the then small community of webloggers.

2 http://ocw.mit.edu/ (accessed Jun, 2005)
3 http://cnx.rice.edu/ (accessed Jun, 2005)

Theoretically, weblogs can be created without dedicated tools at all. A simple text editor suffices. However, dedicated weblogging software like Blogger, Manila and Antville emerged quickly, relieving publishers of routine chores like uploading HTML pages to a server and manually moving articles to archive pages. Those tools played an essential role in the popularization of the format. In Rebecca Blood's words: "[...] *the bandwagon-jumping turned into an explosion*" (Blood 2000).

Soon, the simple format began to evolve, and today features like accepting comments from visitors, "permalinks" and trackbacks are almost universally supported. Some of those concepts warrant further discussion.

Permalinks ("permanent links") emerged when people began to refer to other people's postings. When linking only to the frontpage of a weblog (as was common in the beginning), the referenced posting might have disappeared into the archive already when a reader followed said link (often providing crucial context necessary to understand the referencing posting). Permalinks allow authors to address individual postings (or even smaller units of information like paragraphs) permanently, whether they are still visible on the front page or not. This allows readers to track cross-weblog threads of discussion.

Trackbacks enable authors to notify other weblog owners of the fact that they referenced one of their postings.

Another noteworthy development which originated within the weblog community are "really simple syndication" standards like RSS and Atom. Those were developed primarily in order to make the consumption of a large number of weblogs feasible in the first place (Robert Scoble[4]: *"But, remember, I read 1000 blogs [...]"*), relieving the reader of having to surf through a long chain of weblogs again and again – only to find out that on many, nothing new had appeared since the last visit.

In the context of education, many lecturers have embraced weblogs as a natural communication medium providing everything from slide sets, supplemental links touching on relevant issues discussed in the last lecture to administrativa like cancellation announcements.

For additional background on weblogs, the interested reader is referred to Blood (2000), Winer (2003) or the German article by Praschl (2001).

4 http://radio.weblogs.com/0001011/2004/11/28.html (accessed Jun, 2005)

2.2 Problems with Weblogs

The biggest problem of weblogs in the context of microlearning management is that in many cases, the potentially valuable and relevant archived body of information is not used to full effect.

Remembering, finding and referencing archived postings are not particularly well-supported activities in most weblog publishing systems, the root cause being the limited facilities commonly provided to relate and organize individual items.

Apart from the format-native organizational principle of time (e.g. monthly archives), most current weblog publishing systems either

- do not support categorization at all (Blogger),
- only allow a single category per posting (Antville) or
- make creating new categories comparatively cumbersome, with the predictable result that the set of said categories often remains relatively small and static.

Overly coarse-grained categorization in turn results in overloaded category overview pages, severely limiting their usefulness.

Recently, ad-hoc tagging as known from del.icio.us and Flickr has been implemented for weblog publishing systems as well[5]. If current practice as observed on del.icio.us is an indicator, it can be expected that this scheme will result in significantly finer-grained categorization.

Another issue is that representing lexical knowledge – information about companies, products, people, books, etc. and the relations between them – does not fit well with the mainly narrative-focused approach traditionally encouraged. This limits the usefulness of weblogs as personal knowledge mapping tools.

5 See e.g. "Jerome's Keywords" by Jerome Lavigne: http://vapourtrails.ca/wp-keywords (accessed Jun, 2005)

3. Wikis

3.1 Introducing Wikis

A wiki is a web application that enables any user to easily add to and modify a collection of interlinked snippets of information. We argue that three aspects are fundamental to a wiki:

- Snips and spaces
- Effective support for content creation and modification
- Ridiculously easy linking

3.1.1 Snips and Spaces

A wiki is generally understood to be a web site where any user is allowed to add, modify or delete a significant fraction of the content present. The following definitions from two of the most important sources regarding wikis capture that common ground very well:

> "*A Wiki [..] is a web application that allows users to add content, as on an Internet forum, but also allows anyone to edit the content.*"
> *— Wikipedia*[6]

> *"[A wiki is a] freely expandable collection of interlinked Web 'pages,' a hypertext system for storing and modifying information – a database, where each page is easily editable by any user with a forms-capable Web browser client."*
> *— Leuf & Cunningham (2001)*

Beyond this general agreement, terminology used to describe and discuss wikis is ambiguous. The term wiki itself is widely used to refer to both

- a particular web site that embraces the wiki fundamentals – as in "the C2 wiki" and
- a particular web application that can be used to maintain such web sites – as in "the Vanilla wiki".

We use the term "space" to refer to the former. A space is a web site (supported by wiki technology) that consists of a collection of pages or snips. We strongly prefer the term "snip" for two reasons: it disambiguates discussion between web-pages (pages)

6 http://en.wikipedia.org/wiki/Wiki (accessed Jun, 2005)

and wiki-pages (snips) and it aptly depicts the typical nature of wiki-pages in a personal learning context – small snippets of information related to a specific concept.

3.1.2 Effective Support for Content Creation and Modification

The "effective" here refers to two things: content management facilities must be easy to use and easy to discover. Discoverability (and therefore a low entrance barrier) is typically achieved by placing an "edit" button prominently on each page (see Figure 1). Snip creation facilities vary among wiki implementations, some enforce a policy that new snips ought to be created only when the (not-yet existing) snip is linked to from some other snip – wikis typically present a "create" link in those situations (see Figure 2). This policy stems from the belief that all wiki snips should be interlinked – no insular snip shall exist. Other implementations simply provide an additional "create new snip" button.

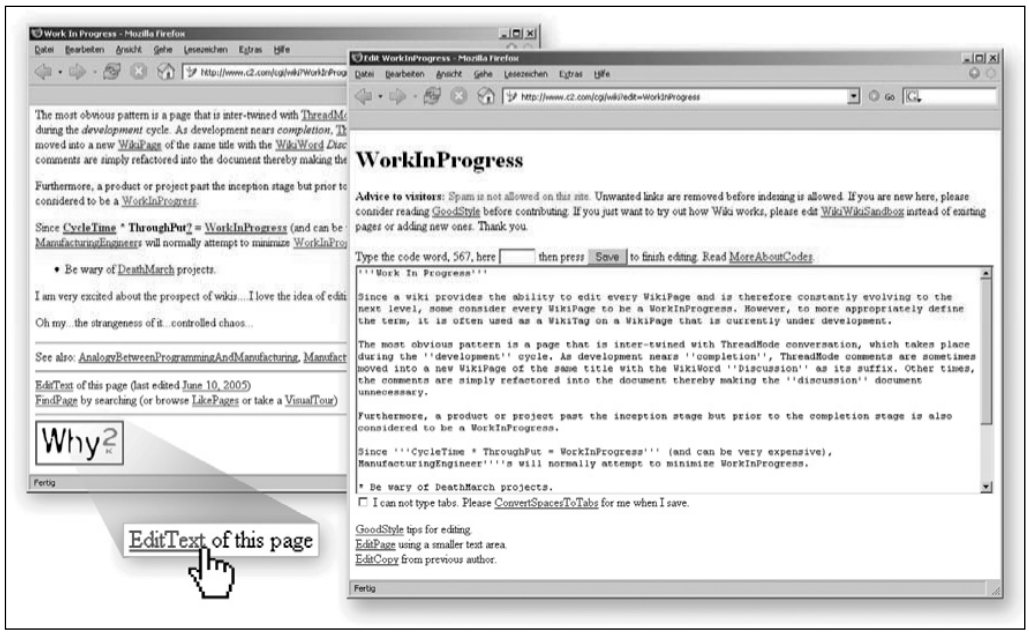

Figure 1: The infamous "edit" link

To facilitate easy editing, a simple markup language for snip content is usually provided. No standard has emerged yet, so wiki implementations differ substantially in the markup capabilities provided – but some functionality is common to most. Important,

obviously, are means for linking to other snips. Traditional wiki implementations like the C2 wiki[7] use the CamelCase convention for linking, under which snips are named by joining capitalized words (a snip on the Portland Pattern Repository which discusses this convention is named JoinCapitalizedWords, for example). As this convention is certainly counter-intuitive for wiki novices, we will not discuss it and the associated advantages and problems here.[8]

More recent implementations abandoned the CamelCase convention for something less idiosyncratic. Snips can be named freely and links to other snips can be established by surrounding the name of the target snip with minor markup like two rectangular brackets (MediaWiki), asterisks (Vanilla) or similar. So to link to a snip named "Microlearning 2005" one would simply write [[Microlearning 2005]] or *Microlearning 2005* (cf. the right part of Figure 2).

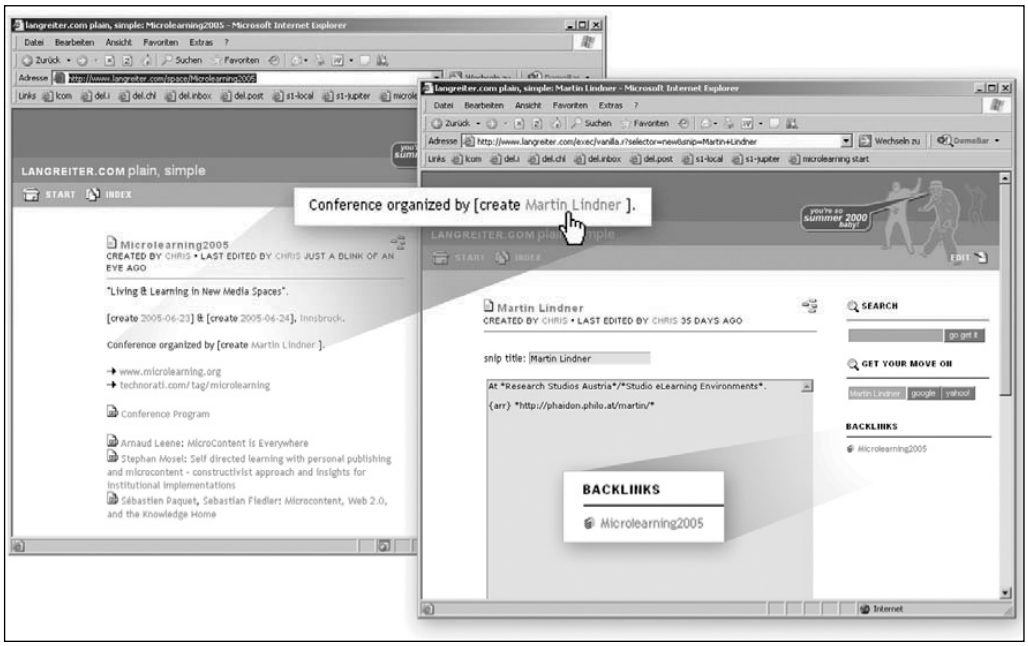

Figure 2: A create link, link markup, backlinks

7 The first Wiki, created by Ward Cunningham in 1996 - http://www.c2.com/cgi/wiki (accessed Jun, 2005)

8 The following places provide an introduction to the discussion:
- http://www.c2.com/cgi/wiki?JoinCapitalizedWords (accessed Jun, 2005)
- http://en.wikipedia.org/wiki/CamelCase (accessed Jun, 2005)

Beyond link markup, typically various text formatting options are supported. Capabilities encountered range from simple things like boldface or italics formatting to support for laying out complex tables or even creating diagrams. Furthermore, some implementations allow the use of full HTML for advanced users, others provide a WYSIWYG editor.

3.1.3 Ridiculously Easy Linking

While the "anyone can edit everything" functionality is well-understood and prominently featured as a fundamental wiki principle in almost every article discussing wikis, we argue that another aspect is at least as important. Over a decade after the creation of the web, we got used to interlinked information. The key to wikis is that they make fundamental hypertext ideas so ridiculously easy to access that applying them becomes second nature. Creation and maintenance of links is a no-brainer in a wiki. Links – and the functions enabled by them – are central to the power of wikis.

> *"We should work toward a universal linked information system"*
> *— Berners-Lee (1989)*

The importance of the link was obviously appreciated by Tim Berners-Lee in his seminal work that lead to the creation of the World Wide Web. But wikis are able to provide functionality that goes beyond what unidirectional HTML links can support. As a wiki space is a closed, self-contained entity, links between snips are fully bidirectional, i.e. not only outgoing links of any snip are known, but also the incoming links (cf. Figure 3). Those are usually referred to as "backlinks." We will expand on the power of backlinks in Sect. 4.

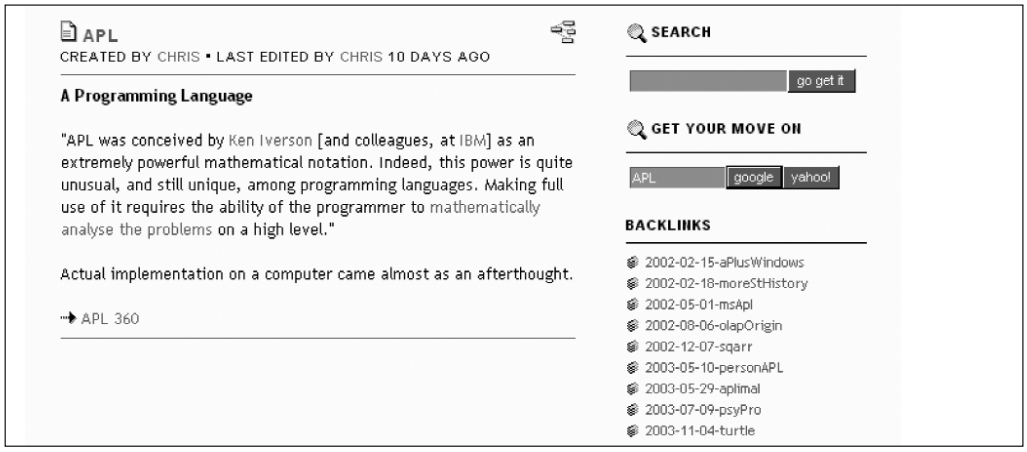

Figure 3: Backlinks displayed in a sidebar

"Intertwingularity is not generally acknowledged – people keep pretending they can make things deeply hierarchical, categorizable and sequential when they can't. Everything is deeply intertwingled."
— Nelson (1974)

It is through the clever use of hypertext features a wiki achieves its flexibility. Links can be used to establish almost any kind of structure over the underlying content snippets, and indeed, even multiple structural views can be provided in parallel.

Classical hierarchies pose a barrier to quick content creation. Unless something fits perfectly into one of the available drawers, attention of the content creator is drained by the ever-nagging question "now where the heck shall I put this?" Using bidirectional linking, a hierarchical structure can easily be established. The original Portland Pattern Repository (the "C2 wiki") employs backlinks to categorize snips[9], a pattern later adopted by Wikipedia[10]. We will briefly describe how this works in Sect. 4.

> "*A Wiki, a free form, unstructured space, is like a room. A room can be used for anything. For meetings, for sleeping, for swimming (provided it has a pool), but a room is just a space. And to the people using the room, that space becomes a place. A place to situation themselves, a place to call home, a place to organize themselves, or a place to orient from.*"
> — *Meatball*[11]

The three fundamental principles of the wiki result in an extremely flexible medium, aptly described on Meatball wiki by analogy to a room.

Contemporary wiki implementations supplant those basic features with a slew of useful extensions. While the totally open nature is appropriate in some situations, personal wikis or wikis supporting small project teams often require access control, a feature found in almost every modern wiki implementation. Another widespread piece of functionality is snip revision control, which not only aids against vandalism in totally open wikis but also supports cooperative document creation or similar tasks in project scenarios.

Full-text search with results sorted by relevance is a natural and important complement to the hypertextual "browsing" typically used to retrieve information from a

9 cf. http://www.c2.com/cgi/wiki?CategoryCategory (accessed Jun, 2005)
10 cf. http://en.wikipedia.org/wiki/Wikipedia:Categorization (accessed Jun, 2005)
11 http://www.usemod.com/cgi-bin/mb.pl?WikiAsRoom (accessed Jun, 2005)

space. Especially useful in wikis targeted at personal learning support or smaller project teams is an attachment feature, where arbitrary files can be attached to a snip. This effectively extends the wiki to also become a document repository; current implementations are, however, typically rather basic.

A list of "recent changes", i.e. pages that were created/modified during a certain time period, helps users in watching the activity on a wiki. "Cross-pollination" from weblog publishing tools resulted in the availability of the recent changes list as RSS feed or similar formats. Further, comment systems in the style of those found on weblogs or web forums are incorporated into some wikis to replace the discussion method used in traditional wikis, where users wanting to discuss a certain paragraph in a snip simply append their contribution indented right below the paragraph in question.

Plug-in mechanisms and/or macro facilities allow wikis to be used as small-scale web application development frameworks and provide powerful tools for experimentation. In Vanilla, for example, most of the features (snip attachments, full-text search etc.) are implemented as plug-ins on top of a slim wiki "core".

3.2 Problems with Wikis

Traditional wikis not enriched with weblog functionality suffer from a set of problems which are mostly inherent in the format ("problems of format"). Furthermore, wikis in general also suffer from a "problem of perception". We use this to describe the phenomenon that wikis are widely perceived as exclusively collaborative tools. This perception obviously hinders adoption for personal microlearning purposes and can only be overcome by further research and proper communication of the possibilities of wikis in this context.

A major problem with the format is the lack of guidance. Using the "Wiki as Room" analogy mentioned before, people confronted with an empty room do not immediately appreciate what can be possibly made of that room. In another situation, a person entering a multi-floor building is certainly not aware of "what's going on" in that building.

While helping users with initially getting acquainted with a corpus of content is typically achieved through "entrance" or "guided tour" snips, users who actively want to watch the progress on a given wiki are usually left with only the recent changes lists. In active wikis where lots of different threads are developing simultaneously those recent changes lists can quickly get overwhelming. Voß (2005) measured the change rate of the English Wikipedia at an average of 16 changes per minute and while this is

certainly an extreme example, it makes obvious the fact that even far less active wikis cannot be completely monitored by a single user. Traditional wikis lack effective means for providing a condensed, edited summary of what is happening inside the space.

> *"[People] either fall in love with the use of hypertext on Wikis or they run away screaming"*
> *— Angeles (2004)*

People trying to establish a personal wiki are often intimidated by the "empty space" they are initially confronted with. Questions like "what should I put into it?", "how should I name things?", "how can I structure my thoughts?" result in a considerable entrance barrier. Those questions arise because a wiki can be used for almost everything (at least that is how they are typically promoted). This naturally leads to confusion – what is "everything"? Those who already drank the wiki kool-aid are regularly baffled by those problems – they have already found their personal nail to use the wiki-hammer for.

But even advanced users are confronted with problems inherent in the format. A wiki has no natural or obvious place where information snippets that are to be recorded for later reference (clippings) can be stored. Every page stored in a wiki must be named, so there is a certain burden on the user to come up with proper names. But some pieces of information simply resist attempts to be named at the moment they are recorded – as in situations where the user has no or limited knowledge of the field of information the piece is related to. Traditional wikis have no practical facility to handle ephemeral notes and observations.

And finally, even a feature as fundamental as bidirectional linking is underrepresented and underused in traditional wikis. Usually, backlinks are not displayed along with the content of a snip but are only accessible through an explicit request by the user (for example by clicking on the snip title). Once requested, only the backlinks are displayed, so the user has to switch between content and context. This severely reduces the value of backlinks as "context providers".

4 Combining Wikis and Weblogs

We argue that some weaknesses of the two formats – wikis and weblogs – can be overcome simply by combining and integrating them. This claim is supported by several years of experience with using, developing and observing the use of the first

combined wiki/weblog tool, Vanilla[12]. Such combined wiki/weblog systems are also commonly referred to as "Blikis" or "Wikilogs".

Vanilla was originally developed by Christian Langreiter as a testbed for experiments in web application design in late 1999 and has since been developed by Christian Langreiter, Andreas Bolka and a group of contributors. The original inspirations were exposure to the Swiki wiki implementation and the release of Userland's Manila content management system, which was one of the first CMSes to embrace weblog functionality as conceptual cornerstone.

It soon became obvious that both weblog postings and wiki snips are fundamentally similar. Both are small snippets of information (hence the term snip), and by adopting a simple naming convention (YYYY-MM-DD) for weblog snips, a couple of lines of plug-in code ("dynasnips" in Vanilla parlance) would be sufficient to appropriately render weblogs in the familiar reverse-chronological order.

A significant portion of common wiki functionality can be reframed and understood as a "dynamic view" onto the contents of a space: recent changes are a limited (filtered) view sorted by the date of last modification. An index is a full view, sorted lexicographically. Backlinks are a view of snips which link to the current snip. Full-text search results are an ad-hoc view defined via user-provided criteria. And, ultimately, a weblog is nothing but a limited view over snips following a certain naming convention, sorted reverse-chronologically.

It should be noted that this paradigm of decomposing information into small, easily consumed, easily (re-)arranged units and then proceeding to provide dynamic views upon such collections is rapidly gaining favor. On the decomposition side this is evidenced by the enthusiasm surrounding microcontent formats/microformats (hCalendar etc.). Dynamic views as supplement (and in many cases, replacement) to the rigid, hierarchical folder structures of desktop operating systems, mail clients and other "productivity" software have recently been implemented in mainstream software like Apple's iTunes ("Smart Playlists"), MacOS X Finder ("Smart Folders") and various email clients ("Virtual Folders", e.g. in Novell Evolution, Mozilla Thunderbird or TheBat!).

12 http://www.vanillasite.at/ (accessed Jun, 2005)

4.1 Benefits of Adding Weblog Functionality to Wikis

Lower barrier of entry: When introducing wikis and weblogs to new project teams, it has been observed again and again that of the two formats, weblogs provide the lower barrier of entry. Usually it takes a while before opportunities to use wiki functionality are recognized; the value of weblogs as project communication tool however is intuitively obvious upon first contact.

By starting with weblogging in a learning context, the situations where a user wants to gather background information related to certain concepts naturally arise. In a tightly integrated system like Vanilla, the writer of a weblog entry only has to surround a reference to the concept to be expanded on with asterisks – after storing the weblog entry, a link will be displayed that allows to immediately create the wiki snip.

It is through this combination of easy-to-grasp weblog functionality and the seamless availability of wiki functionality that a smooth progression towards using the full power of the wikis is enabled.

Narrative glue: Weblogs are often used to provide contextualizing narrative to an effort. In a combined wiki/weblog, this narrative can serve as the glue between otherwise disconnected information fragments. This also helps to overcome the problem of overwhelming recent changes lists by providing a human-edited view, a window into the wiki space. Jon Udell (2001) precisely describes the value of such a "storytelling" facility.

> *"[Weblogging is] a powerful new way to tell stories that refer to, and make sense of, the documents and messages that we create and exchange in our professional lives."*
> *— Udell (2001)*

Short-term memory: The problems related to storing ephemeral information in a sensible way are effectively eliminated by using the weblog as "dump" for interesting news and information snippets with appropriate links to the rest of the space. Through those links, these small notes are interconnected and therefore retrievable through a variety of means (full-text search, browsing) or even automatically visible through a permanently visible backlinks list.

An interesting effect arises out of the fact that a weblog view typically lists only a certain number of postings (e.g. the most recent 10 postings or the postings of the

last month). As such postings are visible on the front page for a limited amount of time only; the weblog can be regarded as the "short-term memory" of a wiki. Ephemeral weblog postings stay around for a few days and then vanish (metaphorically speaking) into the subconsciousness of the space.

4.2 Benefits of Adding Wiki Functionality to Weblogs

Obviously, the place for storing lexical knowledge that is missing in a weblog is provided by the supplemental wiki functionality. As soon as weblog entries ("weblog snips") are linked to other snips ("wiki snips"), a number of interesting synergetic effects can be observed.

The aforementioned problems of remembering and referencing weblog entries are alleviated. The archived body of information in weblog entries stays readily accessible – backlinks from non-weblog snips to weblog snips contextualize weblog information, which in turn leads to serendipitous remembering of postings. Referencing a weblog posting (which is nothing but a snip following a certain naming convention) is as easy as referencing any other snip.

Figure 4: The backlink browser

In contrast to many other wiki implementations, backlinks are always visible in Vanilla. In combination with the weblog functionality, a special tool called the "backlink browser" easily allows to track contact with certain topics over time (see Figure 4).

Generally, bi-directional links provide a rather surprising flexibility in building all kinds of information structures. Categorization can be maintained by simply linking "content" snips to "category" snips. For example, a snip about "K" would link to a "Category Programming Language" snip. The backlinks of a category snip then automatically form the list of all snips belonging to a category. Even "tagging", as has recently become popular, can be subsumed by this functionality with ease: no one restrains the author from placing multiple links to different "category" snips. Add sweet user-interface sugar consisting of powerful pivoting and browsing functions and have your delicious, tag-enabled wiki served ice-cold.

5. Future Directions

5.1 Profile-driven Information Filtering

Interest profiles have been used to filter and personalize large information collections for a long time, with varying degrees of success. Two axes along which profile-driven filtering systems can be categorized are:

- Mode of data collection - implicit (side-effect of primary user action, like buying a book) or explicit (solicitation of ratings).
- Nature of data to be filtered - system-supplied or user-supplied.

Amazon.com regards an individual customer's purchasing and viewing histories as interest profile; the data is therefore generated as side-effect of the primary actions of looking at product details and purchasing products. Through item-to-item collaborative filtering (Linden, Smith & York 2003), product recommendations are generated. Users cannot reference products not already in Amazon.com's database.

Findory[13] is a "personalized newspaper" service being developed by Greg Linden, one of the prime architects of Amazon.com's recommender systems. By reading news and/or weblog articles, an interest profile is implicitly built up. It is possible for users to add new syndication feeds.

13 http://findory.com/ (accessed Jun, 2005)

del.icio.us[14] is a "social bookmarks manager" having rapidly gained in popularity over the past year. The central organizing metaphor is "tagging". An arbitrary number of tags (lightweight keywords) can be assigned to every bookmark posted (popular tags: "web", "design", "music", "css", "java"). What makes this service interesting from an information filtering perspective is the multitude of possibilities to filter bookmarks – by user, by tag or even by a combination of tags. This allows users of the service to discover other people interested in the same topics (and, prerequisitely, using the same tags). As in the case of snips and spaces, we can interpret the set of all tags used by a user as an interest profile.

Google Personalized is an experimental search service based on technology originally developed at Kaltix (Haveliwala, Kamvar & Jeh 2003). It requires the user to explicitly select from several dozen domains of interest before search results can be personalized.

The totality of all snips contained in a space can be regarded as an extraordinarily fine-grained interest profile of the individual or group contributing, conditioned on the specific context the space was created and used for. As the main components of such a profile are subjectively relevant concepts represented by individual snips, we propose the term concept-centric interest profiles. When combined with data gathered through usage tracking (logged edit/view events), the profile can be seen as an accurate time-dynamic model of equally time-dynamic user interest.

Concept-centric interest profiles can be used to
- seed automatically repeated, long-running web queries ("agents") using search engine APIs,
- filter high-volume streams of information (world news, RSS feeds or even emails),
- automatically generate (and then weight) combined-term queries,
- discover people with similar interest profiles.

Discovery of people with similar interest profiles (people matching) could be implemented based on simple concept intersection counts, maybe allowing for some fuzziness in spelling. More sophisticated implementations could use a variation of the well-known TF/IDF algorithm (cf. Baeza-Yates & Ribeiro-Neto 1999) to weight individual concepts. In this case, concept counts over all spaces examined should determine term frequency, whereas concept counts local to a given space should contribute to what is usually referred to as document frequency. Similar to the effect when

14 http://del.icio.us/ (accessed Jun, 2005)

filtering document collections, concepts everyone is interested in would therefore be discounted, whereas rare concepts would contribute heavily to the final similarity score.

For example, if it is observed that people who first were interested in a given concept cluster A often progress to map out or otherwise show interest in concept cluster B, the system could present that information to people currently showing interest for concepts in cluster A.

In an educational context, both fellow learners currently dealing with similar topics and potential tutors competent in the area of interest could be discovered in such a fashion.

It should be noted that a similar concept-centric interest profile can be extracted from traditional weblogs as well. This, however, requires the application of sophisticated natural language processing techniques such as key phrase/concept extraction, etc. - for a good introduction see Manning & Schütze (1999). Furthermore, the precision of selecting subjectively valid relevant concepts manually can be (and usually is) much higher than when utilizing automated techniques.

As many more people are using weblogs than wiki/weblogs at the moment, however, the potential value of deriving interest profiles in such a fashion could nevertheless be substantial - despite the higher complexity. As informally captured in Metcalfe's "law" and shown heuristically in Odlyzko & Tilly (2005), the value of a network increases with the number of participants:

> *"[...] if we have to select a rule [...] that is concise and yet captures many of the key features of communication networks, then we feel that our n log(n) formula fits the available evidence and is supported by reasonable heuristics."*
> *— Odlyzko & Tilly (2005)*

The distinguishing feature of the proposed approach is its inherent simplicity - when using a wiki/weblog, the profile comes for free.

5.2 Automated Syllabus Construction

Above we observed that while microcontent reduces the effort to create and therefore the barriers to publish, it shifts the job of organizing disparate pieces of information into a coherent whole to the learner. For microlearning in a decentralized setting to realize its full potential, the emergence of either organizing intermediaries or power-

ful tools for semi-automatic organization of materials is a necessity, so that learners can invest most energy in learning - instead of spending disproportionate amounts of time hunting down the proverbial herd of chunk-sized cats.

In a network of wiki/weblog spaces, we can observe publishing and (to a certain degree) consumption patterns, leading to time-varying interest profiles as described in the latter section. By analyzing a sufficiently large number of such profiles, patterns of dependency among topic clusters can be inferred from frequently appearing similar subsequences of the complete event/activity sequence. By linking those sequential dependency patterns to a measure of individuals' learning performances, it will be possible to discover preferential topic exposition sequences; those in turn could then be used to either directly guide new learners or as valuable input for syllabus designers.

A precondition for such a scenario to be realistic at all is critical mass, in terms of both the number of participating persons as well as in volume and level of detail of individuals' learning journaling.

6. Conclusion

We have shown that the combination of weblogs and wikis is, especially in a microlearning context, more than the sum of its parts. Complementing each other, the primarily associative nature of wikis and the more ephemeral, journal-like nature of weblogs allow for and motivate both the constant inflow of new information as well as the gradual build-up of a body of more permanent, lexically structured information, which serves as a meaningful structural backbone for this kind of personal knowledge store. The immense flexibility hypertext systems gain through the power of the link assists in building structures that support multiple means of re-discovering information.

As avenues for further research, we sketched the possibilities of observing learning behaviour to derive material sequencing hints, eventually contributing to automated syllabus construction, as well as regarding the set of concepts and relations recorded as an extraordinarily rich and fine-grained interest profile to be used for calibrating information filtering systems or matching like-minded persons.

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Self Directed Learning with Personal Publishing and Microcontent (On Microlearning and Microknowledge in a Microcontent-based Web)

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Abstract: The paper will be sketching out a constructivist approach to learning with microcontent, with special regard to new web technologies emerging in the "blogosphere", the networked space created by weblogs and widened by many new web services that help to assign metadata to objects, or to construct social networks and webs of trust through the use of personal publishing or social networking platforms. Especially new "tagging" technologies and practices, creating "soft" metadata, show a possible way to new kinds of collaborative knowledge environments. It will be shown that is not only microcontent itself, but also its contextualization through learner-centered approaches, discussion through trackbacks or commentaries, and "soft" object metadata which contribute to an understanding of microlearning and provide insights for implementing personal publishing systems in (educational) institutions. Until now, most of these conceptions are emergent on the web, so future research would have to identify possible uses and integration into learning environments and didactical applications.

Keywords: social software, weblogs, microcontent, constructivism …

1. Microcontent through Personal Publishing

Microcontent has been increasingly gaining importance with the rise of personal publishing on the web. Nowadays, virtually anybody can upload / generate and share content through the use of web services and personal publishing systems. Many new, sophisticated web services have arisen, helping us also to assign metadata to objects, or to construct social networks and webs of trust through the use of personal publishing or social networking platforms. Presently, most Microcontent is generated, published and shared through personal publishing systems (blogs [1]) photo sharing (like flickr) [2], collaborative text editing (wikis [3]) or social bookmark managers (like del.icio.us [4], furl [5], or scuttle [6]).

2. What is Microcontent?

Microcontent itself is a term which is vaguely defined. Wikipedia [7] does not have any entries for "microlearning" [8] and "microcontent" [9], so there does not seem to be a common consensus which is known to or relevant for a larger number of people until now. Some valuable attempts of definition can be found in the blogs of Nova Spivack [10] and Arnaud Leene [11].
Important (formal) aspects of microcontent are that it is referable, can be machine-readable through metadata / xml formats (RSS [12], Atom [13]), and is generally focused on one or few single ideas or topics. The most popular type of microcontent are weblog-postings, which are referable through a permalink, often provide metadata through RSS, Atom, or other XML formats, and are usually focused on a relatively small subject.
Therefore, MicroContent does not mean a genuine quality of content, but is a formal approach of how to present content.

3. Theoretical Implications

With personal publishing, it becomes more and more easy to generate and publish microcontent, based on one's personal, subjective view of the world. This does have various implications for an understanding of self-organized learning.
A theoretical approach to this relatively new way of sharing, accessing and contextual understanding of information should focus on our personal perception, interpretation and representation of communication and personal, subjective knowledge. The learner-centered approach of the weblog-format [14, 15] facilitates self-organized learning processes on the web and corresponds with a constructivist's theoretical view on perception, consciousness and learning.
The theoretical works of (Radical) Constructivism (Von Glasersfeld, Von Foerster, Hejl, et al. [16]) provide a perspective on the construction of subjective reality and personal knowledge.

4. Constructivism

(Radical) Constructivism describes any perceived reality as an active mental construction of human beings. Therefore, we do not perceive objective reality itself, but we actively *invent* an individual representation of it through our subjective perception *and* interpretation of the world which surrounds us. Therefore, an objective reality which is *beyond* any individual perception cannot initially be perceived *at all*, because any per-

ceiver is a part and also actively *taking part* of what she perceives and constructs as a subjective world view.
Accordances between a postulated objective world and an individual's constructed reality are not understood as equality, correspondence or a mere copy. To postulate a fundamental difference in the relations of compatibility, radical constructivist Ernst von Glasersfeld introduced the term "*viability*". [17] Instead of relations of accordances, the relation of viability is based on "fitting" in the sense of functioning/working. This means that a construct of reality, a perception or an action is viable, if it is not in conflict with any restrictions or obstacles.
Radical constructivism sees an "objective" outside world as something which actually cannot be perceived, so the concept of viability is the measurement if people successfully interact with the world surrounding them. The outside world and its population are understood as non-trivial machines. Non-trivial machines are dependent on the past, analytically indeterminable, and unpredictable. How they act is dependent of their present inner state and self-references. Any action, which is an interaction with the outside world, can trigger a change of the current inner state. This will have an effect on subsequent perceptions and mental constructions.

5. Self-organized Learning

The theoretical approach of radical constructivism can be used to come to several conclusions when it comes to an understanding of active self-organized learning. They are based on the assumption that perception is a construct of a living being and not simply a copy or an image of reality. This means that an objective reality cannot be discovered, and conceptions of "absolute truth" lose their meaning. Furthermore, changes of the environment do not have deterministic functions for the individual, but are merely constraints which have to be either evaded or overcome. Any theoretical conception of the world (space and time, laws of nature, scientific formulas) are understood as constructed inventions which do not belong to the environment or any idea of "objective" reality. Therefore, a solution to a problem, the result of an action, an assertion or realization cannot be verified through reality itself, but through considerations concerning intersubjectivity and viability.
This leads to the conclusion that human beings do not only actively construct perception and consciousness, but also knowledge and learning. Humans are not seen as recipients without any self-activity which could be determined by changes of their environment, inscribing cognitions into them. In fact, they are seen as inventively active subjects (autopoietic) who create (the perception of) their environments through self-activity and the resulting constructions.

This understanding of learning emphasizes the learner's self-direction and autonomy. An orientation towards the individual learners and the subjective meaning of what is learned comes into focus, learners can personally identify with what they learn, and reflect on it. [18]

During my blogging activities within the last two years, [19] I have noticed that the gaining of an online identity through blogging is the key factor to web-based learning and networking. I have been publishing on the web before, but have gotten much more awareness and feedback through being represented through a blog. Instead of static texts, blogs make persons and personalities visible, allow for archiving of subjective knowledge and personal communication, and help building up social networks through references in blog postings and blogrolls.

6. Personal Publishing as subjective World View

The theoretical framework which was described so far, helps us to explain activities in self-organized learning settings, and research & design micropublishing and microcontent conceptions.

The most popular way of micropublishing currently is *blogging*. Short weblog-postings with a timestamp, a permalink, and the possibility of leaving a comment right on the site usually are chronologically arranged on a web-page, which usually represents one or few authors of that particular weblog. Weblogs often are subject-based and learner-centered. They do not only represent their authors, giving them a personal space on the web, but also their subjective views, statements and relations (references to older weblog postings or external sources).

Entries in a weblog are microcontent items, which are mostly rather short, and consist of one or few central ideas or topics. Therefore, they can be more focused than longer, elaborate articles which tend to have many interrelated arguments and are often highly complex. Small units of knowledge are much easier to discuss and deconstruct on a peer-to-peer basis. [20]

Bits and pieces from a specific field of interest or simply because of personal curiosity / involvement can be blogged, often taking into account what they personally mean for the author. These bits and pieces of information or microcontent are combined through external and internal references, shaping a personal knowledge history of the author. By identifying, formulating and discussing problems and interests, a socially shared view can evolve through interaction with other users.

Personal publishing systems seem to be able to support some of the implications which the theory of radical constructivism has for self-directed learning: The subjective personality of the learner is taken into account through being represented by his

personal weblog space, situation and personal motivation can be expressed because of the subjective approach of personal publishing, a personal knowledge history becomes accessible through archiving and combining microcontent items with internal and external references, and a socially founded view of an intersubjective "reality" can evolve through interaction with other readers and authors. Furthermore, content can be searched and found through specific search methods which are unique to microcontent, like collaborative categorization through "tagging" or inbound link searches which show links or blog-posts pointing to a specific url. This helps users find content of their personal interest, and incorporate it into their previous knowledge of a field.
Since learning is always socially situated, and a constructivist understanding of knowledge denies the existence of absolute truth, intersubjective knowledge is the key to a shared view upon the world, or at least parts of it. Learners' motivations, personal interests and states they are in have to be taken into account, because they construct knowledge on a highly subjective basis.

Therefore, two important requirements for self-organized learning with microcontent are emphasized:

- Microcontent, published by an individual, is a subjective view upon the world, which can form a personal knowledge history through chronological archiving and references to other items (internal and external). It furthermore is easily discussable and can be referred to.

- If intersubjectivity replaces the idea of absolute, objective knowledge, the *social construction of knowledge* comes into focus. Through web-based collaboration, intersubjective knowledge can be socially constructed. This does not only happen in text (collaborative wiki entries, discussion in weblog comments) itself or through the infrastructural emergence of metawebs through external references, trackbacks and the like. Another important aspect is the possibility of adding metadata to microcontent items. This way, learners can express what an item means to them (how they construct it), and combine these subjective constructions with how they labeled other items, or how *others* did.

7. A Perspective Towards Introducing Microlearning in Institutional Conceptions

Much of the topics discussed so far seem to be emergent. The theoretical background helps to understand why microcontent is an emergent phenomenon and how it is

opposed to traditional methods of instructional learning or objective, factual knowledge. The question, how to implement the approach of generating web-based microcontent through self-directed, constructivist learning in curricular activities, remains unanswered. Similar to the microcontent conception itself, the usage of it can be introduced by the subsequent incorporation of its elements into existing or experimental learning scenarios and / or conceptions.

7.1 Static Text vs. Microcontent

One example how at least the rather simple, formal requirements of microcontent can already enhance learning activity in online courses is the modification of static text. The Adult Education at the University of Giessen, where I worked as a student researcher, conducted a blended learning course which goes by the name of ew.web. [21] It is a blended learning course, which introduces students at a beginner level to common pedagogical theories and concepts. Furthermore, the students learn metacognitive skills for a better learning. The course was run several times, and at first mostly consisted of modules with static texts, and instructional tasks. During the time which was reserved for reading of a module, students were instructed to discuss the text and their questions in a bulletin board. This rarely happened at all, which is a rather common occurrence when the trainer wants relatively long, static, and theoretical texts to be openly discussed in a bulletin board. Students said that they found it hard to formulate a question, or if they should take the entire text, or just a single idea into account when posting in the bulletin board. Forum activity was not very high, and mostly on a general basis.

However, in a later run of the course, I introduced wiki technologies to the department and we implemented it in their course, replacing the bulletin board with it. We used the wiki more for collaborative text editing in groups with a learning task, than in an encyclopedic format. The course consisted of several student groups of two to four people, who shared one wiki page for each group. Furthermore, we split the static reading texts into much smaller units, with a separate wiki page for each bit (a paragraph, a single topic or at most about one page) of reading text. The wiki-pages with the text were linked together in both the linear format of the original text, and through non-linear hyperlinks which connected text references and ideas to each other.

Note that the reading text itself did not change, but the matter of representing the text on the web did. Not only were topics connected to each other to allow a further reading without necessarily having to follow the original's linear structure. Furthermore, some rudimentary aspects of microcontent conceptions were introduced: The reading on wiki pages consisted of smaller text units which were grouped around the original text's headlines and / or paragraphs. Each of them was referable

through the wiki pages' URLs [22], and allowed the learners to edit the text or insert questions, assumptions or notes into or below the text at any time, due to the underlying wiki technology.
This mode of presenting a text for reading and discussion on the web notably increased the learner's discussion activities: "On-site" questions or discussions emerged right where the microcontent text is (in the wiki). Through the ability of writing down notes, statements or questions directly into or below the corresponding text passages, learners have the possibility to engage in discussions which are situated towards their personal interests, and can concentrate on a single topic or "micro-discussion", in order to re-construct their personal knowledge about it through intersubjective, socially shared knowledge. Note that this discussion of smaller text units cannot be as elaborate as a discussion on a larger scale with complex theories possibly could. The advantage lies in the circumstance that learners have to formulate their statements in micro discussions very clearly, because they cannot assume a particularly high level of previously shared knowledge in the group. This facilitates discussions on a peer-to-peer basis, and requires less previous knowledge from students at a beginner level.

7.2 Socially constructed knowledge through tagging?

In 2004, *tagging* [23] became popular through web services like the collaborative photo-sharing site flickr.com, social bookmarking systems like del.icio.us, and Technorati.com's tagging feature for weblogs, just to name a few. Generally, tagging can be understood as labeling a unit of data with appropriate metadata. The aforementioned web-based applications of collaborative categorization through tags imply that a tag is a freely chosen keyword, which is assigned to an object by an individual user.
In a constructivist sense, the act of tagging an item is an individual's expression of how the object is represented in her mental constructions. This subjective construction is based on the individuals knowledge history and how this construct knowledge about this item was viable for reaching one's goal or not. Therefore, this kind of metadata is not a description of an "objective" world, but an expression of knowledge of others about it. The advantage of collaborative tagging is, that either all tags assigned by any user to an object can be viewed (flickr photos, for example), or that it is possible to visualize how individuals tagged an object without knowledge of any other possible tags which might have already been assigned by other users (this is usually the case when using a social bookmarking system). Tags can be analyzed and visualized as tag clouds [24], which show the most popular tags in a system as weighted words, usually by displaying them in bold type and / or larger print.
Another kind of further references are the *related tag* features, which show the most important or all tags, which are related to a specific tag. This features enables users

to browse through "adjacent" tags of an object, and helps identify coherent areas of knowledge. Note that this type of representation of information is actually derived from collaborative efforts of describing an object through the use of tags as keyword by several different users.

For the individual user, the universe of tags which habe been assigned to objects on a system is sheer endless, and can hardly be "objectively" perceived in their entirety, or would be without any identifiable sense or meaning. For (social) groups however, tags can be used to negotiate the meaning or at least the categorization of objects among its members. This practice might be able to support a deeper understanding and / or interpretation of microcontent objects.

Learners in an online course, for example, could use a social bookmarking system which is integrated into the course environment in order to tag their weblog postings, (microcontent) reading texts, and external material they find and reference. If multiple users assign metadata based on their individual constructions of reality and understanding of microcontent objects (like adding keyword sidenotes to paragraphs of printed text on a paper, for example), a socially founded shared view will evolve. The personal knowledge history in the learner's weblogs could lead to a categorization through tags, which visualizes shared knowledge through tag clouds.

So, it is not only microcontent itself, but also its contextualization through learner-centered approaches, discussion through trackbacks or commentaries, and "soft" object metadata which contribute to an understanding of microlearning and provide insights for implementing personal publishing systems in (educational) institutions. Until now, most of these conceptions are emergent on the web, so future research would have to identify possible uses and integration into learning environments and didactical applications, possibly based on the constructivist approach to learning with microcontent, of which I hopefully managed to describe some core aspects in this paper.

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The Blogosphere Map
Visualising Microcontent Dissemination – Inspired by Maria Montessori (On Microlearning and Microknowledge in a Microcontent-based Web)

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The Blogosphere Map was originally presented two years ago at the first *Blogtalk* conference in Vienna by Christian Langreiter and me. I have been asked to reformulate the concept for the Microlearning Conference. The Blogosphere Map hasn't changed a lot but the narrative around it is entirely new.

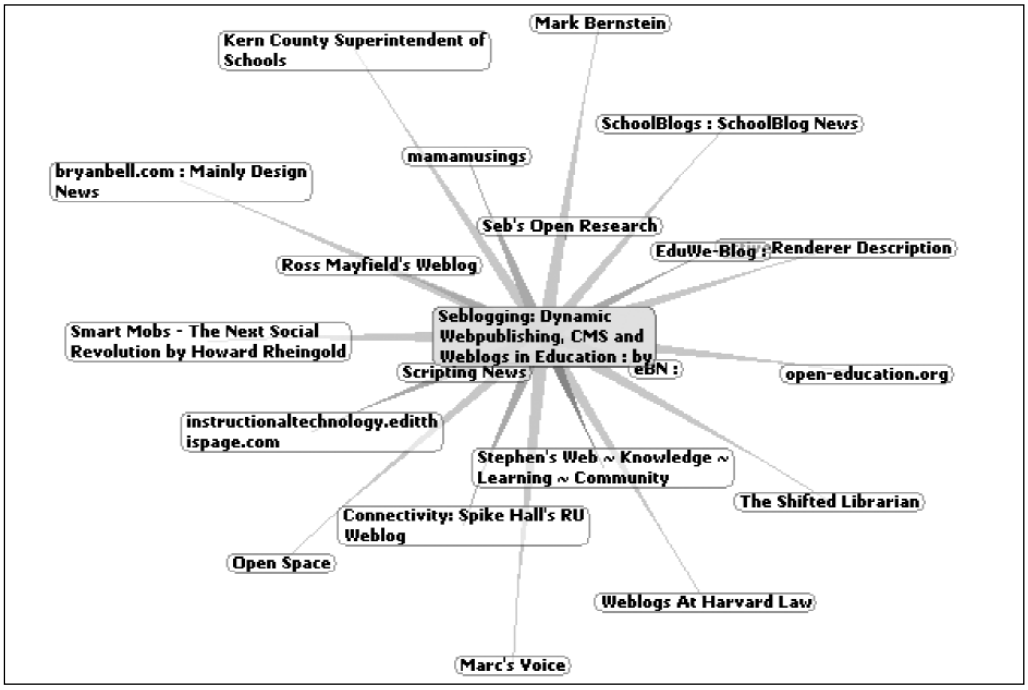
1. Blogstreet, Blogdex

The Blogosphere Map is a combination und further development of web services like Blogstreet, Technorati, Daypop, Blogdex, and others with the focus on two things:

- The visualising the dissemination of microcontent over time.
- Interaction with graphical representations is more important then plain text.

There are two services that come closest to our concept of the Blogosphere Map: *Blogstreet's Visual Neighbourhood* and *Blogdex*.

Blogstreet (http://www.blogstreet.com/) visualises the neighbourhood of a weblog which is defined by its blogroll:
"we take into account *whom you blogroll* and *who blogrolls you,* add to that a few other factors, give weightage to all the factors and there it is – the neighbourhood." (http://www.blogstreet.com/faq.html)



Example for Blogstreet's Visualization of a blog's "neighbourhood")

Blogstreet is the perfect tool for exploring your own neighbourhood, especially neighbours of neighbours - because each node is expandable. Thus you get a brilliant overview of who is reading whom and who is quoting whom. Blogstreet gives us an impression about the spread of news though it doesn't inform us about single news-items.

And that's exactly what Blogdex does.

Blogdex (http://blogdex.net/) shows the diffusion of Microcontent within the blogosphere. It lists those postings, which have been cited most by other Weblogs within last two or three days. Topicality and the amount of citations are the key criteria. (For more info see http://blogdex.net/about.asp)

Blogdex displays dissemination over time: It shows the exact time and date when a posting has been cited by other Weblogs. That is not necessarily a indicator for a certain sequence of citations (e.g. A -> B -> C ->…) but nevertheless it allows some conclusions about news dissemination.

1. The Blogosphere Map

The aim of our blogosheremap is to visualise the flow of postings among weblogs. It is not a list like Blogdex but a graph, which allow some important observations:

- Where are the hubs, i.e. most influential weblogs that distribute microcontent;
- where does the postings originally come from;
- patterns of dissemination: the blogospheremap shows that there are some news that spread only within a certain community and others which spread over the whole web. Cultural and national barriers become evident.

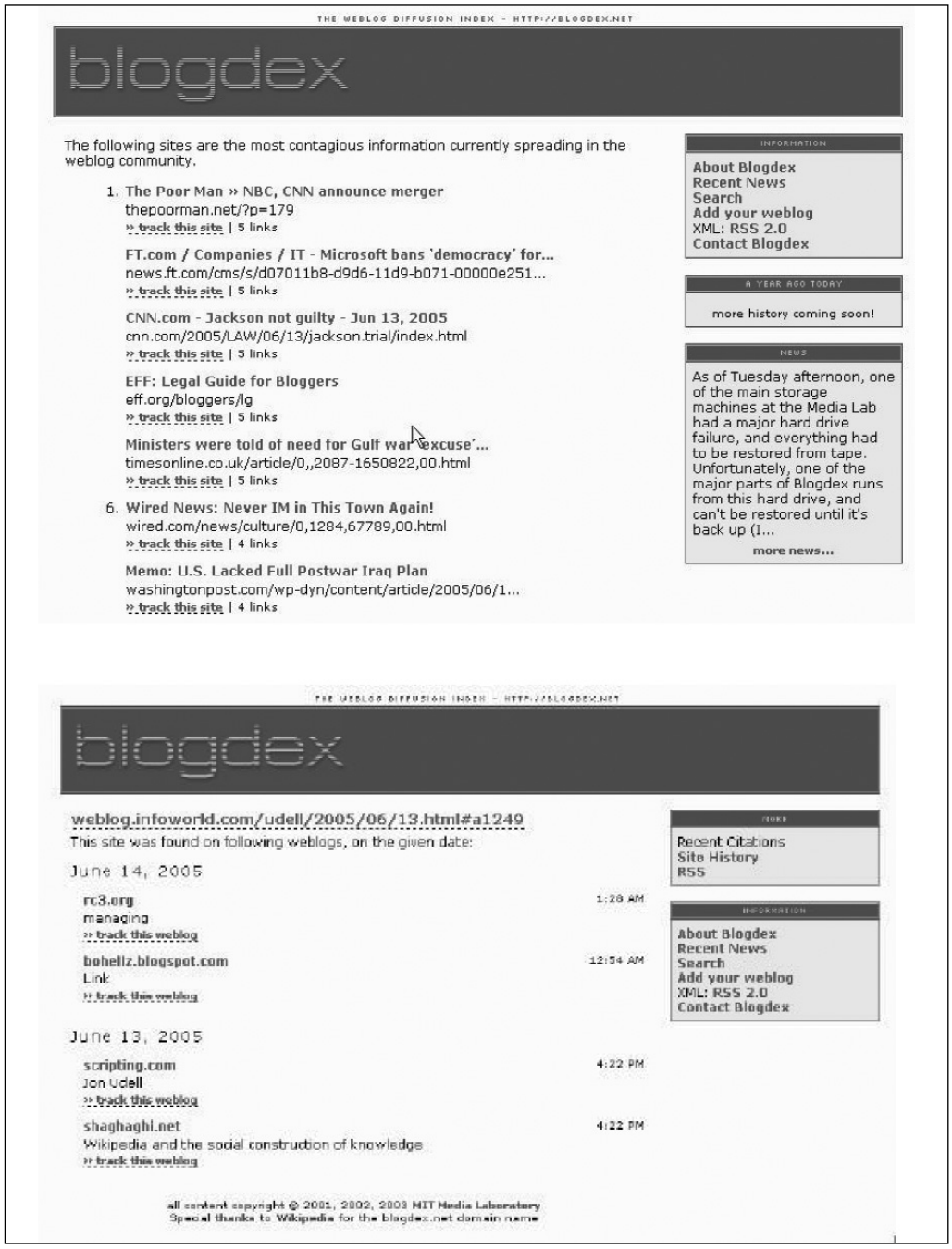
There are a lot of practical applications:
Blogosphere Maps may be used for commercial purposes, like e.g. visualising how campaigns spread; showing the dissemination of microcontent (slogans, citations) related to a certain campaign. That could be interesting for entertainment industry (music, movies, gaming, gadgets,…) E.g. it would be possible to track how a certain album spreads among webloggers.

On the other hand, probably more interesting, a Blogosphere Map may show the drifting of ideas and memes, which may enhance our abilities and competences to interact with those knowledge environments.

And that's how learning comes into play, because learning is of course not reduced to sequentially absorbing knowledge. Learning always means getting generic competence, like to get acquainted with an new field of knowledge or like to find his personal method to solve a problem or to perform a task.

At present the Blogosphere Map is only working as a prototype. Unfortunately we cannot offer a service that is available to the public. –

Maybe you have an idea how we further develop this – but even as a concept it is worth thinking about the potential of such tools. They may be used to visualise the dissemination of Microcontent within the blogosphere and they could generally be interesting for learning environments, where self organised learning takes place. The Blogosphere Map and similar tools may make us comprehend something which is invisible by nature namely the dissemination of knowledge. After all it's a plea to leave learning up to learners by providing adequate tools and materials that help them to navigate and experience new realms of knowledge.



2. Microlearning with Maria Montessori

The idea „to leave learning up to the learners" is naturally not new. It is part of the natural idea of men by Chinese Taoism as well as it is part of western Romanticism, which both is not meant here. The tradition I specifically want to follow on has its roots in the pedagogy of Maria Montessori, which is offering a hundred years of experience. The principles of Maria Montessori may not only be applied to kindergartens and schools. Montessori herself wanted to apply her principles of non-violent education also to universities and basically to all spheres of society. The idea behind Microlearning seems if it was inspired by her thoughts and automatically applies some of her learning principles. Some of them I'd like to introduce here [2]:

(a) The Montessori pedagogue is acting in the background. He or she is not a teacher in the common sense, cause he is not giving lessons, but defining special learn-settings that allow for certain learning experiences. Special materials supplied by the pedagogue support the learner in the process of learning by him or herself.
That shows already a main difference to Microlearning. On the one side it is true that the Web and especially weblogs allow for free and independent learning but those learn-settings are mostly not arranged by a pedagogue. They are mostly unreflecting learning environments driven by personal preferences, with often unexpected outcomes, whereas learning environments by Montessori are well reflected with clear objectives. Montessori learning has its clear objectives whereas Microlearning is often aimless and accidental. But the main objective of Montessori learning is to educate young people to independent learners who are able to define their own goals. So sooner or later they all should end up as Microlearners.

(b) Learning by playing in mixed groups: Learning groups and classes in Montessori schools and kindergartens usually consist out of children of different ages. E.g. from 3 to 5 from 6 to 9, or from 10 to 12 and so on. Montessori realized that children like to learn from other children especially from older ones, and that children generally like to help each other in learning specific skills. Such learning often takes place without a direct intention, simply by playing.
Also Microlearning in the blogosphere takes place amongst learners of different ages and levels of knowledge there is usually no distinction between academics and non-academics. It is mutual learning, but sometimes of course some webloggers know more and/or post more and other people are learning by them. A good example of mutual Microlearning gives del.icio.us, a service for the exchange of bookmarks. It demonstrates that there is cooperation even in anonymous and very heterogeneous groups if it is for the benefit of participants. This kind of benefit is typical for the Web

and for its cooperative potential. It happens not because people become better men when using the web but by making the experience that cooperation pays and that it may be very funny to cooperate.

(c) Free schedules, no collective teaching; The learner is free to make his/her exercises whenever he/she wants but within a certain period of time. He is able to learn according to his own state of mind and at his own speed. He is not forced to the uniformity of collective teaching; he is getting individual help according to the progress he makes.
Free schedules are also important key factors for the success of Microlearning through Weblogs. Weblogs are perfect for learning and writing in between times for both for personal Weblogs as well as for professional documentation of web inquiry. Weblogs demonstrate perfectly the advantage of asynchronous media. Asynchronous learning is characteristic for both, Montessori and Microlearning.

(d) Prepared Environment: Freedom must not be misunderstood as arbitrariness. Unintentional learning may be very effective but it needs a certain framework. It is quite challenging to create his own framework if it is not provided by a pedagogue or another helpful spirit. The lack of limiting conditions while learning may end up in discontent just like you feel when arbitrary browsing the web. It's kind of interesting but you don't really know what you're doing and end up with a dull feeling in your head. That's the reason why Montessori stressed the importance of an adequate framework for learning.

It is a common prejudice that Montessori learning is antiauthoritarian and that it lacks rules. That's not the case at all, it's quite the opposite. When visiting a Montessori kindergarten one will realize that the learning material is very organised. It is a rule for all children to put everything in its place after having played or learned with a certain material. The whole environment is prepared to fulfill the needs of children. It is not only child adequate in respect to ergonomics but also in respect to perception and cognition, by providing specific learning materials.

Abbildung 1: Vorbereitete Umgebung im Kindergarten.
Bildquelle http://www.doerfles -online.de/f_kiga.htm

(e) *Learning Materials* are kind of small interactive games for real life learning experiences.

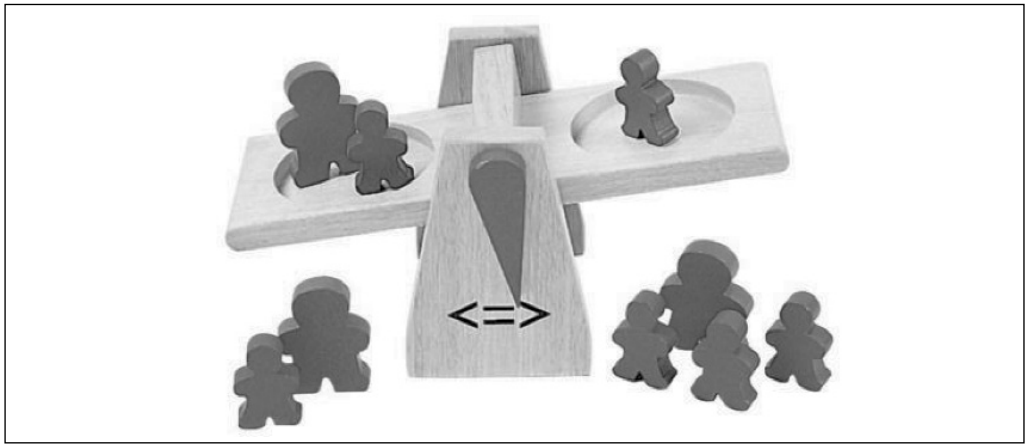


Image 2 :Learning Material, Source:http://www.montessori-shop.de/

As a key feature Montessori Materials provide physical experience. Knowledge and skills emerge out of a process which is guided by the learning material and which involves not only the brain but also the body as much as possible. Skills emerge spontaneously by continuously playing with the materials. Thus Montessori is not about transmitting abstract knowledge from the teacher to the learner. It provides a prepared learning situation that enables the child to learn by itself resulting in a certain competence.

Microlearning obviously lacks such a framework or prepared environment for learners. Learners have to produce their own methods and learning materials. The blogosphere is full of highly personalized learning environments created by web personalities. But this is not representative for all learners. Microlearning is avant - garde and it is a challenging goal for people who try to guide young persons to become such self responsible learners.

(f) *Sensomotoric*: As we could see, Montessori learning experience involves the body to a large extent. The body takes part in learning and even in thinking, perfectly by the number materials made out of sandpaper, which have been invented by Montessori herself.

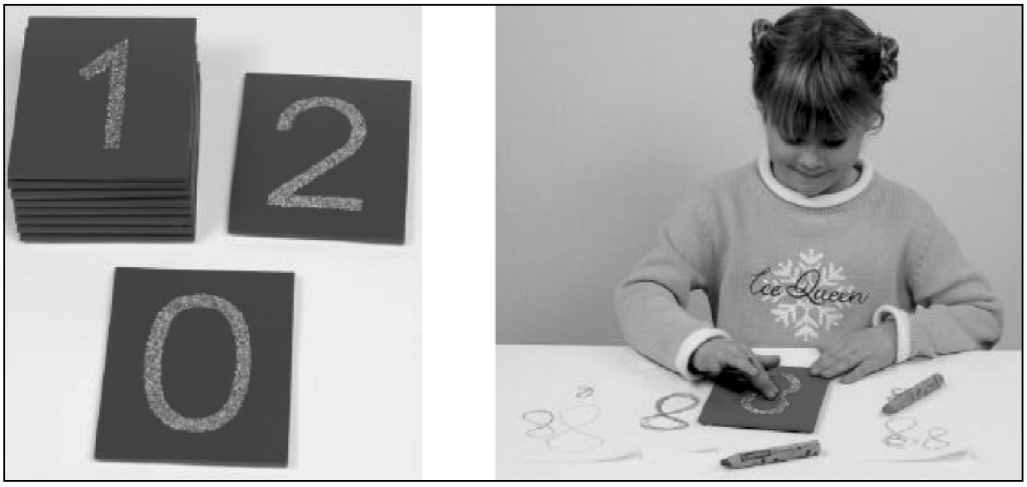


Image 3: Number material made out of sand paper, Source:: http://www.montessori-shop.de/

By touching and following numbers cut out of sandpaper with their fingers children get a sensomotoric experience. The numbers become physical.
It is one of the biggest disadvantages of Microlearning that desktop computers reduce physical interaction to a minimum by using only screen, keyboard, and mouse. Microlearning with mobile devices may help to involve more senses and allow for a richer experience.
In schools and universities it might be possible to distribute microcontent stored e.g. on RFID tags over the campus which can be experienced by walking around equipped with mobile devices thus linking certain topic to certain locations. (It was common in antique rhetoric to learn a speech by literally walking from one topoi to the other – the original meaning of Greek "topoi" is "site" and the English word topic obviously deri-

ves from that antique habit of learning by walking. But even within the web there are promising approaches to create richer perceptions by stimulating haptic experience. Touchgraph is one of the most interesting and popular approaches into haptic browsing and that's why we would like to integrate a Touchgraph concept into the Blogosphere Map

3. Microlearning is not Autodidactic but „Ambididaktic"

It's quite senseless to talk about Microlearning "in general" without looking at specific learning situations. Basically one should distinguish between learning with a pedagogue and free and self-reliant learning in the web (Microlearning).

The first may lead to the latter but depending on age, talents, personality and learning objectives either one mode or the other will be predominant. Montessori pedagogy demonstrates that self-reliant learning needs a perfect framework (prepared environment and a educated pedagogue) which is obviously hard to provide outside of school and university. Self-reliant Learning without a pedagogue makes only sense for older and mature learners who are able to define their own learning objectives.

In real life such a learning behaviour is generally called "autodidactic", but that is not the case for Microlearning, which can be better described as "ambididactic". This term seems to be more appropriate for learning in a community of learners. In such a learning situation there is no clear distinction between learners and teachers, there is a mutual benefit. "Ambididactic" describes individual and self-reliant learning in a cooperative learning environment which is exactly the case for Microlearning.

Microlearning environments are made possible only because there are certain preconditions:

- First of all there are conventions like archives, formats of postings, blogrolls which are generally accepted and understandable in all parts of the blogosphere. Weblogs and Wikis are not only technical devices for organising thoughts and memes. They are social standards of interaction and exchange.
- There are generally accepted technical standards like RSS.
- There are services and innovative tools like del.icio.us, blogstreet, blogdex and so forth that help us to comprehend and navigate this vast realm of information.

By using these conventions, standards and tools people unintentionally create Microlearning environments with fluent boarders and open groups of participants. Compa-

red to school the social relations amongst (Micro-) learners are far more anonymous and far less obliging but at the same time the mutual benefit is considerable. Microlearning through Weblogs and Wikis create an emergent phenomenon which is often called collective intelligence.

4. Tools for new comprehension and competence

Microlearning is obviously closely related to new and fast developing fields of knowledge, because they attract much awareness and a large amount of postings. A long time before universities and other institutions start to react, webloggers create new trends and approaches. This conference is a good example.

New trends and approaches are generally accompanied by new terms which open up a large space for imagination and interpretation. In spite of the fact that such open situations may hold some risks and disadvantages, a lot of people – like us – consider them as a real blessing. We love Weblogs and Wikis because they offer openness and vividness.
So when talking about Microlearning we should have an eye on keeping that openness and vividness alive. That's a reason why I am personally quite sceptical about the semantic web, especially in new fields.

The Semantic Web requires clear definitions and relations between terms which on the other side might become obstacles to vivid discussions and knowledge evolution. It is hard to imagine that we can agree on a general ontology of microlearning without endless debates. I am quite sure that such debates would be that interesting that they will end up in a new topic and the process will start again. Definitions and other tools of comprehension should only serve for keeping that process alive.
All kind of services mentioned above and our Blogosphere Map should not only be judged by their suitability to find interesting sites and personalities but also by their consequences to our learning and capabilities.

The critical question is whether they are able to create new experiences of knowledge and new behaviour competences, which is quite hard to explain. Probably the best explanation how cognition evolves was given by Jean Piaget who proved that comprehension of so called "absolute categories" like space and time are constructed during a child's early development. They are not inherited but emerge out of a series of sensomotoric experiences that involve that whole body. Only by interacting with a "ball" a child gets a concept of what a "ball" is what it can do with it.[3]

In other words a „ball" is not only what we perceive in a certain moment but the emergence of previous experiences including the social context of learning.
Similar to children who construct a concept of reality, we construct concepts of the blogosphere and other social spaces of the web. Our basic intention is to raise our adeptness and our competences. Web technologies like the Blogosphere Map will help us by sharpening our senses for flows of communication and by intuitively realising situations and constellations, which is quite close to the role that Montessori materials play for young learners. We urgently need more learning materials that help us to create new perceptions und experiences what finally may result in comprehending new objects and new forms of cognition.

It seems quite impossible to produce such experience without personal contact amongst learners and without giving guidelines. This conference is another evidence that one cannot replace personal contact. Nevertheless it is a fact that Microlearning works amongst people who have never met in real life. Microlearning is collaboration amongst equal and like-minded learners who mutually create new fields of knowledge by simultaneously smoothing the way for comprehending them. So as a minimum Microlearning will provide not only Microcontent but also Microlearning materials in the form of web services like the Blogosphere Map that may help us to acquire new forms of perceptions within new media spaces. Especially the second part, the creation of Microlearning materials, seems to be only at its beginning and we may look forward to more.

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The best german introduction online are [werner.stangl]s arbeitsblätter at: http://arbeitsblaetter.stangltaller.at/KOGNITIVEENTWICKLUNG/Piagetmodell.shtml

Find more papers by the author in English and German at: http://www.realitylab.at/aufsaetze.shtml

Microlearning with Mobile Weblogs (On Microlearning and Microknowledge in a Microcontent-based Web)

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Abstract: Blogs are a core phenomenon of the "bricolage" or "remix culture" John Seely Brown (among others) had anticipated, and the connectivistic "learning theory for the digital age" of George Siemens. Mobile communication in general widens this tendency, finally blurring the boundaries between the traditionally separated sectors of life: private communication, work, entertainment. In the field of learning, Mobile Blogs or "moblogs" may be an instrument to capitalize on the new technological, social and cultural breakthrough of "ubiquitous" media. In detail The paper will cover the following areas: Smart M-Learning applications / Micro and Mobile; New media technologies and media cultures between mobile devices and the web; Practical experiences with and theoretical reflections on microlearning; Microdidactics in story- & scenario-based learning.

Keywords: Blogs, Moblogs, Mobile Blogs, Mobile Learning, Microlearning, Autonomous Learning, Social Software, Comments, Tags, RSS, learning/work/life balance, locative media

Blogs and the Future of Learning and Learning Institutions

Blogs (or Weblogs) are not only having an impact on traditional media, they could also become a challenge for learning institutions. Not long ago traditional media had the news monopoly, but thanks to the internet which made publishing cheap and global, and helped by the strong fragmentation of the reader- viewership, this monopoly today no longer exists. Blogs have significantly accelerated this evolution offering an "open, real-time, two-way information flow" (George Siemens [3]). Today blogs already play a significant role in the current media environment as studies (PEW Internet), media companies of a new type (Gawker) and some interesting cases (Dan Rather) show.

Learning institutions like schools and universities had the monopoly of giving access to knowledge and more importantly to the community which shares and generates

this knowledge. Naturally the possibility to learn by oneself – as an autodidact – was possible, but such a learning was always perilous as one lacked the setting of learning or – as we say today – the community of practice. The reason is that a large part of learning is not in what one learns explicitely, but the knowledge gained implicitely by following guides and peers. It's this commonly constructed reality, that makes one's learning "productive", that makes it possible to use it in real life.

With the advent of blogs and other social software tools, autodidacts do now have a direct and open access to their community of practice. In the technology area which is quite naturally a forerunner in this field (the tools were made by the first users), the immense benefits of blogs are obvious: no learning institution, no book can offer a similar "live feeling" of what's going on, what and who is important, what one has to delve into, how to find and how to filter information etc.

Tech bloggers are also the early adopters of learning by blogging and lifelong learning.

Here learning is seen as something ongoing and as an integral part of working. In accordance with constructivist learning theories, constructing the reality together with others is just normal, an example here is the recent discussion about tags and tagging in blog and other social software.

Also Bloggers have already adopted, what John Seely Brown [1] calls "Bricolage":

> At some point it might be worth noting that the shift from linear logic to bricolage is actually a very subversive move away from the Cartesian Frame to much more of a situated, action frame. It also paves the way for considering the 'Remix Culture' as being a new form of social learning, social capital formation and becoming a more central member of a community of practice/interest.[2]

This seems a good description of blogging, as quoting and linking are two basic blogging activities. For the blog reader this practice has not only the advantage of gaining new knowledge, but also to see the context - where it is coming from. And here we join George Siemens' Connectivism:

> The pipe is more important than the content within the pipe. Our ability to learn what we need for tomorrow is more important than what we know today. A real challenge for any learning theory is to actuate known knowledge at the point of application. When knowledge, however, is needed, but not known, the ability to plug into sources to meet the requirements becomes a vital skill. As knowledge continues to grow and evolve, access to what is needed is more important than what the learner currently possesses. [3]

As George Siemens shows, blogs are not only important for what they offer today, but also for the access to what is needed in the future. As one gets to know more bloggers their interests and skills and the clusters they form, one can tap – if needed – into this network.

Having seen the impact blogs can possibly have on learning, we now see that the role of learning institutions has to change as well. They no longer can simply deliver information – that at its best is good to know or worse is totally outdated – they have to bring learners together and enable them to join professional communities of practice. If every learner has a personal learning tool, a blog, evaluation of the current situation, coaching and connecting become the essential services a learning institution needs to offer – the learning is done by the blogger himself.

The blogger or lifelong learner connection to the learning institution also will change: instead of a strong tie (e.g. taking courses for a semester) for a short period of time, the tie is weaker but it could lasts over a longer period of time. At its best this new kind of connection is a mutual relationship which benefit both parties – the learning institution gains a learning partner who can help the next learner, the learner has a coach which can offer him opportunities to connect with relevant people.

Mobile Blogs and Learning

So far we have only spoken about the traditional weblog, but when the blog gets mobile, more opportunities to learn, to share and to connect are offered. Mick Masnick noted:

> Increasingly, it appears that young people who grew up within the always-on technology world have no problem being connected all the time, any place, and won't think twice about turning "down time" into "productive time". Of course, they're also just as used to having their personal life encroach on their work/school life – so employers need to be prepared for this increased blurring of the boundaries. 84]

No dependency on space

As Mick Masnick notes, the boundaries between work/school and personal life will fall and the mobile device has a lot to do with it. The world we are coming from was one where physical space ruled our life – a place for home, a place for work, leisure spaces and in-between spaces. With the advent of the mobile phone, our life is no longer dependent on physical space and we can connect with others in whatever space we are.

Personal Tools

Another characteristic, shared by the blog and the mobile phone is that these are personal tools. With fixed telephony we called a place, now we call the person. With most institutional software the person is not that relevant, but with the blog the person is at the center of the themes aborded.

Discussions

Third characteristic, Blogs like Mobile Phones are strongly used for discussions. The term Live Web has been coined in regard to blogs and it mainly meant what is discussed now, what are the hot topics right now. Blogging not only seen as publishing, but also as an exchange via comments can have the characteristics of a chat, a chat nevertheless which can be studied and searched later.

Mobile phone is no longer used for calls only

It is also important to note that the evolution of mobile phones and the habits of mobile phone users make text and images in some situations more attractive than speech. As Japan, the i-mode country, and the heavy usage of SMS in western countries show, the mobile phone gets more and more used to write and read. SMS texting or using the mobile internet is used in idle time situations where most of the time others are around (during commuting, queueing etc.).
All this makes blogs and even more their mobile usage extremely interesting for the autonomous learner. We will now look at a mobile weblog in detail.

Moblogging and Mobile Weblogs

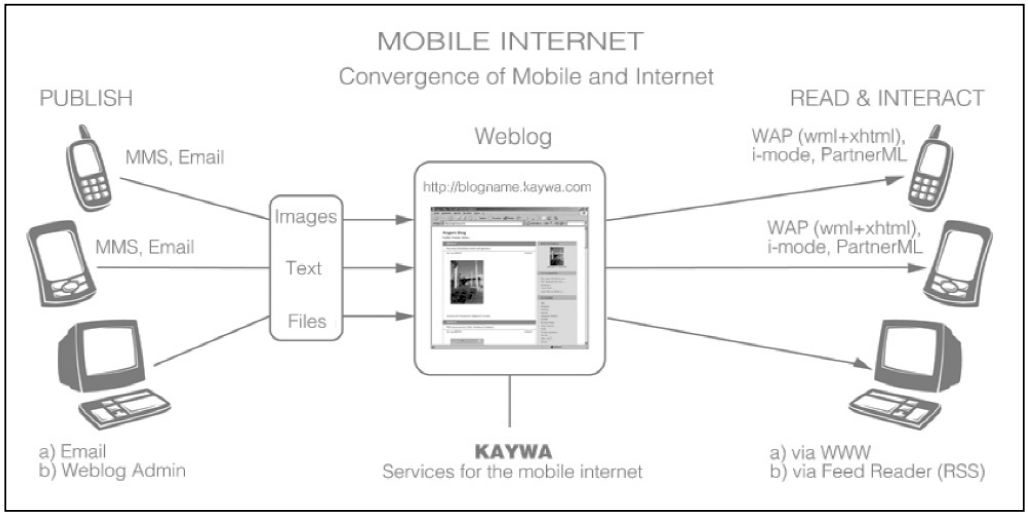
Recently one can hear a lot about "moblogs" or "mobile weblogs". Almost always people mean that one can send photos via email to their weblog on the internet. Only a few companies also offer a mobile version of their weblog. It would therefore be good to make a clear distinction between blogs which offer "moblogging" – sending email (and MMS) to an internet weblog – and mobile weblogs – weblogs which offer a mobile version readable via a mobile device.

A second problem arises with the definition of the mobile version. As many blog companies offer today blogs in xhtml, the temptation is big to declare that their blogs also offer a mobile version viewable on a mobile device. The problem is that the web ver-

sion is never satisfying and that the download of pictures optimised for the web, is - at least till now - a «money burner» on a mobile device.
We consider that the mobile version of a weblog must be conceived for the mobile device and we will show what we mean by that by discussing the mobile version of the KAYWA weblog.

The mobile version of the KAYWA Weblog

Every KAYWA weblog is usable via the Internet and all sorts of mobile devices. The internet version is normally available under an address like http://subdomain.kaywa.com or a freely chosen address.

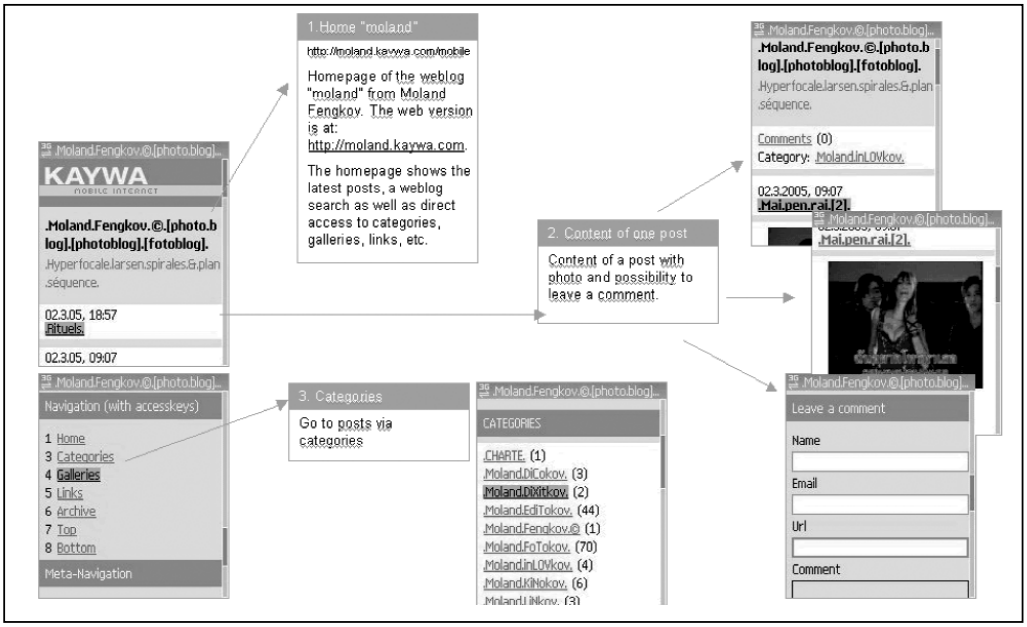


The internet version is in XHTML 1.0 Transitional, so it can be browsed on some mobile devices if
1) bandwidth and data traffic are not an issue and
2) when the mobile device has a screen large enough.

This is one of the reason we opted to create a special domain for mobile devices. The mobile version can be found either by adding "/mobile" to http://subdomain.kaywa.com or by searching it via the mobile portal (http://home.kaywa.com/mobile).

Mobile Weblog Navigation

As shown in the graphic above, there are wml, xhtml, i-mode versions as well as one in PartnerML which is Vodafone's proprietary XML format. Taking PartnerML as the source, Vodafone creates then different versions for the phones they support. For all other formats mentioned, KAYWA does the transformation for every phone type itself. In the following screen captures we use a Nokia 6630. The screenshots were taken with the Psiloc Screen Capture Software.



Overview of Posts and Search

By arriving on the weblog, one sees the first ten posts with date, time and the title - which is something easily understandable for everyone who knows RSS- respectively feed readers. Then follows the weblog search, which is an alternative way to navigate on a mobile device.

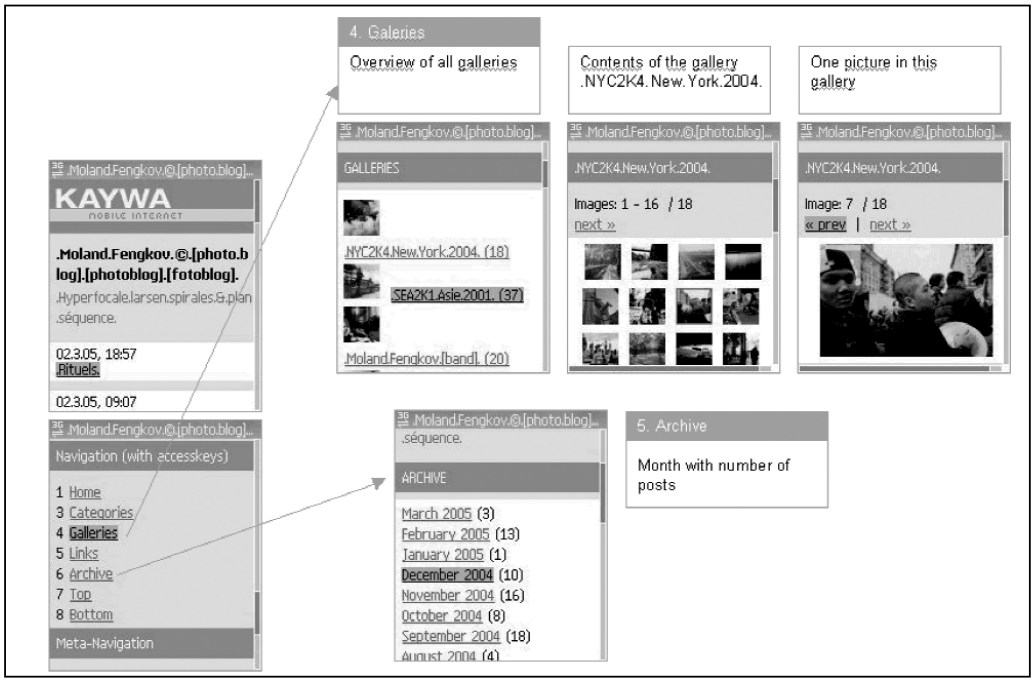
Weblog Navigation

Underneath one finds the weblog navigation. On some phones one can use the access keys (used to type a phone number) for navigation purposes – that's the rea-

son why we use numbers in front of the navigation labels (example: 4 Galleries). Once one starts navigating by numbers, navigation changes at any point in your text are possible. It is important to note that the navigation offers the same navigation options available on the web version, but always adapted for mobile devices.

The Post: Comments, Image Rendering

If one clicks on a post, he will have the comments field on top. This makes it easy to write a comment in a longer post and also to check how many comments there are. The image rendering is also crucial: images are rendered on the server for every screen size. And as it is possible to have posts with a lot of photos, we only render the first photo and offer links to the following. This reduces the download time as well as the cost of a single post. This is especially crucial when posts are heavily commented.



Galleries, Links

In the above image one can see links to galleries and to the post archive. In the meantime we have reduced the number of the thumbnails displayed in the overview pages

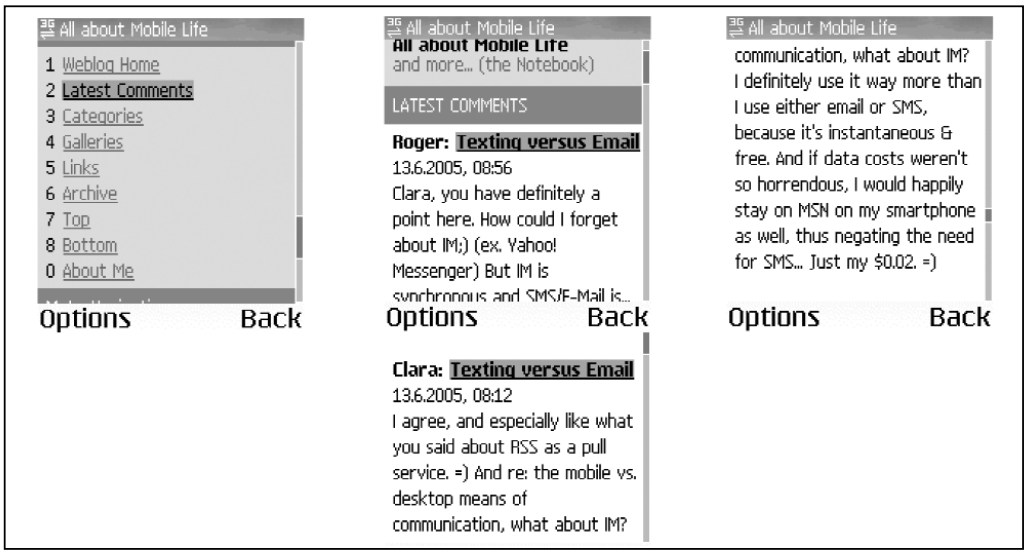
of the galleries – the purpose was once more to reduce the download time. Other links go to the categories of the posts or to links. Under links one finds normally the blogroll as well as other links. All KAYWA links are transformed on the server so that one always gets the mobile version of any page. This makes it attractive to surf from one blog to the other.

Links to non-KAYWA content are in red and by clicking the links you get a warning that you are leaving KAYWA on your own risk (HTML Pages which freeze your mobile browser, pages with a large file sizes etc.).

Mobile Weblog: New Developments

Our mobile version went trough several releases and by using it daily we and our customers gain an ever better knowledge of what works and what doesn't. One of the last big changes was the addition of «Latest Comments» and of the «About Me» page.

As we want the KAYWA weblogs to become a tool which is used for learning and for discussions, we needed something which enables people to interact more easily. On the internet this was never a problem, as the weblog owner receives an email when somebody writes a comment. But on the mobile where SMS or email push is quite expensive, we looked for other options. The most convincing solution was «Latest Comments».



For the blog owner and all participants in the discussion it is now possible to click «Latest Comments» to be updated on what is happening on the blog. From here you can go back to the post in case you need to get the context again.
With «Latest Comments», we have now two main entry points to the blog: one to the published posts by the blog owner (Weblog Home), one to the ongoing discussion (Latest Comments).

Interplay between Mobile Blogs and Mobile Portal

As the place of this paper is limited, we left out the description of the mobile portal, something we consider nevertheless crucial for the mobile KAYWA community for two reasons:
1) the mobile portal (http://home.kaywa.com/mobile) makes it easy to access other weblogs. Typing two, three letters already suffice to find someone's weblog.
2) You can see what others are posting by clicking «Latest Posts».

Future Developments

As mentioned earlier, the development of the mobile solution is an ongoing process: user participation in the development is key. The next big steps are therefore:
1) a way to give access to a limited audience or even to keep posts, galleries, categories etc. private. The latter makes especially sense for personal learning where you want to store – probably copyrighted – material, retrievable anytime and anywhere.
2) a push service via SMS and email for posts and comments. We have to find ways to make it at the same time affordable, easy to use and most importantly effective. The challenge here is to conceive a service which offers an easy interface to the newcomer and at the same time offers options concerning frequency, persons, comments and/or posts which an experienced user can personalize.

Conclusion

Having shown the impact blogs had on traditional media, it's probable to predict that blogs – together with other social software tools – will also change how we think about learning. Traditional learning institutions should be well aware of these new developments unless they want to lose ground and finally sink into oblivion. As an example how quickly these changes can operate today, one has only to look what happened to traditional analog photography.

Porting blogs unto mobile devices offers new ways of learning and gives the learner options he never had before – he can now access his knowledge anywhere and anytime and keep in contact with peers and coaches.
Taking as example the mobile version of the KAYWA weblogs, we tried to offer insights about the difference between a blog on the internet and on a mobile device. Finally, we mentioned the importance of the comments functionality as well as the mobile portal, important to keep in touch and to interact with peers and friends.
As an outlook and as a concrete learning scenario, we opened a pilot blog called «Schweizerdeutsch für Deutschsprachige» (4). This blog about swiss german for german speakers is available both via internet and mobile.
People from Germany, Austria but also from the Balkans residing in Switzerland do often know german very well, but they still do not understand a word of swiss german spoken by the local population. Unfortunately courses for swiss german are sparse and the few existing books are outdated.
A mobile blog with it's immediacy can offer a simple to tool for interactive language learning. We started with a swiss german dialogue, available as mp3 and in written form, and some additional comments. People interested to learn swiss german can now engage in a dialogue via comments. In a official learning environment, we would offer all participants a personal weblog to take notes, record themselves, engage in conversations and start helping each other.

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Need for Web-based Metadata Repository on Online Resources Usable for Language Teaching (On Microlearning and Microknowledge in a Microcontent-based Web)

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1. Introduction: Search Difficulties Language Teachers Encounter

One of the significant developments in the area of eLearning or Web-based education has been the standardization movements of the so-called Learning Object Metadata. Several major international bodies like Dublin Core Metadata Initiative [1], IEEE LTSC [2], or projects like ARIADNE [3] have already proposed detailed metadata specifications for a Learning Object (LO). However, in Japan, as the term "Learning Object" tends to imply a formal learning unit created by educators themselves which consists of multiple learning modules involving a certain kind of learning procedure, distribution or reuse of the LOs has not been so widely practiced. Several public organizations in Japan have tried to encourage the LO distribution movement through their brokerage services [4] [5], but up until now it has not been so successful.

From the viewpoint of a researcher of foreign language teaching, this seems to be a rather natural consequence, since the creation of a formal LO for foreign languages, especially at the university level, normally requires a certain authentic raw material, or a "microcontent" in the target language as a "Learning Element" (hereafter called "LE"). An LE can be a text form or sound or video form, and if an educator can find a good LE and clear the copyright problems when necessary, then it will be quite easy for them to create a larger LO using the LE as a core component and adding some notes, quizzes and other educational components.

As the English language is dominant in the Internet society, the Internet is considered to be a goldmine of learning/teaching resources for teachers of English as a Foreign Language (EFL). Although there are a lot of junk Websites, it is true that we have an enormous amount of high quality learning resources as LEs suitable for the teaching of EFL on the Internet offered free of charge. Still, we must admit that looking for appropriate online resources for our everyday teaching activities is really a hard task [6].

Unfortunately, it is not common for teachers of EFL, especially at the university level, to rely heavily on search engines in order to search for appropriate LEs on the Internet. For one thing, it is quite difficult for the teachers of EFL to explicitly represent their needs in a concrete string of words to be typed in the keyword search window of popular search engines. Moreover, we also know that the results of search activities will be far from satisfactory even if the educators have carefully chosen the keywords.

If we consider the way the educators of EFL make use of the Internet resources in detail, we can easily recognize that the discipline of EFL is in a very special situation in terms of how the search activity is implemented in an ordinary educational setting. For example, in ordinary educational settings for subjects such as mathematics, physics or history, useful Websites or other online resources suitable for educational use will be easily searched just in terms of basic concepts or terminology of the discipline. When you search for Web pages containing the keywords <complex numbers> using major search engines, for example, you will inevitably encounter "Dave's Short Course on Complex Numbers" [7] within the top 10 hits in the search results page. This page contains the fundamental concepts concerning the searched phrase "complex numbers," but within this page, the hyperlinks to other related concepts such as "powers and roots," "the number 'i'," or "quadratic and cubic equations" are also given. Thus, just searching for a certain key concept or one learning theme of the discipline, we can normally obtain its exact definition and the information concerning the related thematic subjects from the Web pages that are given as the search results. As the search results and each Web page listed in there will have rich hyperlinks related to the searched concept, educators can easily create a copious and sophisticated LO using the searched LEs after this type of search. In addition, most of the searched Web pages exist within the same academic domain where the searcher belongs and the pages are in most cases "educational" in nature. The author will refer to this type of search style as "thematic search style."

On the other hand, when teachers of EFL type <gerund> in the search window of a popular search engine, the result will be very often a list of Web pages offering the definition and explanation of "gerund" as a terminology of English grammar. However, in most cases this is not what the instructors really want. What they normally require is the actual English writings or speech materials in which certain teaching preferences or needs are reflected. In other words, what they need is "data" or "instance" where language is actually used and not the summary of the linguistic or grammatical concepts. The author will call this type of search style, very often employed by the teachers of EFL, "instance search style." This style of Internet search is commonly used not only by instructors of EFL, but also by educators and researchers of marketing, management, or business administration, where actual cases or

instances of organizational activities are important in addition to the definition of the terminologies. It is easily predicted that information retrieval in "instance search style" will be much more difficult and complicated than the "thematic search."
Thus, for the educators and researchers of EFL, marketing or management, the problem concerning the LOs is normally not how they can assemble one whole LO, but how they are able to look for good LEs suitable for a certain educational framework in the target subject. In the case of the discipline of EFL, the LEs do not have to belong to the Internet sites of the same discipline. A weather forecast Website can be used as an LE or a Website of a TV broadcasting company or an automobile manufacturer can also become an LE. However, these online resources do not "know" that they are often searched for by instructors of EFL, and naturally, they are not equipped with language learning-oriented metadata. This leads to difficulties in searching for appropriate language learning LEs meeting the specific educational needs of an instructor.
For example, if a teacher would like to teach some typical features of English telephone conversation in the business world and tries to search for appropriate sites entering the keywords <telephone conversation business>, major search engines will return the top search results with many Websites which sell or advertise the "telephone call recording devices for business use"!

2. Other Factors Causing Search Difficulties

It is true that we are experiencing the rapid development of metadata processing technologies, such as XML, RDF or Semantic Web these days. However, we feel search efficiency still remains at a primitive stage, especially if we follow the "instance search style." There should be several reasons for this, but one of the main problems is that except for some industrial domains, standardized metadata description vocabulary for the online resources is not available. In addition, even the seemingly standard metadata description elements together with their ontologies available in some industrial domains are just in the level of "recommendation" and they do not strongly constrain the whole metadata description system in the industrial domain or academic discipline.
Another problem causing inefficiencies of search activities on the Internet lies in the fact that the metadata describing the contents of a particular file is embedded within the file itself. An HTML file of course contains its metadata within its "<HEAD>" part, and even an MP3 file or other multimedia files embed their metadata within themselves. Although major search engines are able to pick up these actively marked metadata sources of educationally reusable resources all over the Internet, such metadata cannot be collected unless the search robots actually access the file itself which contains the metadata. This situation causes particularly serious problems when one is

involved in an "instance search." Ironically, as the author also argued elsewhere [6], people cannot perfectly search for desired resources unless they are offered a privilege to access the resources themselves beforehand to obtain their metadata description! Experience tells active teachers of EFL to rely on a yellow page or "recommended links to valuable teaching resources online" included in a homepage of renowned professors or teachers of the same discipline in order to obtain useful online LEs. There is also a tip to look for a good yellow page or link collection for instructors of EFL which the author has learned from the experience. You first rely on a certain yellow page and try to look for a nice online resource as an LE. Then you search for the name of that online resource using the search engine again. Naturally, the result will conversely include ample information of hyperlinks pointing to various educational Websites or yellow pages describing the features of the same online resource together with the URL information. The irony here is we, researchers of teaching of EFL, do not strongly rely on the search engines when we actually want to "search for" something for our educational activities.

3. Necessity of Web-based Metadata Repository

As argued above, what language instructors normally need as LEs are the actual language corpus or speech materials in the target language where certain teaching preferences or needs are reflected. A lot of high quality online resources suitable for LEs for language teaching lie hidden in the clouds of the Internet and as language teachers very often employ the "instance search style" in searching for the appropriate LEs online, it is quite difficult for them to find desired LEs just by using ordinary search engines. If we consider these problems, creating a large scale Web-based metadata repository on LEs in this discipline will greatly aid to the language instructors who would like to create formal LOs using the high quality LEs by themselves. Such Web-based metadata repositories should be keyword searchable, and the metadata for each LE can include language teaching-specific attributes, such as structural difficulty level, vocabulary level, readability, material length, suitable skills to be trained (listening, reading, etc.) in using the LE, or genre or domain where the LE is originally used, etc. It is argued that the taxonomy used in metadata description can be language teaching-specific and that at the level of LEs or microcontents, each discipline is allowed to launch a Web-based discipline-specific LE metadata repository organized in terms of a discipline-specific taxonomy.

3.1. Web-based Metadata Repository Using Hyperwave

Hyperwave Information Server (HIS) was originally developed as Hyper-G at the Institute for Information Processing and Computer Supported New Media (IICM), Graz University of Technology, Austria. It is one of the oldest content management systems (CMS) and there were special devices taking care of the metadata of each object published from the first days of the product development. The latest version is of course equipped with a metadata (called "attributes") description tool for all objects published on HIS. We can see the attributes of an object by clicking the "i" mark on the left side of each object listing (see Figure 1).

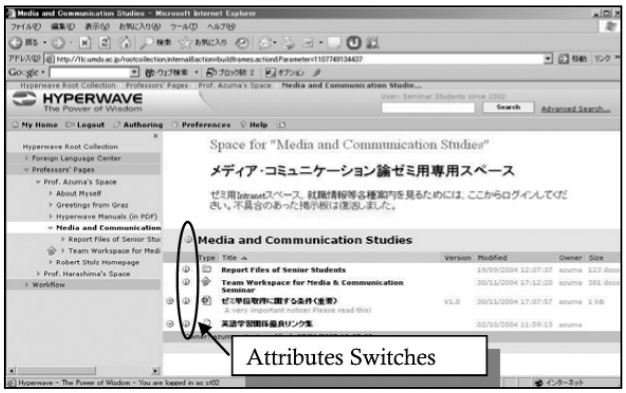


Figure 1: Standard Interface of Hyperware

If we have appropriate write rights, we can of course edit the contents of the attributes by switching into the authoring mode (see Figure 2).

We can not only add "Keywords" and detailed "Description" of the object which will appear just under the title but also control the behavior of the object by entering necessary information somewhere within this attributes menu. For example, access rights or the period while the object should be displayed

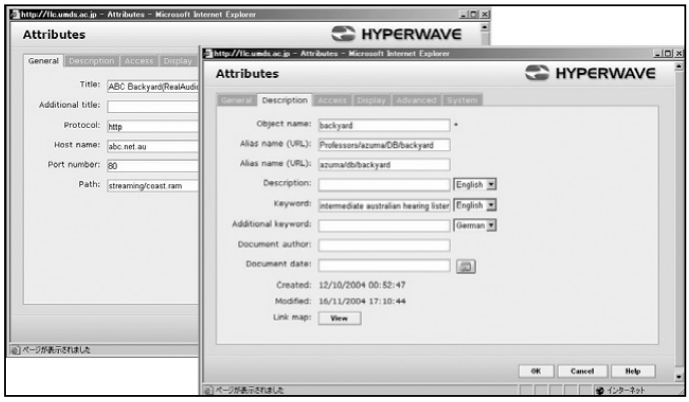


Figure 2: Attributes Menu

can be easily controlled using this menu. Some of the entities in attributes such as "Title" and "Keyword" are searchable using the internal search engine of HIS.

A very interesting feature of HIS is that we can also publish only the URL information of an outside online object as a "remote document" on this server. There are no actual contents within this remote document and only the hyperlink pointing to the relevant outside online resource is generated. The remote object looks just like a hyperlink pointing to a certain outside resource. In fact, the resource can be an HTML page or any kind of object published on the Internet. If the resource is a RealAudio meta-file, RealAudio streaming will automatically start by clicking the seemingly simple hyperlink published on HIS. However, even if the published object is a remote document, it is a genuine object within HIS, and thus, as is shown in Figure 2, a normal attributes menu is available for them.

Combining these features, we can have HIS work as a kind of Web-based metadata repository of LEs. The author published more than 50 remote documents on HIS. These included the URL information for Voice of America, CNN, Radio Canada International, Encyclopedia.com and other well-known online resources generally considered to be usable as teaching materials or LEs for EFL. For each remote document, certain elements of metadata were added to the "Keyword" section of the attributes menu so that the internal search for appropriate LEs can be easily implemented. The searchable keyword elements included difficulty of the material, skills suitable to cultivate using the material (listening, reading, etc.), file format, and country/region where the resource was created. Figure 3 shows the "Search Results" generated by HIS when the author tried to search for remote documents with a keyword "Canadian."

Figure 3: Search Results by Keyword "Canadian"

3.2. Web-based Metadata Repository Using XOOPS

XOOPS (eXtensible Object Oriented Portal System) [8] is one of the popular CMSs distributed under the GNU General Public License (GPL) and we can download the package and use it free of charge to create community Websites, educational portals, Blogs and so on. It is basically one of the systems that operate in the so called LAMP (Linux, Apache, MySQL and PHP) environment, and thus people can launch a full-fledged XOOPS-based CMS completely free of charge. Of course the system also operates on the Microsoft Windows platform.

XOOPS is made up of modules, which are freely chosen by the owner or the administrator of the site. In order to create just a small-scale community site, you can only use the News module, for example. As the XOOPS official site describes, for a standard and medium site, you can "use modules like News, Forum, Download, Web Links etc to form a community to interact with your members and visitors." [9] The normal installation of XOOPS includes standard modules, but new modules created by the XOOPS community are also available at the official site of XOOPS. XOOPS offers a comprehensible module administration system and necessary modules can be easily installed and activated. Uninstallation of unwanted modules is also easy.

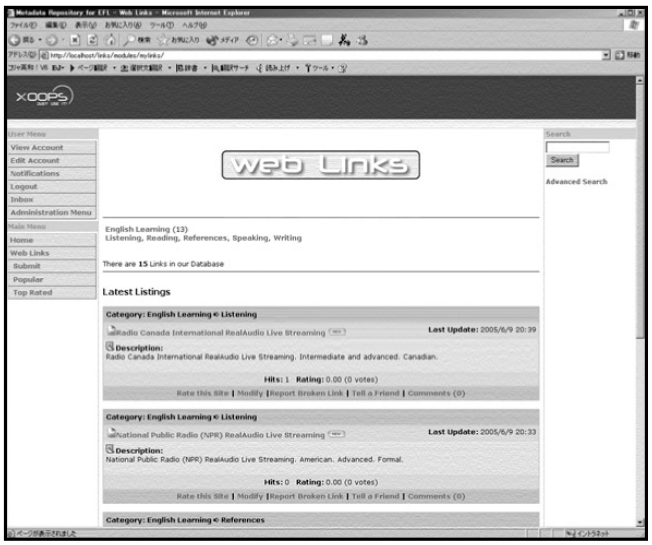
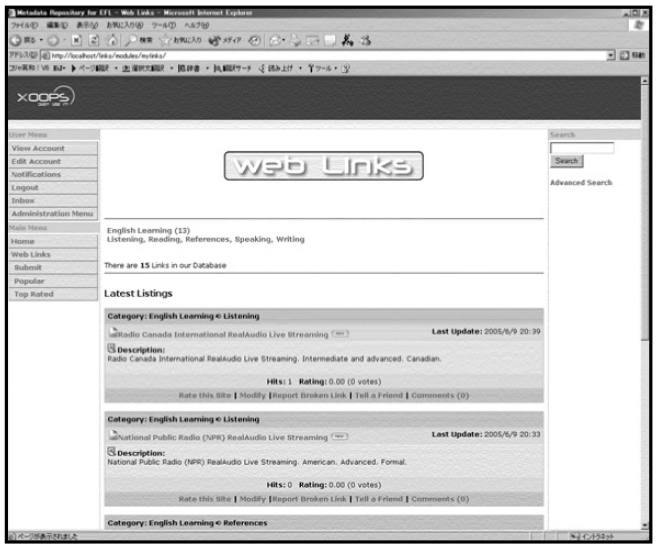


Figure 4: XOOPS Top Page

Figure 4 shows a screenshot of a XOOPS site launched locally by the author equipped only with the "Web Links" module. This is the top page accessed by an anonymous user, with the "latest listing" page automatically loaded.

Actually, Hyperlink information on some recommended online LEs for the subject of EFL was uploaded by the author beforehand. If users search for certain keywords using the internal search system offered by XOOPS, the system looks for matching



link information and a list of the suggested LEs with a relevant hyperlink will be presented. The Figure 5 shows the search result of the keywords <advanced British> and the hyperlinks pointing to three different BBC audio streaming services were found.

Figure 5:
Search Results of LEs

4. Conclusion

Through the small-scale experiments using HIS and XOOPS, it was proved that these CMSs are capable of functioning as a meta-information database of online educational resources. This type of database is really valuable for disciplines such as foreign languages, marketing, business administration and others where the "instance search" approach is mainly employed for everyday research or educational activities. In addition, if we use HIS or XOOPS, database construction will be easily implemented online, and collaborative publication of the metadata on online resources will be possible among the registered users. This means that even educators of the humanities or social sciences without a full knowledge of network engineering or programming can establish a large-scale Web-based metadata repository without much difficulties.

A learning object is, as Wason defines [10], "a package of one or more resources that have educational utility." However, the meaning of this type of definition seems little too broad and the author is inclined to differentiate an LE as a raw material from a higher-order LO, which consists of one or more LEs equipped with some educational scenario. For the disciplines where "instance search" strategy is often employed in the course of teaching material searching, the searchability of LEs as well as of LOs is one of the central issues of eLearning. Establishing a discipline-specific or local "learning *element* metadata standards" is another big challenge these disciplines face today.

Waves of new technologies such as RSS feeds, Blog and Podcast are rushing to the discipline of language teaching. Web-based metadata repositories and other tools for easy and effective retrieval and distribution of LEs as microcontents will be the neces-

sities not only for educators of language teaching but also for advanced and independent learners who can integrate the necessary LEs into their own learning strategy.

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MOOP – Mobile Learning Environment as Part of Daily School Work (Projects and Practice: Learning Spaces, Mobile Learning, Microlearning)

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Abstract: This paper introduces the Moop m-learning environment developed for use by primary school pupils and teachers in the city of Oulu in Finland. Moop is an interactive m-learning environment for situations where primary school pupils take use of a mobile phone to analyze their surroundings and to communicate within groups. Through Moop, a pupil makes observations and saves and manages information in the mobile and network learning platform. The learning environment supports the process of inquiry learning, during which a pupil outlines his or her thoughts on the current topic, collects information and observations from the surroundings and reports the findings in the network-learning environment. Moop project is based on needs of schools and teachers: the traditional learning environment is broadened from classroom to observation in the surroundings. The goal is to increase interactivity and collaboration in learning with the help of a mobile phone. In the Moop environment the mobile learning is realized through tasks based on geographical location and requiring creative problem solving. Camera phone is familiar for pupils and a meaningful tool for communicating and working. The benefit of a mobile data terminal is that it goes where the learners go. Experiences with this tool have showed that inquiry learning processes can happen as part of daily school work and the tool was easy to use with students aged 10–12 years.

Keywords: m-learning environment, primary schools, inquiry learning

1. Introduction

The aim of this paper is to introduce the Moop m-learning environment and show its benefits to the primary school learning. Young people use mobile phones, SMS and other mobile services undoubtedly and without prejudice. During Moop-project has been created contents that improve the teaching opportunities and genuinely motivate the pupils. Moop is a "real" practical application for primary school use. The de-

mand for such environment came from teacher's need to expand the traditional classroom environment to the examination of the surrounding phenomenon and problems.

The basic ideas at the background of Moop-Project are: school curriculum and contents of education, pupils as users of technology, collaboration with parents and school, cooperation between the schools, breaking the boundaries between the classrooms and developing the pedagogy. The main purpose for the school is to provide basic education and it is important to maintain it. ICT-technologies support the pupils learning process. Mobile learning environment has to adapt as a natural part of the daily schoolwork and pupils class schedule – as a part of the knowledge building model.

The purpose of this project is to create a learning platform for mobile learning situations where a pupil works in a mobile and network environment. Mobile phone is used to bring observations from nearby surroundings to the classrooms and to school teaching situations where they are handled co-operatively. Information from neighbourhood will be utilized in learning process. One goal is to create a user interface, through which a pupil is able to outline his thoughts, observations and share them with other pupils. The intention is to use the environment both at school and in leisure time. Then the application will be seen rather as a possibility, not as a necessity for study. Learning through observation occurs in real life. This project can be considered as a student-based technology development.
This paper expresses in practise the pedagogical principles from the learning impression and from the teacher's work. The actions and qualities of the environment and the accomplished education are described in this paper – ending up considering the direction of the continuation development.

2. Pedagogy

The pedagogical principles are: inquiry learning, skills for gathering information and building knowledge, creative problem solving and leading to the interactive and cooperative learning.

Information and communications technology must support the learning. Mobile learning environment supports the ICT-teaching entity by offering a wireless and transportable solution to support the pupil's thinking and actions. The bare equipment won't just do the learning – ultimately the learning still takes place in learner's own head.

School actions must be based on rational contents from the school's curriculum. The equipment or teaching method being used depends on its benefit to the learning. Teaching is aimed at developing the learner-centric classroom techniques, when the learning is seen as a process. Learning process is based on a familiar and meaningful approach, which will be used when solving the task. In our teaching practise we use the model for knowledge building. We call it also as model for "rational actions" in a classroom. It is based on experiences noticed in a school practise.

This knowledge-building model has been developed as a pedagogical guideline for working at school. Model is originated from the teacher's need to understand the entity of the teaching situation. The learning process is based on a simulation of learning positions. This model is meant for both primary school pupils' and teachers' use. With this model they know in what phase of the task solving process they are and what actions still need to be done in order to achieve the desired outcome. This model creates logically proceeding learning path, where all the phases of the learning process form own entities. This model isn't constant – it can freely be modified according to the own task.

Learning has the nature of process. Pupil forms new information to the basis of earlier created knowledge. In the first phase the pupil forms the inquiry learning problem. After that he sets the hypotheses to his functions and creates the mind map from processing subject. Into this map he gathers the information already has or is able to find from the study book. The next level is to search information concerning the subject. Findings and observations from the nearby surroundings have become as distinguished entity as the information gathering during the project. These observations are crucial, because pupils act like content producers at the same time.

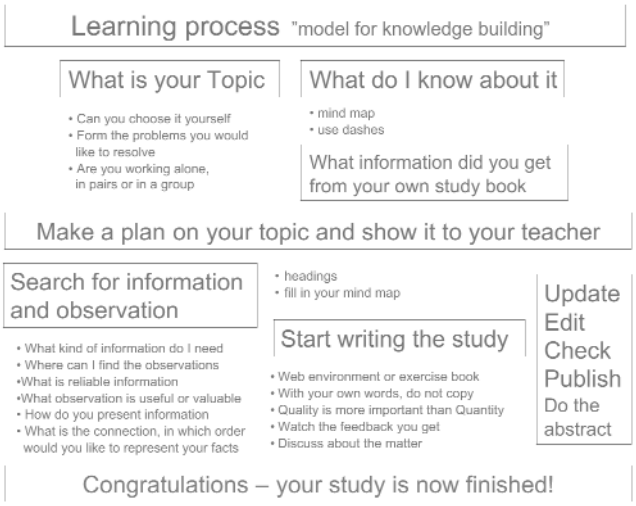

Figure 1: Model of knowledge building stages

With the information and knowledge gathered the pupil classifies the subject matter again and rebuilds the schoolwork. The possible conse-

quences will be considered further through the common class discussion. The outcome is that pupil has solved the set problem with the help of the learning process model. From the pedagogical background the technology is being carried out to a natural part of functioning in classroom and working model. The crucial learning factor, even more important than information, is the learning process itself. (Roschelle & Pea, 2002)

3. Learning situation

The aim is to create a model of a learning situation, which can be accustomed further as a support for learning and teaching. It rises from the basis of curriculum to the different school tasks. During teaching process knowledge is being built in a modern and meaningful way. Learning situations from neighbourhood are connected to the curriculum themes. The intension is not to compensate the traditional teaching, rather give more equipment and means to realise it. With real-time feedback and interchange the pupil is guided to do the observations and downstream operations that follow the idea. In teaching the attention will be paid to the interaction and cooperation.

Pedagogical Aims by Using Moop

1) Main principles are based on pedagogical ideas of inquiry learning and creative problem solving and the tasks led from the learning process. During process a pupil lists the previous information and opinions about the task, forms the project plan and through that seeks for more information and observations about the subject being dealt with. Then the pupil composes the study on a school subject according to the process. Before it is finished it is useful to discuss the subject with others and comment on other students' work. (Edelson & al, 1996; Hakkarainen & Sintonen, 2002)

2) Location-bound task courses are based of path being constructed to the certain area. Pupils make observations in specific task points, which are bound to GPS-location technology. The information gathered from the task points are tied to school learning process and curriculum. Pupils benefit the information collected actively in classroom and share it in cooperation with peers. The knowledge is achieved and applied like in everyday situation. (Lave & Wenger, 1991)

3) Collaborative project learning is realised through tasks which pupils have to figure out in a group activity. There is a certain time for the task to be finished. To cope

with the mission the group has to split in smaller groups, take roles and to communicate with Moop-environment and the tools on offer, for example by using the PoC function. (Dillenbourg, 1999)

Working with Mobile Phones in Primary School Learning Process:

One of the themes that have been used is recycling. During this period the pupils get to know the chosen phenomenon, recycling, many-sided and hands-on guidance. The process starts by giving the instructions to the pupils, connecting the technology used and teaching process and connects the recycling and close surroundings. From that point of view pupils analyse their subject, consider the inquiry questions and find the basic information about their subject.

The orientation task was to find a location-bound observation from school surroundings and report that to others. When the observation has been sent through Moop, there is location information included automatically and it is possible to find the specific place.

After that the public information officer from recycling centre of Oulu came to the classroom to tell pupils about recycling and the essential points concerning pupils' subject. She became an expert in web-based learning environment as well. Based on gathered information pupil's task was to create waste management plan for the school. With the help of all the information from thinking and analyzing the briefing knowledge, searching new information and collecting observations, was the basis for each one to create the work to the network-learning environment.

At the end of the learning process there was a field trip to the recycling centre. Our expert introduced us the centre and pupils collected observations and asked questions. Before excursion pupils got three possible tasks based on an inquiry learning to get familiar with the theme. So the group of the pupils chooses their own point of interest and forms their learning questions and strategies by themselves. Through these questions it was easy to pupils to structure the visit and collect the material to build the real learning duty.

Inquiry learning questions:

- Are there small animals like birds, rats or life in general at the recycling centre – Why there are so many birds?

- Does there smell at the recycling centre?
  – Why does it smell at the recycling centre?
- How does the recycling centre affect to the protection of environment and our sensitive nature?
  – For example for pollution of waterways or formation of biogas?

The observations were collected from Moop-environment and were used as a part of schoolwork build in net-based learning environment (Riihi). Pupils were able to edit the observations by themselves to the appropriate form and construct the mind maps in relation to observations and the rest of material.

Pupils had a possibility to use phones also at home and do some mobile observations at their leisure time. They were interested and willing to take the device at home and carry on their task there, to continue to study the recycling at home by utilizing the mobile terminal. The overall process is demanding. Pupils are deep insight into a subject area only after many rehearsal times. Operation can be practised through single observations and examples by constructing the meaningful and motivating learning situations.

4. User Interface

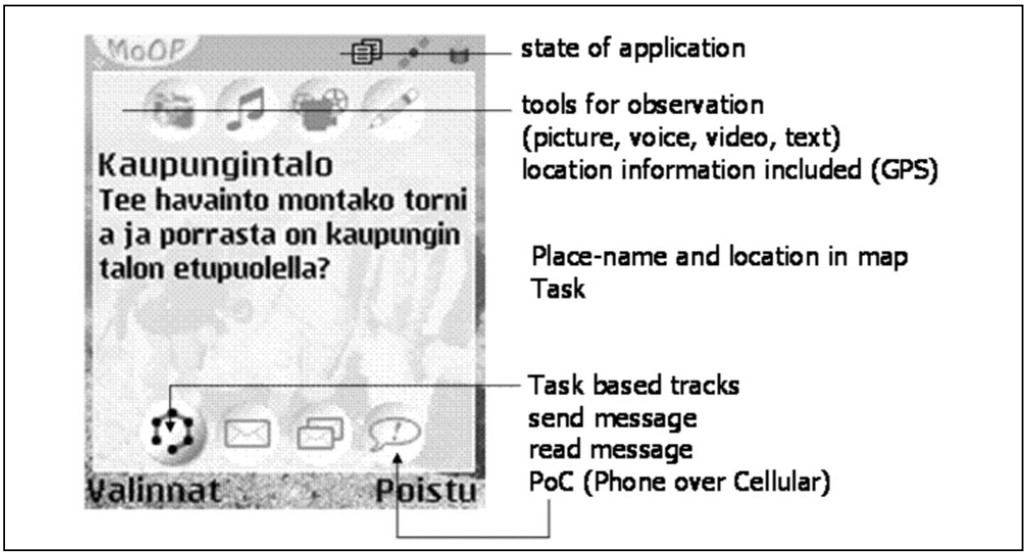

Figure 2: User interface in Mobile Phone

Mobile Phone

In the Moop-project it has been designed a user interface and application working in Symbian S60 operating system for mobile devices (for example Nokia 6630). An observation gallery, an own user interface for management of users and map bases and some administrative tools have also been created for the network. Moop-observations are utilized as a part of web-based learning environment (Riihi) at schools in Oulu.

Moop learning environment is a user interface for mobile phones. It collects the features concerning the teaching inside the same applications. Through Moop the pupil analyzes his/her thoughts and makes observations from the mobile device and carries on the process in network. Moop application has been planned from the basis and needs for primary school pupils. According to the experience the phone and user the interface can be adopted approximately in 15 minutes. The user interface planned for primary school learning situations must be logical, motivational and easy to use.

The pilot project can be described also as a learner centric technology development process. The fundamental point is pupils' actions. The demands and benefits can be obtained to the pupils work through m-learning. At the same time it is possible to achieve information about the culture how the youngsters use the cell phones. With this feedback it is possible to continue the developing process and share it to pupils' level.

A platform for collecting data from immediate surroundings was created in the first phase. It enables the perception, saving and sending of phenomenon from observation point straight to the server and bound by the location information. It enables also the edition and analysis of raw data in the observation point. The created application was already more than just a tool for collecting observation. It creates the base for learning platform or m-learning environment. It is a surrounding where pupil logs on with his own username. Mobile terminal is in connection with a server program which transmits the information between mobile terminals, www-browser and data base. In the second phase the environment has been developed into a possibility to build task courses, which enables to form location-bound routes. The returning time and the safety area will be defined to the route. Tools for helping to enlarge the cooperation and interaction are PoC (Push to talk) function and other features like reading and answering messages tools for Moop.

The application created to the phone collects digital data and transmits it to a certain server address by using only acceptable data connection (GPRS/3G/WLAN). The

media transmitted through mobile user interface can be text, photo, video (.3gp), a report, a record or transcription like voice message, for example an interview (.amr). The equipment used is also a phone and it can be used as a normal phone. With a phone call it is possible to clarify the subject. Pupil has also a possibility to search the task, messages and notes made by teacher or other group of pupils.

Both the teacher and the pupil have a camera phone using the Symbian operating system. The learning tasks are being transmitted through this application. Teacher guides the action by setting questions and pupil does the observation in a meaningful way from the surroundings. When GPS-locator is switched on the pupil is able to find his own position and the observations taken from the map base. The location information will automatically be attached to every observation and will be transferred to the class room, directly to the school teaching situation. There are more tools such as web-based learning environment to handle and perform the observation in the classroom. We have a web-based learning environment called Riihi. The information stored with mobile devices is then categorised and specified through logical user interface. The meaning of that information is to fulfil the information found from the study book, as a natural part of school's learning process and curriculum.

Network Services

Pupils have Moop-network environment in use. They sign in with the same username as to their mobile device. The observations made by camera phone are transferred to the server application and through the server. Those observations are available to the pupils in their computer or laptop. Then the pupils operate by using tools on a Moop-network environment or the used web-based learning environment. The observations are listed according to observation group or shooting date. Writing notes can be added as well. The meaning of these messages is to analyse their work and thoughts when writing the final outcome. All the observations are presentable and the included text editable in the Moop-environment.

The teacher has also administrative tools, which give the teacher an opportunity to have wider opportunities, such as run and edit tasks. Admin user has a right to create maps and the location points needed for the GPS-locator. Admin user can plan routes and tasks to the pupils and for their mobile devices. Teacher works as an intermediate between closed and open surroundings. Teacher can remove the pointless observations and also publish good quality works or pupils' material which will be moved to some sort of a media bank, from where it can be utilized by the others. Teacher can also transfer the photo straight to the web-based learning environment.

The Key Elements in Moop-Application

- Tools for observation: Moop is based on the idea where the application collects the useful features from mobile phone inside the one user interface. Though Moop application user can control a camera, a video camera and a voice recorder features. When GPS-locator is connected the location information will follow observation automatically. The additional information like the shooting time, date, place and the photographer is being recorded. Before the application sends the observation further it must be named or classified by typing. The function is for the analysing the observation purposes straight from the shooting point. It guides to consider more closely the circumstances in the place the observation is made. This information is useful when the learner is building the final examination later in the clasroom situation.

- GPS-location technology: Maps are located at the server and are downloadable to the user's mobile phone via data connection and GPS-positioning system. It is possible to benefit the map vision based on address information or aerial photograph while moving with Moop at the moment. A variety of electrical maps, for example guide maps, orientation maps or aerial photo maps, can be used. Before utilization the map has to be transformed into a suitable form and scale. A GPS-locator device can be used in the teaching situation. A task course is created with the help of locating and a user can easily proceed on course to reach the set goals. The defined boundaries limit access to safe and permitted routes only. If a pupil leaves the defined safety area, both the pupils' and teachers' mobile phone notifies them with a voice signal. Planning the route with Moop's map view gives the possibility to plan a variety of learning situations and study plans. With the teacher application it is possible to plan the route directly on course in nature and in observation place. The benefit of geographical location technology has been used in school learning situation when the teacher have planned routes but also when pupils have made roots for themselves and to smaller pupils. (Vygotsky, 1978) Using the maps in primary school learning we can get plenty of useful information to benefit the teaching.

- Push to talk – function (PoC, Phone over Cellular): PoC enables a direct voice communication between teacher and / or pupils in a closed environment. The Poc connection is opened with a push of a key (tangent), just like in the old radio phones. Pupils have also noticed the benefit in leisure time or in hobbies when forming closed groups or one to one connections when demand. This feature has turned to be useful in education. PoC connection establishes security. In remote learning

situation the teacher or peer group can be activated by pressing just one button. By using the PoC connection it is easy to direct group movements and to give extra information which can be helpful when seeking the solution to a task. It is also realistic to give all introductions through Push to talk connection. This direct call over data connection improves the quality usage of environment by giving remarkable additional feature to interaction and cooperation tools in Moop. As an individual application the PoC became a part of user interface easily. The interaction between learners can be also supported by the tools for send and read messages. It is possible to send message bases from one phone to another, form one group to another.

5. Utilization Experiences and Results

The operational environment for Moop-project is the primary school classroom, which is led and guided by the teacher. The actions occur in real school day situations in three primary schools in City of Oulu, in three classes. The pedagogical developing process is participated three teachers. There are average 20 pupils in a class. The environment and the equipments are in constant use of 60 primary school pupils at the age of 10-

12 years (3rd to 5th grade). During this spring there was a big school festival in Oulu and the environment was used there by about a thousand novice pupils. Mobile phones are used as much as it is rational from the point of view of learning. Moop-environment and the use of terminals are part of ICT-didactic use in teaching.

The main mission to the teacher is to connect the teaching into practise, branch of study, study material and observation of surroundings by utilization of developed learning platform. The new features are attempted to be planned according to the need of the environment and contents. They will also be tested in practise. The existing environment will be developed through the interaction between the school learning, software design technology and the desired user descriptions.

Pupils have been aware of the progress and the learning model used. The aim concerning the learning is to define phenomenon, not just to remember pure facts. The attitudes and functions among girls or boys have been quite similar. There have been no significant differences. Pupils have also had a possibility to operate the device during evenings and weekends. At the piloting session the amount of phones has been limited and eagerness to run those, also at home, has been considerable.

Based on the experiences on the mobile leaning environment and the knowledge building model, the users have found them to be motivating, encouraging – and in their own language, "cool". They thought that the best outcome was that the only solution didn't find out just by reading the school book, but it was possible to do research, seek and test the best solution by them. At the same time it was possible to learn how to use equipment and how to transfer data of your own picture, voice or text to the network and process them there.

The first pilot was carried out in Korvensuora Primary School (17.-25.5.2004) and contained one school class with 25 pupils. During the piloting project it was taken around 362 mobile observations with image, voice, or video data. The amount of the observations taken was positive concerning the time and equipments used. Also the quality of data and how significant it was towards leaning was positive and encourage continuing the trial. After the first piloting session the surrounding was developed and supplied with new features, which have been described earlier. During this spring term 2005 there has been stored up to 2 GB observations taken by mainly three school classes. The accuracy of observations has improved significantly along the new phone models, when one a observation can be average 500 kb these days. The standard of observations rise remarkably when the observer learn by experience and when the observation situation is designed in advance. The utilization of observations in school use does not depend on the quality of a digital data anymore. The observations in the server are in connection with school day, home environment, big events, pets, festivals or to the school task. There are so many observations that the classification and searching tools will be emphasized in the continuation development.

The observations are especially valuable, because those are pupils' own. When considering closer the use of Moop-environment and knowledge building process it is noticeable that traditional school teaching will change. Study books made by publishers and photos included in paragraphs are no longer the only source of information – it is one important source among the others instead. Pupils own working process and importance of their own observations are being emphasized – pupils take an active part as content producers. They are not only learning the information nuggets but also the learning process itself which will be useful afterwards in equivalent situations. Pupils' activity and their own working process are emphasized and the role of the teacher is becoming more and more as a mentor of a class, group of pupils or single pupils. The teacher shares the basic information of knowledge management and media education. These skills are important when doing the projects. The value of the information that the pupil gathers from peers and peer groups is more crucial. (Vygotsky, 1978) All this depend on more communication and interaction skills. Moop-

environment includes the tools supporting the process. It is very important to analyse and develop this technology further when there is more evidence of utilization in school practise. Overall the function teaches responsibility and ethicality how to use this kind of system. It can be described as a sort of mobile etiquette which will be practised in a closed group.

In the future the effort is to increase the work with mobile terminal and it leads the learning process in distance. The stages will be integrated to network learning environment working, your own study process and a class schedule. Bidirectional data transmission is part of the process and the environment is working as a toll for knowledge building. Practically this means that the learner analyzes the observation before it is made and learner can benefit from this information when and where ever. With this information the learner can edit the working plan and affect the course of process. The possibility to suggest comments to the work and observations by others is improved and that will affect directly to the own working process.

When the pupils are familiar with the surroundings, it is possible to establish cooperation between classrooms and teamwork between teachers. Pupils are able to do larger projects and those can benefit from other pupils at the same or completely other circumstances, for example natural science projects. The learning process and utilization of ICT-technology in the teaching educate to the information gathering and managing process. This forms an important base for future learning and missions of life. In addition to the learning the thinking and the view of life are expanding and becoming as part of lifetime.

6. Conclusions

Through Moop mlearning environment it is possible to reform the culture of openness, based on sharing the information and cooperative learning. The opposite of that can be seen the information hiding. Open discussions held with interactions between peers are leading towards the group shared knowledge and at the same time the standard of knowledge of an individual learner is rising. By using the right learning environment it is possible to support the knowledge building process in a way we can achieve the understandable and profound learning results. The benefit from using the learning environment is to practice the information and abilities which can be useful to the citizen of tomorrow's information society. Pupils are operating rationally and responsibly with mobile phones, by given instructions. Experiences with these mobile terminals have shown that it is a meaningful tool for primary school pupils and part of lear-

ning process. The tool has been motivating and easy to use and it benefits the situation in practice by supporting the learning process and helping the classroom functions.

Moop affords a useful opportunity to do problem based observations from nearby surroundings. According to a pattern of working model the teacher can create learning situations that the pupil can solve through own planning, actions and reasoning. The pupil reached a unique learning experience that is not dependent on any school books. Through given tasks the pupil makes observations from neighbourhood, for example the recycling process at home, take a stand in a matter and influence the decision and way of activity at home. By following that mode of action the pupil can directly affect the decisions and actions in surroundings. The noteworthy observations can be taken from the same position at a different time or different angle by different pupils according to task. The remarkable observations are as well the unique observations which will appear suddenly and are valuable to record for further examination. Through Moop-environment and a camera phone pupil can look at the living surroundings by open eyes.

The solutions used in Moop-environment efforts to increase security. A task course is created with the help of locating technology and a user can easily proceed on the course to reach the set goals. The defined boundaries limit access to safe and permitted routes only. Teacher is all the time aware of the pupils' location, their progress and the time used on the task course. If a pupil leaves the defined safety area, both the pupils' and teachers' mobile phones notify them with a voice signal. The teacher and pupils can communicate real-time through the mobile phone's PoC connection while outdoors and make focusing questions. Regardless of task based routes it is possible to do Moop observations from normal surrounding in every day school situations and on a way to school, at home or in hobby. Mobile phone is generally part of everyday life.

The main aim is to work together is to find new innovations in teaching and the pedagogical teacher work. From the experience learned in this project mlearning and Moop-environment are suitable ways to benefit in different learning objects and fit to as part of primary school learning process. Before the cell phone is considered as a prohibit tool for classroom, although for children it's quite natural tool for communicate. This Moop-project has been start from the idea, if it is possible to find real, true and useful subjects of benefit the camera phone in school and as part of learning process. The children don't accept to do things in an one certain way. They have not accepted the way that you can do things in only certain way. It is allowed to do mistakes in

school learning and the activities are being prepared in closed surrounding. One goal for the school system is to raise the citizens of tomorrow society.

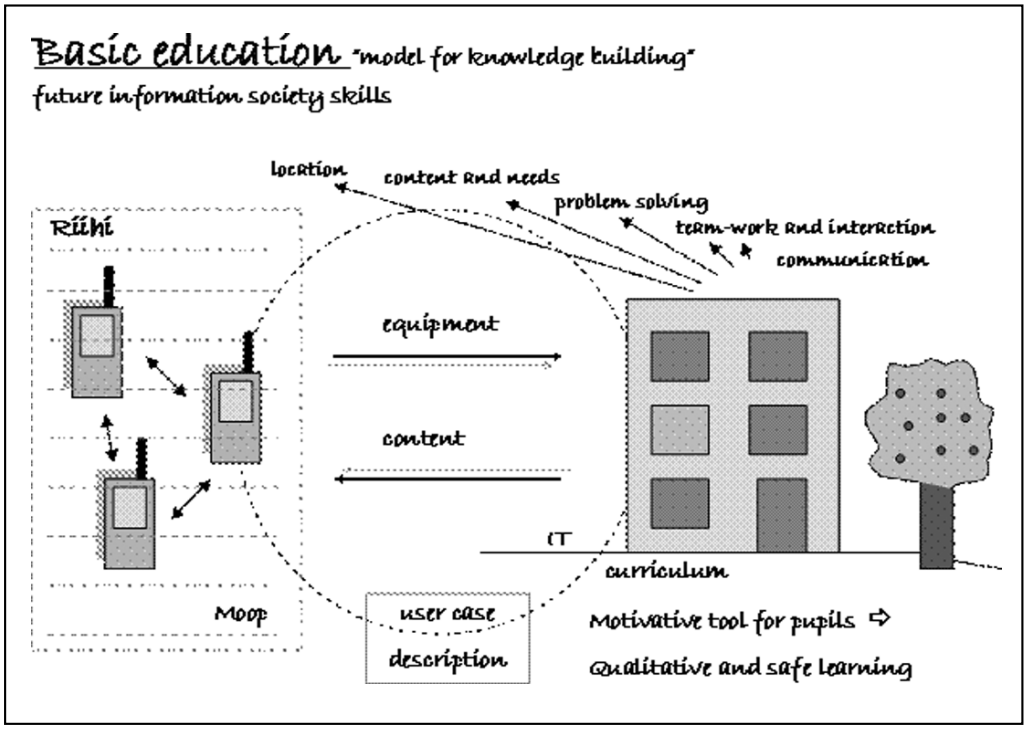

Figure 3: Developing aims

Moop is used as a certain learning model in classroom. When look at the outcome of the learning results and pupils work you realize how much essential matter dealing with teaching subject those include – mind maps, mobile observations, concept explanations and the text pupils can form through the whole model. The observations pupils make are saved to the server, to the digital data storage which is growing gradually and will be in use of all the pupils using Moop. Little by little all the mobile services become merged in school system. It develops and brings its own benefit to the existing learning solutions. Attend to school pupil build own learning portfolio which goes together to the following school level. The building tools during the project are possibly opening the channel to make cooperation between parents and school. School with it information get nearer to pupils home and for parents it's easier to stay in contact with the school – when the one natural goal for learning starting point will be the problems coming up from neighbourhood.

7. Future research

Moop mlearning project is in a way of "expedition" journey during which we are building something new and as far as concerning about user's learning process – we have to let space to do some experiments. There are no certainty towards we are heading. Progress takes place little by little through the feedback we can get from users and by following and reporting the function and advance. In the educational matter the user interface set up large pedagogical challenges, which will be interested to consider by doing researching work and practical teaching in normal school day.

8. Acknowledgements

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Mobile blogging, 'Skyping' and podcasting: Targetting undergraduates' communication skills in transnational learning contexts (Projects and Practice: Learning Spaces, Mobile Learning, Microlearning)

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Abstract. This paper describes a research project in its early stage of implementation: first year Engineering and Business university students in Australia, Africa and Malaysia use handheld computers (HP iPAQ 5550s) to communicate with peers to form transnational learning communities which focus on their achievement of key learning outcomes. These students will use innovative applications such as blogs, VOIP telephony and audio files; their gains in confidence and ability to think, research and communicate will be mapped to their level of engagement with the technology. The project also investigates the cultural and infrastructure issues which arise when emerging technologies are introduced into varied geographical contexts. The project is currently in its trial phase, and results of the trial will be reported in this session.

1. Introduction

Universities around the world are competing more and more in foreign markets, stretching their existing resources to capture overseas student markets. While this often strains the human and educational resources of the parent university, exporting educational experiences 'offshore' also opens the possibility for enriching and internationalising the curriculum (Weir, Wright et al. 2005). While much work is being done in the area of curriculum-making sure that curricula have global reach – it has until recently been very costly to enable students from diverse locations to interact in a quality way in the one physical learning space.

In Australian universities, web-based learning has been predominantly in the form of online text, email, discussions boards and chat and has given students greater asynchronous opportunities to interact with each other usually from a desktop or laptop computer physically attached to the telephone system(Bell, Bush et al. 2002). This has

shaped online learning experiences in Australia largely as formal deskbound events – different from the predominant relaxation mode of youth culture. Typical Australian undergraduates have grown up in rich and fairly reliable electronic habitats which include highly interactive gaming environments (Smith and Curtin 1997); it is unlikely that these Western students will be engaged or stimulated by static textual websites and email. On the other hand, take-up of online learning in other cultures, particularly in developing countries, has been affected by more basic issues such as bandwidth and infrastructure (Darkwa and Mazibuko 2000); nevertheless; cultural issues for users – including the potential for importing cultural imperialism from dominant Western cultures would also have serious implications for students in developing countries (McLoughlin and Oliver 1999). Recent applications may be able to address both these issues: they allow more cost-effective solutions in developing countries, and they allow much richer interactive learning experiences for students in more developed cultures. Because some are more interactive and synchronous, they allow for an environment in which cultural differences can be negotiated.

This research presented here investigates the use of three such collaborative applications, all increasingly popular with the undergraduate age group in developed countries (Cook 2005), within the education context: blogging, 'Skyping' and podcasting. Blogs allow individuals or groups of users to co-author reflective websites (Downes 2004; Flatley 2005). Voice Over Internet Protocol (VOIP) telephony applications such as Skype (2002) enable users to communicate orally at low cost. Podcasting, which draws its name from Apple's iPOD, means broadcasting MP3 audio files over the Web (2005).

Students in developed countries are high end users of mobile phones and MP3 players (including iPODS) for socializing and entertainment (Caruso 2004). A growing number of universities are using these devices to extend their e-learning services (Duke University 2004). The take-up of handheld computers by students in developed countries is generally much lower than their take-up of laptops, mobile phones and music players (Caruso 2004). However, when handheld computers such as iPAQs have the capability to include web-authoring (through blogs), telephony and audio delivery, universities have a potentially cost effective tool which can facilitate more interactive and engaging e-learning environments which are obviously more mobile than traditional forms of e-learning which are large desk-bound (Caruso 2004). When those experiences are offered to students in transnational contexts – for example, when a unit is offered in the country of origin as well as offshore – then a richer and more mobile intercultural mix may be introduced to the virtual classroom.

2.1 The project

At Curtin University in Australia, groups of first year Engineering and Business students studying units offered in Australia (as well as offshore in Africa and Malaysia) will use handheld computers (HP iPAQ 5550s) to form transnational learning communities which focus on their achievement of key learning outcomes (Oliver 2005). The African students – part of the African Virtual University (2005) – will be enrolled in a Curtin University Business unit (Legal Framework 100) and will be located in Addis Ababa, Ethiopia; they will pair with Australian students studying the same unit at Curtin's Perth campus. The Malaysian students – enrolled at Curtin's Sarawak campus – will study Engineering Communication 100; their counterparts will be peers in the same unit at Curtin's Perth campus. The evolving nature of the project has been a collaborative effort involving Curtin staff and students through a project blog (Oliver 2005). From August 2005, all students in the research programme, under the direction of their lecturers and the project support team, will participate in blogs, and use VOIP and podcasting as part of their unit experience. Because of the different pedagogic emphases in the two units, Business students will focus more formally on podcasting, and Engineering students will be more focused on blogging. All students will be encouraged to contact their peers by using the VOIP telephony application installed ion their devices. Changes in the students' levels of confidence and ability to think, research and communicate will be monitored throughout the programme, and mapped to their levels of engagement with the technology – specifically their use of the mobile devices, and their involvement with the particular applications. The project tests the central research hypothesis that beginning undergraduate students improve in key learning outcomes, particularly those related to communication and intercultural understanding – at a greater rate when they use mobile and wireless technologies to engage in transnational learning experiences. In addition, the project allows opportunities for investigation of wider intercultural and infrastructural issues associated with mobile learning and wireless networks, such as:

- Are students' attitudes to wireless and mobile technologies universal or influenced by their culture?
- Are changes in student confidence and ability using mobile technologies universal, or are they dependent on the culture and IT infrastructure in which the learning is embedded? If so, how?
- What are the specific issues to be addressed when using mobile and wireless technologies in the three cultures represented in this project?
- What is the impact of student use of mobile and wireless technologies in the three IT environments represented in this project?
- Do undergraduate students find mobile and wireless technologies accessible, engaging and useful for their learning? Why or why not?

2.1.2 Using blogs, audio files and VOIP software

Each student participant will be involved in a group blog consisting of five 5 students with at least two students from different continents. The group blog is intended to create a virtual learning community among the students who will use text and image to communicate about their learning. Each Engineering blog will have a focus topic (provided by the lecturer) which will be an assessable part of their unit of study. Business students' blogs will be more informal places where students will be encouraged to communicated on course – related issues. All students will be strongly encouraged to blog about:

- their learning experiences with mobile devices
- their learning in their units of study
- their interests, ideas, questions – using the blog as a group 'think out loud' space.

For this project, the blogs will all be located at Blogger (2005). Students in each blog will be assigned as team members of that blog so that they can all co-author their blog; this use of the blog begins to blur the boundaries with a similar web form known as wikis (Lamb 2004). All the Business blogs, and all the Engineering blogs, will be interlinked so that all blogs in each discipline can read and monitor each other if they wish. Students who are not participating in the mobile project, but who are enrolled in the units of study, will be encouraged to visit and post to the blogs. Students will be asked to install avantblog (2005) on their mobile devices – this small application acts as an AvantGo channel, and allows the user to post blogs directly from their iPAQ to blogger.com. Even so, students who are participating in the project are highly likely to use desktop computers as well as their handhelds to create their blogs. They are also strongly encouraged to use digital cameras, made available within the project, to add video and still images to their blogs. All of the applications related to blogging in this project are free and available on the Internet.

Teachers in the project already offer unit websites where their students may access course materials. Teachers will be strongly encouraged to add to this offering by producing short voice recordings for their students on a weekly basis – this could be a very brief audio message or extend to a full lecture style recording. Curtin University has an existing technology called iLecture (2003) which creates video and audio streaming of course materials. These files can be compressed and downloaded for use on handheld computers. Students within this project, and students in the units of study who are not officially in the project but who have iPODs or MP3 players will be invited to access the files through the Web (using normal desktop access).

2.2 The research programme

This research in this project seeks to test the hypothesis that beginning undergraduate students improve their communication skills at a greater rate when they use mobile and wireless technologies to engage in online learning experiences which supplement classroom experiences. Quantitative and qualitative data will be gathered from student and teacher participants from August 2005 until June 2006. At the beginning of the project, all students in each unit of study and location will be asked to participate in a data gathering exercise to ascertain the following:

- Demographic data including level of interest in participating in the programme, and their current use of technology; and
- Students' self-efficacy and ability in key learning outcomes including thinking critically; accessing, evaluating and synthesising information; communicating effectively; recognising international perspectives and cultural issues in their discipline areas.

Throughout the programme (August 2005 to June 2006) student participants will be asked to give qualitative responses to the following:

- Their perceptions of changes in their confidence and ability in research and communication skills;
- Their use of and attitudes towards using the handheld devices;
- Their use of and attitude towards particular applications such as Skype and AvantgGo channels.
- Their use of and attitudes towards using blogs, VOIP software and audio files for their study;

Any other uses they make of the devices – study or recreational.
In addition, group blogs will be close monitored throughout the programme, particularly in semester 2 2005.

3. Conclusion

This is clearly an ambitious project given its use of mobile and wireless technologies, innovative software applications, and its setting in three locations, one of which is clearly in a developing country. Nevertheless, it affords the opportunity to observe student behaviours, and particularly individual and group reflections on learning over an extended period. In the current preparation phase of the project, researchers are closely monitoring a student trial group who are now using the mobile devices on the

Perth campus. Outcomes from the trial will be reported in addition to this paper, and will be used to further refine the project brief.

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Multimodal integrated System for Learning – MISL: an Health Experience (Projects and Practice: Learning Spaces, Mobile Learning, Microlearning)

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Abstract: The experience of the Local Health Service Department of Asolo in a remote learning approach proves that the introduction and application of new technologies in services supply is a possible aim, in spite of its difficult realization. The Local Health Service Department of Asolo is a public body of the bigger Health Structure of Regione Veneto; it covers an area of 263.000 inhabitants belonging to 30 different villages. It is made up of two socio-sanitary districts and two hospitals, which guarantee 770 bed places and are organized in 64 working units, with a total of 2500 employees and 300 professionals hired under special contract. Since 2003 the Health Department of Asolo has decided to adopt a training integrated system for remote learning. Moreover, it has developed applicative, technological, organizational and infrastructural solutions to enable people's access to the courses - wherever and whenever they might be, even at home. These courses have been carried out by the same Local Health Unit and dealt with medical, scientific and managerial issues. The experience gathered in the remote learning approach, especially on line, has lead to an important partnership with the Regional Socio-sanitary Agency of Veneto. The result of this cooperation has produced E-learning courses on themes such as "Clinical Risk" and "Health Service Humanisation" addressed to the whole sanitary staff working in Regione Veneto.

The remote learning approach of ULSS 8 is supported by the Multimodal Integrated System for Learning - MISL, mixing several sources such as E-learning, interactive TV, web television, web campus: all these means enable people to actively partecipate in training sessions - either directly or indirectly.

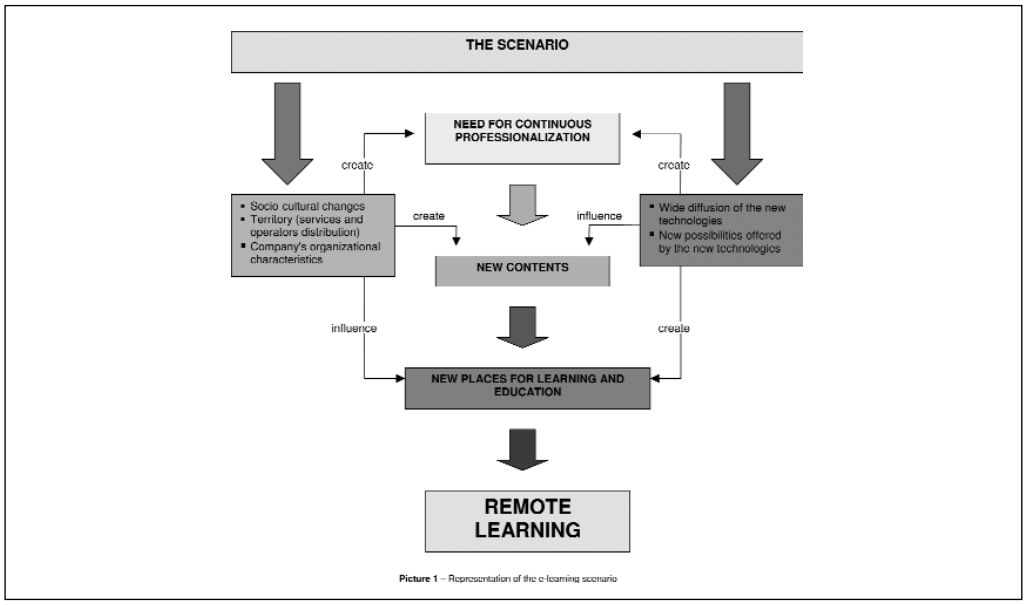
The MISL system assembles all these technologies and transforms Interactive TV courses into E-learning courses. It is equally possible to make them teacher-driven courses (both live and recorded) and to develop

courses applying multimodal systems at the same time. The presence of an instructional schedule concerning both general subjects (such as English, Computer, Institutional and Interpersonal Communication) and more specific ones related to a precise Health Community, offers a valid alternative of choice within the same Department.

Overall, the Local Health Department of Asolo aims to reach the staff's professional growth, development and enhancement through this instructional model. In conformity with European programs, the learning and teaching backgrounds, as well as the educational and social ones, have been thoroughly re-adapted from both the locational and technological point of view. To begin with the final purpose of the MISL project is to support the full development of Human sources, who are strategically important, but also to boost innovative and reforming trends gaining round (such as the project financing, the outsourcing, the global service pattern, the E-government, E-care and E-hospital, drugs logistic)

1. The Scenario

Generally, E-learning belongs to a scenario where on one hand there is a broad diffusion of new technologies allowing a wide range of distance-made operations. On the other hand, social and cultural changes, organization features of Azienda, the distribution of services and operators in the territory together with possibilities offered by new technologies impose to consider learning, training and general education environ-



Picture 1 – Representation of the e-learning scenario

ments (picture 1). As well as the health mission, staff valorisation through training and professional revaluation, represents for the Italian Health Organizations an objective of primary importance. E-learning uses more or less recent technologies, by integrating in aimed ways various teaching methodologies in order to reach the objective of effective and continuous training.

- Socio-cultural changes
- Territory (services and operators distribution)
- Company's organizational characteristics
- Wide diffusion of the new technologies
- New possibilities offered by the new technologies

The use of different technologies and teaching methodologies allows to create meeting places to exchange ideas, suggestions, and evaluations with anyone, anywhere and anytime.

2. Legal and Programming Context

In the past years, Italy has received European indications in the field of e-Learning, and Azienda ULSS of Asolo has conformed to them. In fact, in 2004 it had already achieved the national objectives legislature foreseen for 2005 consisting in training 30% of its staff one via e- Learning.

3. Partners

The practice of distance training activities supplied to the members of staff has been possible thanks to the following partners of and Azienda ULSS of Asolo:

- Banca Intesa S.p.a. main Italian banking group, Treasurer of Azienda ULSS of Asolo;
- Intema S.r.l. - Gruppo Getronics, specialized in the development, supply and management solutions and Information & Communication Technology services for the Health and Civil Service market;
- KPMG Business Advisory Services
- S.p.a., professional services for companies, with whom general theme courses have been organised. The themes included Human
- Resources Management for Health Organisations, health management innovations, or more specific themes such as clinic risk.

An important partnership has been created with the Socio-Health Regional Agency of Veneto for the actuation of courses supplied by means of distance learning. Such courses are about themes like the humanization of sociohealth services.

4. MISL: Organizational System, Methodologies and Technologies, Infrastructures

ULSS 8 has absorbed the European and National directives creating a flexible training system, able to adapt to the training contents through the use of more training technologies and methodologies. MISL (Multimodal Integrated System for Learning) joins the possibilities offered by recent e-Learning and the Interactive Television methodologies, without abandoning proven effectiveness of the Classroom Training.
The use of various technologies and more training methodologies allows to deal any topic for any professional category. Moreover, e-Learning in particular allows the learner to organize the time of development of his/her training path, in order to make lessons compatible his/her own professional engagements.

4.1 Learning Methodologies and Technologies Used

MISL uses especially two teaching methodologies for distance training: e-Learning and Interactive Television, each one uses special technologies.

4.1.1 e-Learning

e-Learning allows the operating to learn "when one wants and where one wants", thanks to the possibility to manage the times and the places of the development of courses independently: the student is offered an interactive environment based on the Internet browser, guarantying an easy way to access learning and professional updating.
The applicative/technology solution used for the e-learning system is made by LearNet, a platform for the management of multimedia centres for the distance teaching, able to integrate various multi media in order to favour teaching effectiveness of the courses supplied by means of Internet.

4.1.2 Interactive Television

It is a multi-channel system via satellite integrated with Internet allowing a high number of learners to follow courses directly in dedicated class-rooms. A special telephone placed in every work-station allows every single learner to intervene during the lesson,

allowing a participation activity to the lessons and creating in this way a communication system emulating normal communication in the class-room. Moreover, the telephone allows multiple-choices tests in real time.

4.2 Facilities

The creation of courses and a system able to supply them is a necessary though not sufficient condition to achieve continuous and effective training. In fact, the environments where the operators can follow such courses, accessible according to everyone's work engagements. Also, it is fundamental that the operator feels that distance learning is really present in his/her professional life and has basic knowledge and in the use of I.T. tools.

4.2.1 Technological facilities

As for as problems related one to distance learning environment, Azienda has adopted three solutions:

- arrangement of appropriate computer classrooms by hospital buildings, these clasrooms can be accessed by operators in order to follow on-line courses (picture 2). The classrooms are equipped with both a blackboard, and a projector in order residential teacher-driven mode.
- arrangement of appropriate classrooms by hospital buildings, where to follow courses by means of interactive television. There is also a projector and a computer linked to Internet in order to allow the development of on-line lessons also in teacher-driven mode, both distance and residential.
- free supply of prepaid cards allowing the operators to follow the course from home free of charge by Azienda ULSS to the staff enrolled on on-line courses.

4.2.2 Cultural support

Problems related to distance learning can invalidate training efficiency. On one hand, selfefficiency perception in the use of an I.T. tool, the possibility that the operators may not have basic internet and computer knowledge. The high number of English terms present in the multimedia language, on the other hand, the novelty of distance learning for operators for whom communication mediated by a computer and Internet is not part of their daily routine and their learning vision. All these elements are strictly connected to the introduction of distance training and if they are not duly considered, they can nullify the efforts made to offer an efficient distance learning system.

In order to approach the operator to this training environment, basic and advanced English and IT course have been organised, to supply staff with the necessary cultural support in order to follow the courses supplied by MISL especially the on-line ones. IT courses are supplied with interactive television method which is similar to tele-conference. The possibility for the learner to interact with the teacher through a the use of interactive telephone ensures a teacher/learner dynamic which is similar to the familiar classroom training.

Picture 2: The computer room of one of the hospital premises; tutor helps students while are studying on e-learning courses.

5. MISL In Progress

The e-Learning platform, Interactive Television, the presence of tools in interactive classrooms which are also useful for classroom training, the possibility for the operator to follow courses from home for free have been integrated to supply flexible and efficient courses.

5.1 Methodologies and Tools Offered By MISL

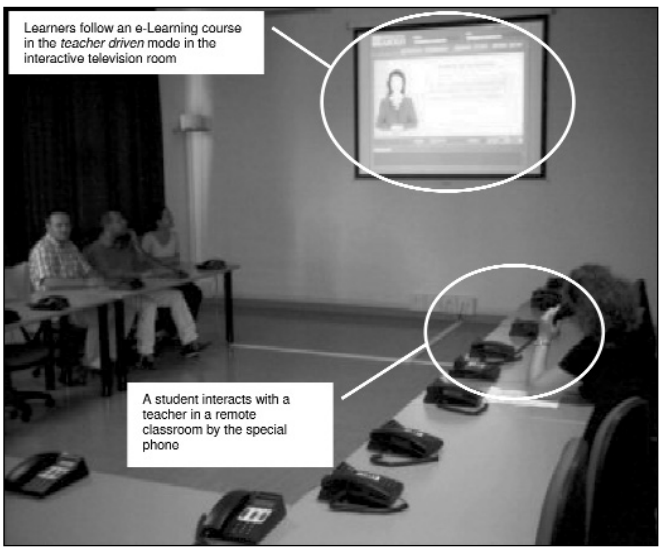
A special system studied by the ICT management and the scientific committee of each course, allows to bring the courses supplied with interactive television methodology into e-Learning. This system offers undoubted flexibility for each learner. By integrating the e-Learning platform with the satellite system used for the Interactive Television, The operators can follow on the monitor of any computer the courses supplied with interactive television methodology. In fact, web television allows the learner to follow all courses in interactive television mode from a remote workstation.

The lessons proposed with the Interactive Television are recorded and are made available on the Internet platform in Web Campus mode. The learner selects the relevant lesson and he/she watches its recording. The e-mail is used for possible questions of the learner and the answers of the teacher or the tutor.

Entire e-Learning courses, or part of them can be proposed in teacher-driven mode using the e-Learning platform and the Interactive and Web Television technologies. Learners from the classroom and from the remote workstation are guided during the e-learning course by a teacher in the classroom or in a remote workstation (picture 3). Courses are also available in web campus mode.
MISL offers all the services already present for e-Learning (Teaching and Scientific Tutoring, Help Desk, etc.) extending them to other distance training modes. This is done with the purpose to make training interventions the most efficient and flexible possible.

5.2 MISL Contents

Professions within the health corporation are several, operators work within different social and territorial contexts. This affects the need of skilled professionals, the possibility for the operators to attend continuous and frequent training events, teaching contents of single training interventions. On the other hand, social and cultural changes require for anyone having some knowledge on themes that are transversal to other competences.
MISL is an adapted but above all an adaptable tool to the contents required by all professions to reach the purpose of efficient, updated customised training (Picture 4). Therefore, courses can have general contents or can be highly specialised within the health community. Two courses supplied via MISL are presented below.



Picture 3: MISL IN PROCESS: in the classroom dedicated to the interactive television, an e-Learning course on SARS in teacher driver mode; the students have the possibility to interact with the teacher by means of special telephones allowing to do in itinere tests.

Course on SARS

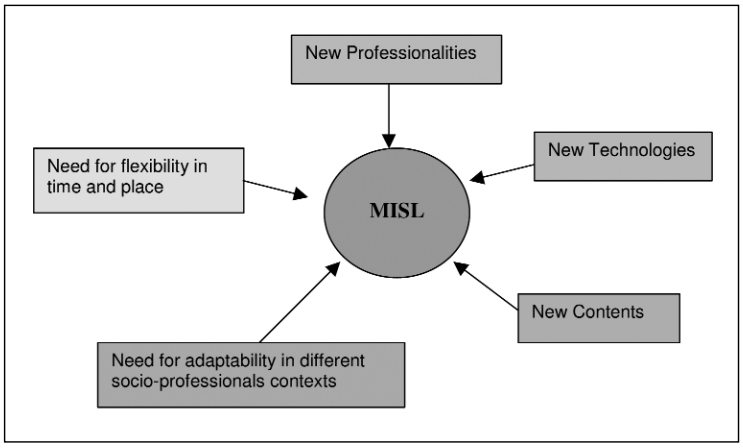
It is a specific course for hospital and health organisations staff members. The average duration is 5 hours. The training aim is to let participants
acquire basic knowledge on Acute Syndrome Severe Respiration and on its prevention and control measures, in order to be able to recognise and manage the illness and the suspect cases, nevertheless to give the population correct information.

Course on Privacy Protection within the health environment

It is a transverse course for all the employees of the health corporation who can be legally considered "subjects involved in dealing with personal data" (overall 900 operators). The average duration is 6 hours.
The aim of the course is to let the participants acquire basic knowledge on the reasons why a personal privacy protection discipline exists, on the contents of current laws, particular reference is made to the health field, to the people involved in terms of procedure and in terms of ethics and behaviour.
The teaching aim is to have participants able to carry out tasks inherent to personal data management correctly, as well as carrying out their job according to their profile and responsibilities.

5.3 Results

The experience of Azienda Sanitaria of Asolo in distance training shows that the introduction of new technologies in the distribution systems of the services is a possible objective, even if not easy to achieve.
Production of effective, contextualised and flexible distance training is possible through discerning uses of the available human and technological resources, a use of all the potentialities offered from such resources. But above all, through the valorisation of the personnel involved in training, who is the first addressee, nevertheless has a pivotal role in the training activities.
Italian national directives imposed to health organisations to train at least 30% of their staff within 2005 by means of distance learning. Thanks flexibility, MISL adaptation, Azienda ULSS 8 has achieved this objective within 2004. Such results have been rewarded by the insertion of courses produced by Azienda ULSS 8 into the distance training catalogue within a project of the Italian Minister of Health. Such commitment by Azienda ULSS 8 also has involved further important acknowledgments. It is the only Italian health organisation to be partner of Ferrara's Expo E-learning, which is the more important e-leaning exhibition in Italy.



Picture 4: The context and the possibilities that brought to the creation of MISL

6. Project In Progress: Health Organisations Network

Azienda ULSS 8 is the promoter of the activation of one Italian network among health organisations that are active in on-line training. The Internet network helped the creation of a community that converses, discusses, exchanges materials and information on the topic of elearning and all methodological, technological and the organizational problems linked to it. The objective is to develop synergies and to spread best practices in order to guarantee to the on-line training to achieve a dimension adequate to the international standards within the field of the health. The distance job synthesis and evaluation of the community of the new network has the chance to have discussions at the annual convention.

7. A New Field Of Work: The Assembly of European Region

Nowadays, civil service operates in a field that goes beyond national borders and it definitely has to have comparisons with other European public systems, considering the essential elements for the E.U.'s plan of action, such as e- Government, e-Learning and e-Health. Azienda ULSS 8 intends to adapt to the above in its technological innovation of corporate training policy.
Azienda ULSS of Asolo operates in the Veneto region, within the Alpe Adria working community, as well as Tyrol operates within the Arge Alps working community, both members of the Assembly of European Region. Within these European regional work environment, Azienda ULSS of Asolo intends to increase the knowledge of practice

and solutions adopted by the regions in the areas of health and social affairs and to transform and develop political initiatives aimed at influencing the relevant European policies; to set up a network of interregional cooperation in these various areas, to take initiatives in order of strengthen links between the European regions - in view of their participation in Committee activities.

Just-In-Time Learning: Re-Design of Micro Learning Platform Toward Design Framework for a Small Group of Learners (Projects and Practice: Learning Spaces, Mobile Learning, Microlearning)

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Abstract: In the world of immense information and knowledge, it might not always be possible to learn and understand all information in a short period of time. Significantly, one needs to get the right information and to acquire knowledge upon demand in a timely manner. Thus, there is an increasing need for systems or supporting tools that are able to fulfill the requirements of just-in-time learning. This paper proposes a design framework for developing a micro-learning platform which can be deployed in a mediated environment for a small group of learners, especially for the just-in-time learning model in higher education. Furthermore, the design framework relies on an integration of the learning concepts such as Constructionism, Learning Webs and Center for Interaction, and software design approaches. In addition, this paper will present a case study of a graduate-level course with a small group of students at University of Bremen during the summer semester in 2004. It represents a scenario for the just-in-time learning in which the students can carry out their projects, share their knowledge and discuss with each others via a Web-based collaborative learning environment, called FLE. Using FLE, it was also possible to collect data for later analysis via its knowledge sharing area. Moreover, the data was analyzed from observations, informal conversations, messages and documents taken during the course. The overall result from the case study has shown that the small-unit learning via a web-based environment enhances interactive learning, collaborative learning and in particular just-in-time learning model powerfully.

1. Introduction

Nowadays the information and communication technology (ICT) plays a great role in educational society. The emerging technologies, such as wireless networking, Internet, and mobile communications, enhance the connectivity amongst teachers and learners. The lectures are not limited only in the classroom. Apart from the face-to-face contact among teachers and students, the communication can occur via these network technologies. For instance, they can use the Internet as a way to exchange

information, sharing file, submit homework and so on. As a consequence, a number of communication platforms have been deployed currently in most university-level courses. In higher education, there are a great variety of learning and teaching software – both recently developed and legacy tools. A class instructor may choose a learning software solution based on his or her preference, costs or campus policies. There are a large number of candidates that can be chosen, and they are different in many aspects such as the software cost or license fees, the target user group, the capacity and scalability (that is, the number of users that can be supported), the extensibility, the target platform and the underlying software technologies. Besides these aspects, the participants in course should have a chance to select the right learning tools that fit to the learning models and philosophies of the class. In addition, the integration and interoperability among these software tools or platforms will play a more important role in conveying the right solution for the classroom or campus learning. Therefore, this paper proposes the framework for that consideration.

The rest of this paper is organized as follows. Section 2 presents the theoretical framework of models of learning and campus platforms. It also describes learning theories that could be applied to redesign a micro-learning platform for just-in-time learning. The selected open sources tools targeting technology-enhanced learning in a small group have been investigated and evaluated. Then, Section 3 presents a scenario and lessons learned from a case study. In Section 4, the design framework of the micro-learning platform is discussed. The conclusion is given in Section 5.

2. Theoretical Framework: Models of Learning and Campus Platform

2.1 Models of Learning

It is important to get a deep understanding of educational methodologies in order to develop suitable software for a small group of learners in higher education. Considering teaching and learning methodologies for higher education, there are a large number of pedagogical concepts and teaching and learning techniques that are used in the classroom and throughout the lectures. They are one of the key success factors for the students' learning progress. To this end, this work aims to investigate and analyze various models of learning in order to meet the requirements of a micro-learning platform. This section briefly describes some learning concepts which have been studied by different educational researchers [1] [10] [11] [12] [13] [14].
In a classical classroom, the teacher stands in front of the class room, next to the blackboard and the students sit at their desks. For the presentation of learning con-

tents, it can be technologically supported by video projectors and presentation software. Learning happens first by listening and discussing in the classroom and then by reviewing the lecture slides or reading a book. The deployment of a computational learning environment can enhance this type of teaching-learning scenario in different ways. When using a computer-based environment, students and instructors do not have to be in the same room. All the lecture slides can be saved and shared onto the repository of the learning platform. They can sit in different places and communicate via a virtual channel by means of video conferences, email and discussion forum. A special groupware system can be used to support the communication and the collaboration of students working in virtual groups. In fact, there are various learning styles that are centered on communications-based learning and teaching, for example, project-based learning [14], activity and discovery learning [16], collaborative learning, interactive learning [17], situated learning [18], and sharing knowledge [19].

Nevertheless, there are only a few models of them that focus specially on the just-in-time learning for a small group of learners. In an attempt to redesign a micro learning platform that mediates just-in-time learning for a small group, this work relies on an integration of three learning models, explicitly Constuctionism [20] [21], Learning Webs [22] [23], and Center for Interaction with Digital Media *(Zentrum für Interaktion mit Digitalen Medien* (ZIM)) [24].

Constructionism is an educational philosophy introduced by Papert [20]. He argues that learners are likely to construct new idea when they are building artifacts that they can reflect upon and share with others in their learning community. Constructionism implies a hands-on and project-based methodology. The foundation concept can be found in Piaget's constructivism [21] which states that knowledge cannot be transmitted or conveyed ready made to another person. The constructionist learning framework is concerned with building things, both in the sense of building understanding and building artifacts, as an object-to-think-with. It purposes a powerful learning where a small group of students can share knowledge and understanding by constructing or building meaning-making together via project-based discipline.

The concept of Learning Webs has emerged from Ivan Illich's Deschooling Society [23]. He argues that a good education system should provide all what people want to learn with the access to resources at any time in their life, make it possible for all who want to share knowledge, then find those who want to learn it from them and later create opportunities for those who want to present an issue to the public in order to make their arguments known. Therefore, it is a need an environment where provide a possible use of technologies which serve personal, creative and autonomous interaction. Additionally, he suggests about educational resources which should be enabled the student to gain access ubiquitously which permits persons to describe the learning activity in which they wish to engage, in the hope of finding a partner for the inquiry.

Center for Interaction with Digital Media, shortly ZIM, has been developed at the research group "Digital Media in Education", Department of Computer Science, University of Bremen, Germany. ZIM is a physical space and offers students from different departments a common place where they can have their own physical learning space and can develop a project initiated from their curiosity and area of interest. The principle of ZIM is "Learning-By-Doing-And-Asking" which promotes students for technological curiosity as well as design and development of technology via hands-on projects. It aims to promote the learning environment and to create a community where a group of students can spend time for their enthusiastic project. Similarly, the students can have new experience from conducting their own research, doing their work, asking the questions and sharing idea among the others through ongoing their hands-on project.

To integrate the learning models described previously, the Computer Supported Collaborative Learning (CSCL) [15] [17] has been adopted as a technological concept for this study. According to [15], CSCL is a field of study centrally concerned with meaning and the practices of meaning-making in the context of joint activity, and the ways in which these practices are mediated through designed artifacts. Moreover, the study of the ways in which these meaning-making practices are mediated through designed artifacts via CSCL technology which is a software object designed to support collaborative learning. In learning with the practice of meaning-making, the learner should collaboratively construct artifact –thing or knowledge which can explicitly be shared and observed by public or community. Furthermore, CSCL technology can enhance peer interaction and work in groups and facilitate sharing and distributing of knowledge and expertise among learners.

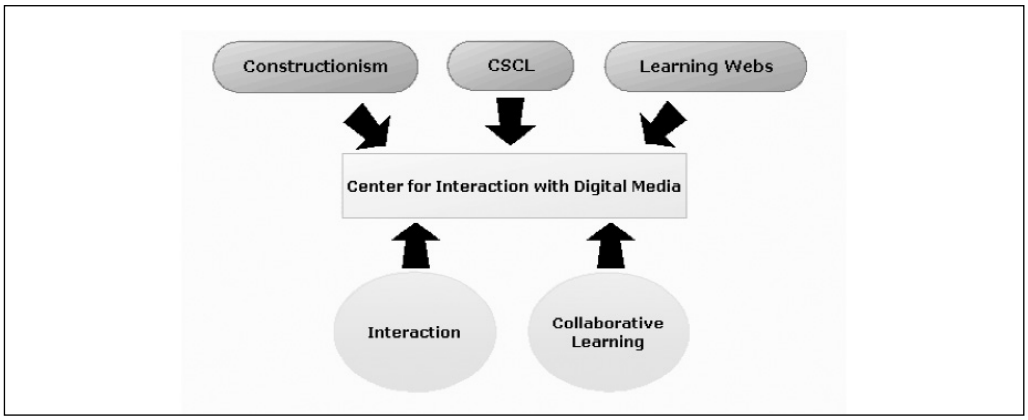

Figure 1 A Framework of Micro Learning Environment

In summary, the components of a micro-learning environment proposed in this work are depicted in Figure 1. According to [33], ZIM serves as a physical space for learners and pulls together other learning components to promote a just-in-time learning for a small group of learners.

2.2 Campus platform

Most universities use different educational software solutions to support the teaching and learning activities within the campus. Earlier software solutions have been developed to serve as a communication platform among students and lecturers. Later, more and more additional features have been added, such as file sharing, web mail, online note, calendar, etc. to enhance the pedagogy during the course. However, it is remarkable that many features have never or rarely used by students. In order to identify suitable features for a micro-learning platform, several commercial and open-source solutions have been surveyed in this work. The overview features of the tool candidates under survey can be categorized as shown in Figure 2. At the top level, the features are categorized into three different modules, namely (1) Learner Tools, (2)

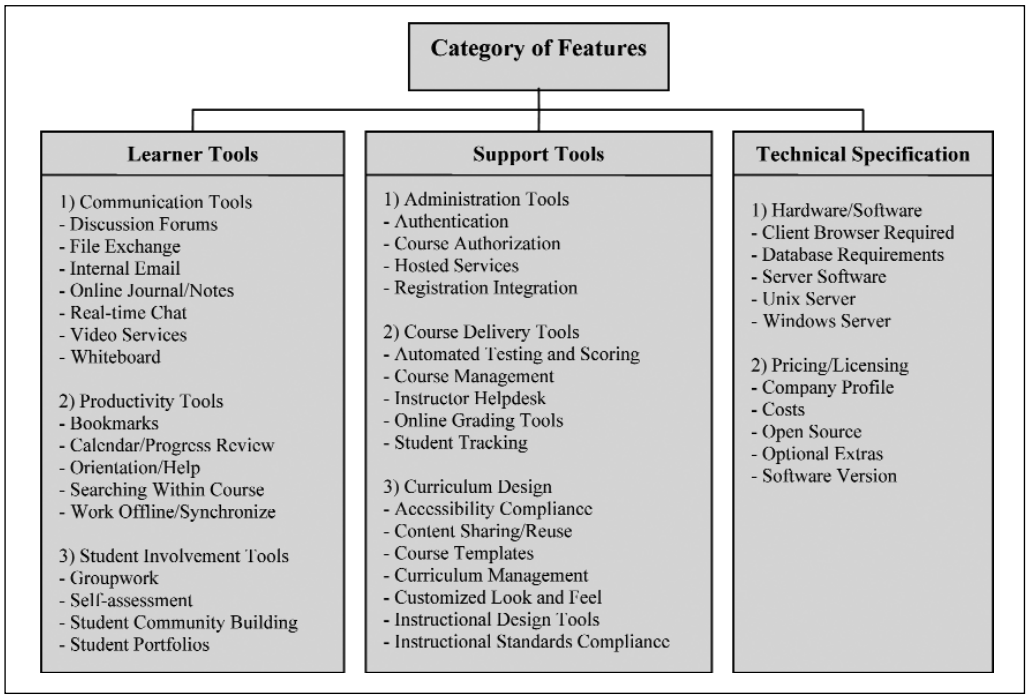

Figure 2 the Category of Feature´

Support Tools and (3) Technical Specifications, respectively. The survey has shown that there are many tools and functions which have been integrated into learning platforms. However, they generally target at large-group of learners in the classroom. Moreover, a lot for features has been never use by the students as time went by. In view of that, this study would like to offer an alternative solution by designing a micro platform that provides a list of necessary tools for the students. They can make a choice on which tools they would like to use. Apply this to the models of learning shown on Figure 1, regarding a small group of learners, they can share information and learn on-demand efficiently and effectively and it will enhance a cohesive learning atmosphere among them.

3. Just-In-Time Learning: A Case Study and Lesson Learned

To gain some experience with micro-learning, a case study was conducted during summer semester 2004. The course named "Re-thinking digital media: Engaging Learning", was offered first time to the students in the Digital Media master program at University of Bremen. It was designed for a small group of students and has applied the framework presented in Section 2. There were 14 students in the class. The following learning styles, called just-in-time learning, were applied to the class. The students worked in small groups to design the digital media and computational tools which should make learning more powerful and meaningful for them. In doing so, they collaboratively analyzed, evaluated and rethought about tools using in the course in order to suggest new design specifications for their desired tools. Therefore, the students had a role-play as both user and designer of software design process during the course. The course contents were rapidly adjusted for learning on-demand principle, in particular exchanging and giving right away information in a short time. It was organized to fit to students' interest, primarily for their project-based and for solving the problem. Due to the time constraints, the students learned the right content for the right project-goal with the right knowledge. Significantly, they learn to get the right information and acquire material upon request and upon priority. In addition, students read, discussed materials, conducted a hands-on project, shared understanding and constructed their knowledge concerning according to "Re-thinking a digital media: Engaging Learning" via a collaborative learning environment platform named FLE [34]. FLE is a system that supports learner and group work that concentrates on creating and developing expressions of knowledge and design. In FLE, Students stored different items (documents, files, links, and knowledge building notes) related to their studies, organized them to folders and shared them with others. In addition, the students met and discussed face-to-face in the class and at ZIM on a regular basis. The class

was organized in the form of discussions, not lectures. Furthermore, in the classroom, the desks and chairs were set to be movable and tailor-designed room. This physical arrangement had a powerful effect for informal interaction in class. At the end, the students presented their final projects and discussed lessons they have learned from a rapid feedback loop occurring both on the FLE platform and in class.

To sum up from observations, informal conversations with students, and note taking during the semester, students reported that they gained benefit from class brainstorm, free discussion, rapid feedback, shared project, and informal learning. Remarkably, during the semester students experienced in a variety of learning situations such as learning from a friend, teaching something to a friend, participating ZIM, and learning on their own within time constraints. From the record of the FLE system, there were totally 96 notes posted in the knowledge building area, this is composed of 7 contexts and 24 topics, respectively. However, the posting pattern was not uniform. With respect to usage frequency of FLE, it indicated that the students have a tendency to use it more often, when the students discussed intensively in class and got motivated to learn a new thing for their project. There was a suggestion from students that the lecturer should put more effort, if the student's involvement is dropped or become a passive learner. Concerning the group project, the students suggested the new design specification of tools that is simply fit to their needs. In conclusion, the computer-mediated tools are positively useful and can deliver the up-to-date information for the right content at the right time to students, but the platform designer should deploy only a set of functions that match students' needs as well as enhance their learning and understanding content instead of getting a problem with using tools.

4. Design Framework of a Micro Learning Platform

Based on the lessons learned from the case study, just-in-time learning can also benefit from the interaction and share knowledge via computational learning tools. Therefore, in a small group of learners, it needs software features that enable the interactivity and connectivity among the learners to share the right knowledge for the right objective at the right time. In redesigning tools, different concepts found software engineering and software architecture [2] [6] [7] are used, especially the component-based software design and architecture [8]. In this work, the micro-learning platform is designed as a set of component frameworks and their interoperation. A component framework is defined a software entity that supports a specific function of just-in-time learning. It provides a set of tools that can be selected by participants themselves for their virtual learning environment. Moreover, the new tools allow to be plug-

ged into the component framework without changing the former design framework. In order to redesign better software to serve a just-in-time learning, the technologies, standards and state-of-the-art software technologies has been surveyed and evaluated [25] [26] [27] [28] [29] [30] [31] [32]. In redesign process, this study extract some necessary tools from the campus learning platform which is already designed and deployed at University of Bremen as shown in figure 3.

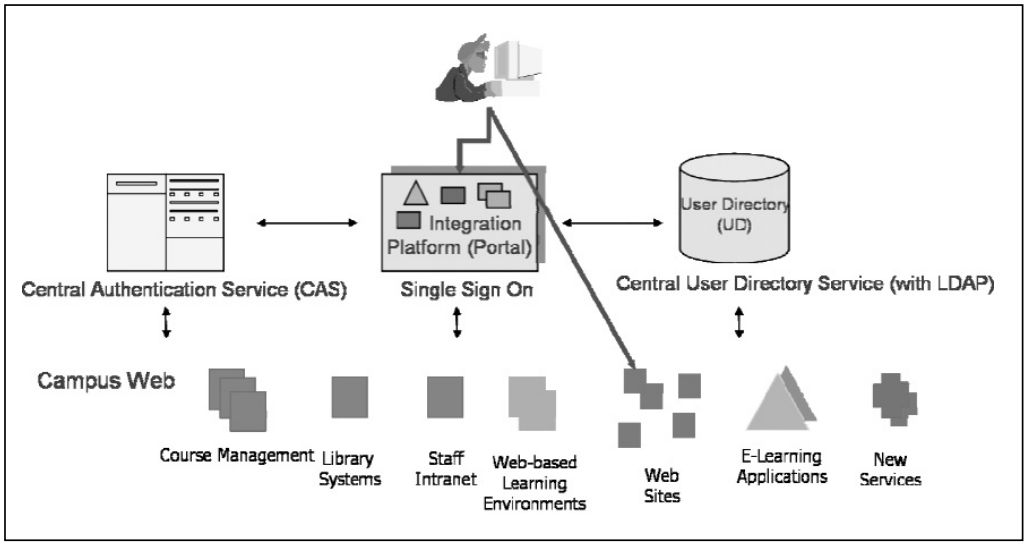

Figure 3 Component view of basic requirement

The web-based interface is an information space or a portal for students, and it offers an index or a collection of information at a first glance. The students can share and access their files via shared file structure. Moreover, the students can communicate and exchange information both synchronously and asynchronously via Discussion Forums and Conference Rooms. To support a collaborative project, there is a virtual space for Design Environment which provides integrated tools for designing artifacts together.

To provide a choice of tools for a small group of learners, the Web Services technology [8] has been chosen for this architectural design framework. A term *Web Services* refers to distributed or virtual applications or processes that use the Internet to link activities or software components. They are units of services, applications, or system functionality that can be accessible over the Web. The architecture design is based on a layered architecture with the separation of application and presentation logic and an

environment that allows tools and services to be migrated and reused between other environments. This captures educational, application, common, and system capabilities into reusable services that can be migrated in the campus software environments. Services are intended to be modular, reusable and portable across environments. Although, the tools integration with Web Services framework has a potential solutions for this platform design, it is an ongoing work. The platform has been incrementally implementing and testing currently at University of Bremen.

5. Conclusion

This paper has proposed a framework that provides capabilities to deploy tools and services in a learning platform. These tools and services have been designed based on theoretical frameworks such as Constructionism and Learning Webs, a physical space called Center for Interaction, and a Web-based environment. All these help establish informal and close interactions among lecturers and students. Regarding the just-in-time learning case study, the students reported that they engaged more deeply with the content of the course and they could get the right information at the right time via the computer-mediated environment. Consequently, the proposed learning framework has shown a positive learning outcome in establishing the interactivity among small group of learners. In designing supporting tools, the concept of component-based software development has been employed in the software design process. In order to integrate the necessary tools for a micro-learning platform, the Web Services have been suggested as a means for selecting and connecting the legacy technologies to the evolving technologies.

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LL2 (Learners Learn 2gether) – a P2P-based E-Learning System (Projects and Practice: Learning Spaces, Mobile Learning, Microlearning)

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Abstract: A traditional university provides a location for students and lecturers to meet but at the same time limits the mobility of both. E-learning can overcome this but places a huge burden on lecturers and tutors to provide material and infrastructure for remote students. Peer-to-peer (P2P) technology offers a chance to overcome the centralized distribution of learning material by leveraging students' computer resources: Given a P2P client, students may exchange material freely in a decentralized and unsuperivised fashion, spanning courses, professors, and even universities all over the world. This paper describes the aim of the LL2 project, a P2P-based e-learning system under development at the University of Passau. Its focus lies in overcoming limitations of existing prototypes and systems, as well as putting elearning in a strongly didactical context. We also give a short evaluating overview of existing tools.

1. Motivation

Educational institutes often operate in an isolated environment, a "walled garden", with little or no exchange of students or instructors. As a result, identical courses need to be conceptualised, developed, and re-invented several times. Furthermore, the mobility of both students and instructors is hindered, because the participation of courses offered by other institutions is complicated by regulations regarding the accre-

ditation of achievements, e.g., credit points or exams. Mobility (in several meanings of the term), however, is highly desirable to allow people to gain new insights and strengthen their flexibility. The initiation of the Bologna process in 1999 aimed at increasing the mobility in higher education, thus increasing employability and competitiveness of European graduates.

As a direct result of the Bologna declaration, universities are faced with the challenge to restructure and modularise study programs. In the case that physical mobility is not feasible due to time and cost issues, virtual mobility can be increased significantly. Virtual mobility in education is closely connected to the concept of e-learning: Computer-based technologies foster communication and collaboration between physically distributed persons.

But e-learning is not a magic bullet that can solve all pedagogical problems. Introducing and using an e-learning system can be a complex and costly task. We propose a P2P based approach that will animate students to become active in the learning process: Instead of students and lecturers being grouped around a course, both are encouraged to actively look for materials, build groups, exchange information and knowledge, and look beyond the classroom walls. In the remains of this paper we address what our goals are for the LL2 project (Section 2.1), describe the basic architecture and functionality in Section 2.2, and discuss related work in Section 3. Finally, Section 4 concludes the paper.

2. LL2—An E-Learning Application

E-learning is widely used and e-learning solutions are rather common in the meantime. A new technology creating new opportunities in the field of e-learning is peer-to-peer (P2P) which is not only a new technology but also a new paradigm within electronic communication. P2P refers to participants in a network which are "equal", who conduct collaborative processes without the need for a central co-ordination, and who mutually allocate resources. It can be considered to be the counterpart of the client-server architecture of traditional e-learning-environments or learning management systems.

We already started the development of a new e-learning tool called Learners Learn 2 gether (LL2), addressing the problem of high entry barriers for campus-wide e-learning solutions. Furthermore, we try to meet the demands of modern educational systems; the aim is to develop LL2 as desktop as well as mobile solution. The system will interact with existing e-learning environments (e.g., Online Campus Passau) and shall be tested within an European partner network (including participants from Finland, Hungary, Czech Republic, and Austria).

2.1 Goals of LL2

With LL2, we focus on four major goals and research questions, and address problems that arise from a changing learning environment:

- globalisation of learning and "modern" learning,
- opportunities/challenges of new technologies as driving force,
- analysis of technology potentials in e-learning, and
- technology transfer to different application fields.

The internationalisation has not stopped in front of universities or any other educational institution. Instead, analogous to economics, learning and studying has become more and more global. More and more students spend some time abroad at universities all over the globe. This in turn had the consequence that courses offered at different institutions had to become comparable. Thus, identical courses and lectures need to be developed; this kind of re-inventing the wheel is cost- as well as time-consuming. On the other hand, with the increasing need of studying and working abroad, more and more mobility is required. That creates another special challenge: the possiblity to attend courses over long distances. This overall mobility is also highly desirable as it offers people to gain new insights. Furthermore, it enhances the inevitable technology and knowledge transfer as well as the collaboration between the academical and more theoretical education and the practical application in real life.
New technologies like P2P, mobile, and voice technologies offer challenges and opportunities to create user-friendly tools and systems that support the recent development and new demands in learning. These changing requirements to learning environments do not only affect traditional learning but even more e-learning. The primary focus in LL2 with regard to these new technologies will be in the area of peer-to-peer technology.
P2P systems are emerging; especially, as internet service providers offer more and more bandwith to homes, peer-to-peer systems like internet voice telephony (e.g., Skype) and others become more and more common. Peer-to-peer computing is a technology that uses the resources of many connected devices to either distribute large computing tasks or content widely without the need for central servers. Till now, most P2P applications have been running on the fixed internet. But as mobile phones and other small devices such as handhelds get increasing computing power, some questions arise: How can peer-to-peer activities be scaled downwards to such devices, what is possible with the current state-of-the-art in P2P, and what are the most limiting factors that we have to overcome?
Therefore, a second focus will be set in the area of mobile computing. Besides a desktop solution, a mobile solution will be developed. As an example, Figure 1 shows how a possible LL2 interface could look like on a mobile device.

Figure 1: Possible LL2 interfaces on a handheld.

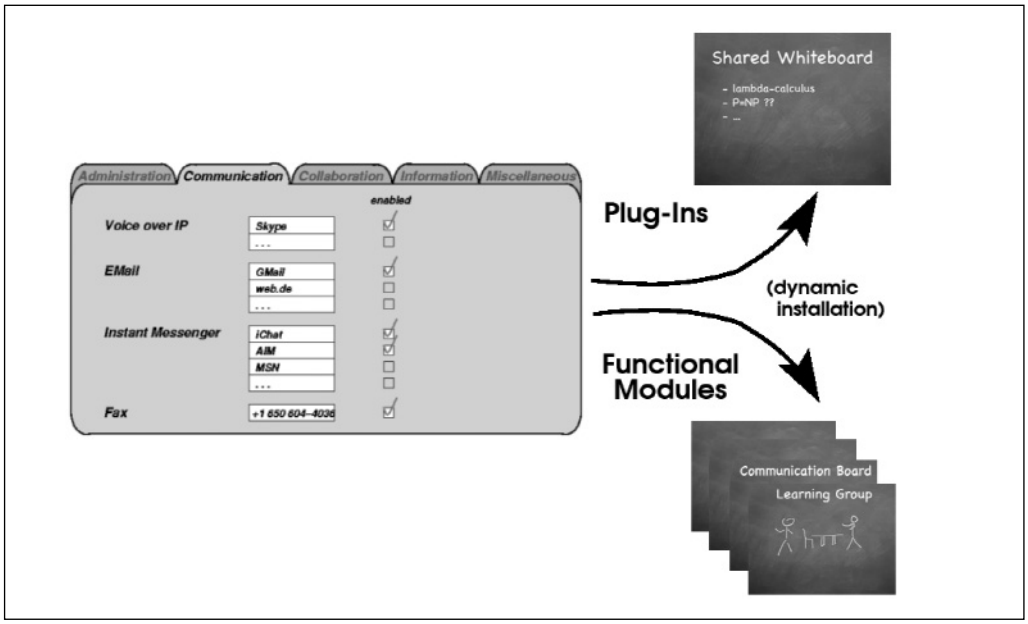
The third major goal of LL2 addresses the assessment and the analysis of the potentials of peer-to-peer technologies in e-learning. This evaluation spans the whole development cycle and beyond. The specification phase includes thorough assessment and discussion of existing APIs to be used, as well as discussion of security and usability features. The implementation of the prototype will consist of two tailored peers, one for desktop PC usage, and one for mobile devices such as cell phones and handhelds. However, the main part of the assessment and analysis lies in the evaluation of the prototype within universities' environments. This test splits into four parts: The general test checks whether LL2 meets the expectations in terms of globalised learning. The main part is the pedagogical evaluation It looks at collaborative aspects and group behaviour, size and composition of groups, while taking cultural differences between participating countries into account. It also investigates if and how LL2 influences the learning efficiency as well as the usage of LL2. The economical test looks at the development costs of LL2, whereas the technical evaluation assesses possible open source development.

The fourth focus of the LL2 project will try to identify other fields of application and transfer the insights and acquired knowledge to those. This can also be considered as part of future work in the area of e-learning. The results of the realisation of LL2 and its evaluation, especially in terms of pedagogical influence and possiblities, can be used to be applied to other fields, e.g., to vocational training. Since LL2 aims at providing an open network, anyone can connect to it and use the provided resources. Thus,

LL2's longterm goal also includes the support of lifelong learning. Besides, it can be applied to and assist knowledge management within international organisations.

2.2 Architecture and Functionality of LL2

Figure 2: Possible LL2 functionalities



The concept behind LL2 aims at providing a highly modular and if possible device independent peer-to-peer network (see Figure 2). This has several advantages: The plugin approach offers easy update and replacement of single modules without compromising the integrity of the entire client. Furthermore, it is possible to develop modules for special teaching and learning purposes, and distribute them under the users of a group, e.g., a simulation program for participants in a lecture. But this module can also be made available to all LL2 users, especially other lecturers and instructors. Another advantage is the fact that by chosing a modular approach, the modules that are built can be realised device independent and thus, allow deployment in a variety of environments.

The modules will communicate with the LL2 network as well as with other plugged in modules via defined messages. The graphical user interface is also planned to be a module; this offers that existing modules from the desktop solution can easily be adapted for mobile devices with little additional effort.

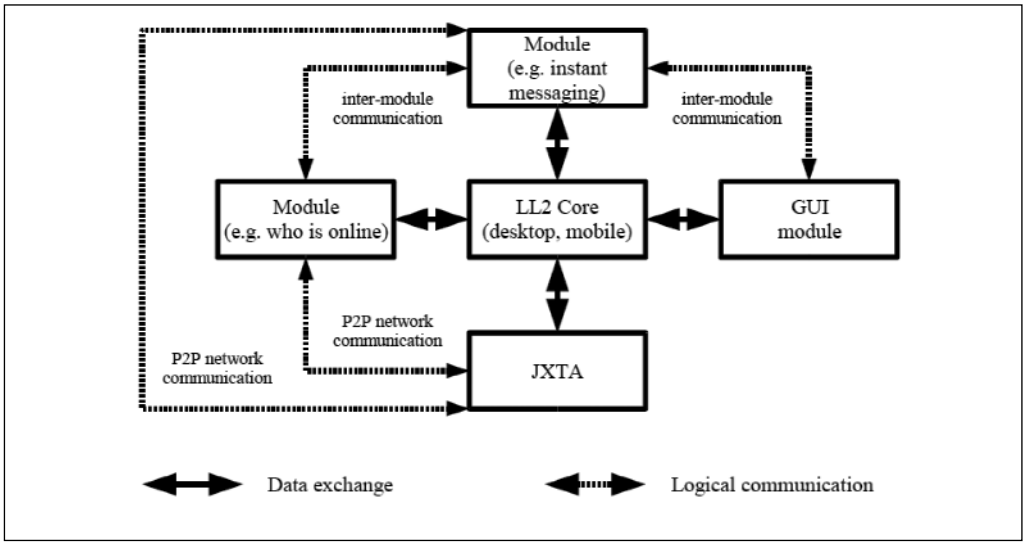


Figure 3: Communication of modules in LL2

Taking the example in Figure 3, an inter-module communication could be between an instant messaging module, a "who-is-online" module, and the LL2 network. The "who-is-online" module maintains a list of peer IDs that are regarded as "friends". In certain intervals, it queries the network for the online status of each ID via the core. If the network reports an ID to be online, the core reports this result to the "who-is-online" module. This module can then instruct the GUI to display a notice to the user, who might then decide to send an instant message to the newly logged in user. The instant messaging module receives text input from the GUI module (via the core), checks with the "who-is-online" module if the conversational partner is still online (via the core), and then sends the text message (via the core) over the network.

It remains to point out that "core" does not imply a distributable piece of software as the core itself is of very little use for a user. A typical distribution of LL2 thus consists of the LL2 core, a GUI module, and additional modules. The fact, that the necessary functionality is given by the additional modules, the distribution can easily be adapted to the needs of specific user groups. We consider this of high value in order to offer a tailored but yet easy customisable e-learning solution.

3. Related Work

P2P technology can be used in several areas, e.g., to support collaboration in workgroups. A well known groupware application with an underlying P2P network is Groove [gro]. It offers the usually required functionality for file sharing, coordination of meetings and projects etc. Some initiatives exist that try to combine e-learning with the new possibilities of peer-to-peer networks. Edutella [NWQ+02, EDU] deals with the development of a RDF based standard for e-learning content, concentrating on the exchange of metadata. However, there are no collaborative functions.

Apple [JYY+04, app], a project at the Huazhong University of Science and Technology, provides live video and audio broadcast of a classroom, synchronised presentation of lecture slides on remote computers, and chat functionality. Content and metadata is stored on a central index server. The project is based on Microsoft .NET.

S2S - Science-to-Science [Wer03, S2S] aims at promoting the information of scientists around the world by providing a document search. Knowledge exchange is fostered by an expert-matching platform, where each participant declares himself to be an expert in a specific thematic area. Questions, which can be entered by other participants, are then presented to the experts in the appropriate area. Answered questions are stored in the system for later reference.

Colloquia [LOBB00, col] (formerly known as Learning Landscapes [BL00]) is designed to support the management and the administration of learning groups and task groups respectively. It is a P2P learning management and groupware system, with no central instance. Participants in the network can create groups, tasks and learning resources. Colloquia seems to be abandoned since 2002.

SkillDog links learners with each other by use of a central index server. This P2P e-learning client is also built on Microsoft .NET technology and natively supports the Learning Resource iNterchange (LRN) reusable content specification. Unfortunately, SkillDog also seems to be abandoned since 2001.

SWAP [ETS+03, swa], a project funded by the EC, has implemented two different solutions which are combining P2P and semantic web technologies. The first solution is a P2P knowledge management tool which was applied in a tourism related context (XAROP [TEF+04]). The second tool, Bibster [HBE+04, bib], uses P2P for sharing bibliographic data.

SeLeNe [RS03, sel], also a project funded by the EC, aims to facilitate the formation of learning communities that require world-wide discovery and assimilation of knowledge. To achieve this, the project focused on learning objects and as a part of the research activities, examined how learning objects could be queried and distributed over P2P networks.

4. Summary

Apparently the current state-of-the-art in P2P e-learning covers only part of the requirements and development is slow. Products which are currently supported and developed are SWAP, SeLeNe, Groove, Edutella, and S2S, where Groove is a groupware solution lacking educational functions and S2S focuses on scientific knowledge management, also missing educational functions. A major problem seems to be the size of the user base for each project. Few projects were able to create the required critical mass of users, which, as a result, hinders acceptance, growth and development. Besides, most do not offer all functionality and features related to e-learning. LL2 therefore aims at improving the state-of-the-art significantly by providing an active P2P e-learning solution and network. During the course of the project a critical mass of users need to participate in LL2, first to provide statistically valid evaluation results, second to build the user base which ensures continued usage, and third to develop and improve the software and optional modules. This will be guaranteed by many international participants in the project, including universities and groups not only in
Germany but also in Finland, Hungary, the Czech Republic, and Austria. Embedding LL2 in existing learning processes, both in academic and industrial environments, by combining e-learning with classroom learning (known as blended learning) fosters usage even further. Within the LL2 project, we will also analyse benefits and challenges but also disadvantages of these new and promising technologies such as P2P and mobile computing for the field of e-learning.

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Workspace Learning Projects: Designing Parts of a Puzzle (Projects and Practice: Learning Spaces, Mobile Learning, Microlearning)

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Abstract: Through new demands, working space and learning space are merging more and more. To consider the experiences and the needs of the employees, data was collected at a papermill through narrative interviews and a workshop in the range of the project "Learning for production" (university of Klagenfurt). We experienced that learning in the working environment of a continuous shift-run company we needed a special design of the Microcontent. Highly complex contents have to be available at short notice and need to be absorbed in equally short time. The requirement is an intuitively playful access with simulations being a helpful instrument.

0. Introduction

How is the designing of parts of a puzzle related to with Microlearning? I suppose that question can only be answered by asking another question, namely: What is a puzzle game?
To puzzle means "to be uncertain, to deal with difficult problems, to rack one's brain". A "puzzle" is a *game* in the course of which out of hundreds or thousands of pieces, all of them small individual components, a picture is constructed. The learning process is quite similar – at the beginning the subject is a mystery, uncertain, confusing and the learner has to cope with fastidious problems, while acquiring knowledge. In the same way a "sculpture of knowledge" is constructed out of small fragments of knowledge.
My paper is based on the experiences with the project "Learning For Production" TP[1]PT. It is about the development of the idea, that it should be possible to design

1 TP PT The project „Learning For Production" is done in cooperation with the paper mill of the Mondi Packaging Frantschach AG at the Institute for media and communication at the university of Klagenfurt since November 2004. It is managed by Univ.-Prof. Dr. Christina Schachtner and coordinated by Mag. Gabriele Frankl. Angelika Höber and Ewald Romé are student project assistants.

small learning modules in a way that it is possible to consume them in a very short period of time despite of the fact that the modules represent complex knowledge. In order to be successful we need a playful approach for the development of learning contents.

1. Learning Playfully

As 2005 is celebrated as 'the Schillers year' I think it is fitting very well to start with a quote of Friedrich Schiller's writings about aesthetics:

"[…] man is only quite a man when he plays […]" (Schiller 1795/1934, 35).

Almost a hundred and fifty years later Johan Huizinga, in the thirties of the last century, reminds us again of the significance of games. Nevertheless there is little space for the ludic principle in our western, primarily rational oriented society. "The child is allowed to play, the man has to work" Thomas Leithäuser cites a skilled worker (Leithäuser 1997, 82).

An approach of the game as a counterpart to work neglects the fact that the game does not end in itself. It is submitted to it's own regulation – the rules of the game which apply to spatial and time compactness and limitation, in which the game takes place. The one who disregards those rules is a spoilsport.
In this ambivalent binding and freeing from everyday lives responsibilities and norms lies the attractiveness of the game: The game is exciting and catches someone's attention and concentration and it furthers concentration. It does not at all release you from obligation to perform. It is rather the rejoice on service provision, through diligence, in order for the game to succeed. Specific experience of success leads to admiration and appreciation by others (cf. Huizinga 1938/1997, 19ff. and 61). And this is motivating. The player is experiencing her/himself as qualified and is acquiring competences. S/he is learning by playing the game playfully. Playing and learning are connected inseparably and this is good so, because why should not it be great fun to learn?

2. Learning and Working

By means of narrative interviews, discussions and a workshop with the skilled workers of the paper mill in the range of the project "Learning For Production", we learned once more that learning and working are merging more and more.

Routine jobs are in decline in western countries, while at the same time the disposition and willingness for lifelong learning become more and more important. As Peter F. Drucker (1994) described, the industrial worker is displaced by "someone who works both with hands and with theoretical knowledge." Even if Drucker neglects the value of experience, which Christina Schachtner points out in her paper, the majority of todays workers need "qualifications the industrial worker does not possess and is poorly equipped to acquire. They require a good deal of formal education and the ability to acquire and to apply theoretical and analytical knowledge. They require a different approach to work and a different mind-set. Above all, they require a habit of continuous learning."

In order for the working environment to become a studying environment, different conditions have to be fulfilled.

Like a puzzle learning requires *time*. Time in particular, however, is missing in the production industry, as the skilled workers of the paper mill pointed out several times. Even if time can be found there is a *lack of silence,* because "everything happens under stress, I mean, everyone is under time pressure " (foreman of the paper mill, LFP). It is never known at which point the next disturbance or failure will happen, but when it occurs, decision making has to be done as fast as lightning: "When there is a case of emergency, I have no time, […] I have to decide within two or three seconds, which button I have to press or which action I have to perform" (foreman of the paper mill, LFP). Furthermore the workers are *not used to learning*.

These basic parameters require great demands of the preparation of learning material: Small, catchy parts of a puzzle, which are easy to add to and to insert to the overall picture, which draw the learners' attention to themselves and which are motivating to continue with playing, seems to be ideal here.

3. What We Can Learn from Working with Computers

Already in the 1960s Seymour Papert considered the computer a great help for working and thinking (cf. Papert 1994, 171ff.). At that time, which was the beginnings of programming, code was written by stringing together line by line. The resulting so- called spaghetti-code brought along some problems. The program was unconcise, difficult to maintain, modifications were laborious and exhausting and the code was not reusable. It was not clear at which point of the program which function was implemented. Over the years object orientation succeeded in programming. The challenges were broken down into little, manageable pieces, which were put into a solid solution. The advantages of modularization are obvious: reusability, easier extensibility and advanced flexibility.

There is a similar evolution in the area of the design of learning content caused by the computer: in the ancient educational medium, the book, also everything is stringed together line by line. The body is mostly hierarchical, modifications are hardly not possible without going through the whole book to find the appropriate point to fill in. To some extend meta data is available, for example different indexes, but the systematic access to required content is not possible, partly the isolated content is not comprehensible. Most books are written either for beginners or for advancers, you cannot switch the mode to go for basics or to immerse yourself.

A different approach to learning is "Hyperlearning", as Lewis Perelman calls the computer-assisted mode of learning. "Hyper" means, apart from the speed and range of the new technologies, "an unprecedented degree of connectedness of knowledge, experience, media, and brains" (Perelman 1993, 3). Hyperlearning allows to break down complex issues into little pieces that are easy to digest without separating them from the coherence. Thus there is the potential to split all-embracing problem solving strategies, as they are needed in the production industry, into small, time-sparing pieces, which can be handled step by step.

For the production of these little pieces, may they be modules of a program, parts of a puzzle or microlearning-objects, standards (for example like SCORM in the area of eLearning) are needed to make them fit together and reusable. Also meta data (as MPEG7 for multimedia content, cf. Kosch 2004) is needed to make it possible to find the required content.

In the area of software-development it is self-evident that modules have to work in the intended way, even if the programming is proper object-orientated. Everybody assumes, that the desired image arises by assembling parts of a puzzle. But when designing learning-systems it is often overlooked that it is the *content* which forms the essence. Therefore content must not be short of professional design. In the following I will put the focus on the design of the surface of the puzzle, the content.

Now I am coming to my main question: What kind of characteristics does learning content need in order to present complex issues in short time, so that it can be acquired even under time pressure and that it is committed to the learners' memory with motivation?

Through the rapid changes of facilities – as for example more complex machines, networked processes or high cycle of innovation - learning contents have to be modifiable and adaptable in short time. This is more likely to be achieved by little items such as microlearning-objects. The content, however, has to be designed in a specific way in order to attract attention even in potentially unpredictable situations.

In terms of Schillers idea of a game, an approach to the design of learning content can be found in computer games with regard to their fascination and pulling on users. Whether the learning processes are potentially successful or not, depends, among other things, on the quality of the software and the design of the content.

In order to live up to the increasing demands and complexity it is not enough to intensify approved learning processes or to simply learn harder. New feasibilities of learning should be found, which means facilities of learning smarter.

4. New Dimensions of Learning

When we think of a puzzle, we usually have 2-dimensional puzzles in mind which produce a picture. In the mean-time, however, a new dimension has entered the world of puzzles: 3-d puzzles are not built together to images, but to sculptures (see illustration 1).

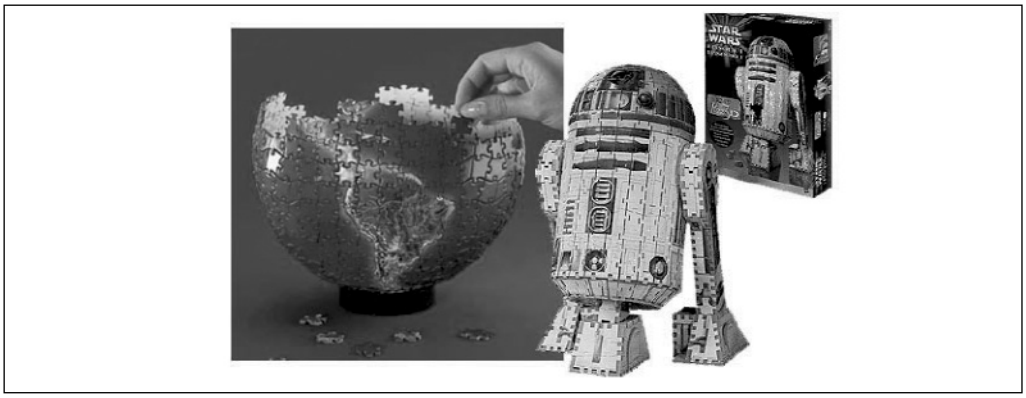

Illustration 1: Examples for the new dimension in the world of puzzles

Comparable to that is a new dimension of learning through the computer. This new dimension is called Multimedia.
The traditional medium script is only in parts suitable to mediate complex knowledge of coherency and for the presentation of knowledge on the screen. Larger amounts of text can be read on the screen only painfully and slowly. Jakob Nielsen noticed a problem when using text for the design of learning content on websites: "If you have to keep it short, that might be a very good advice for, let's say, writing an article. But, if it is going to teach people, if it needs to get all the content across – given that people are just not willing to read so much – I think it leads to a completely different approach to learning on a computer than learning in a traditional environment." (Nielsen 2001)
Multimedia Learning opens up possibilities for learning in an explorative way which is quite close to reality. As Ludwigs stated multimedia makes it possible to take multiple perspectives and to generate multiple contexts. The mix of circumstances, events,

solution paths and/or role-ascriptions as well as the reference to the context of contrary material allows the increase of the amount of information and the reflection of processes in particular. Briefing is supported and cohesion is within reach. "Multimedia diversity, when applied appropriatly is able to generate real light bulb moments." (Ludwigs 2004, 153f.) With tools like Macromedia Flash it is also not too laborious to develop multimeda contents.
Simulations represent one example for the use of multimedia. Their advantages were identified by some of the skilled workers of the paper mill of the Mondi Packaging Frantschach AG. They based their experiences on a simulation which is used by a papermaker-school in Austria.

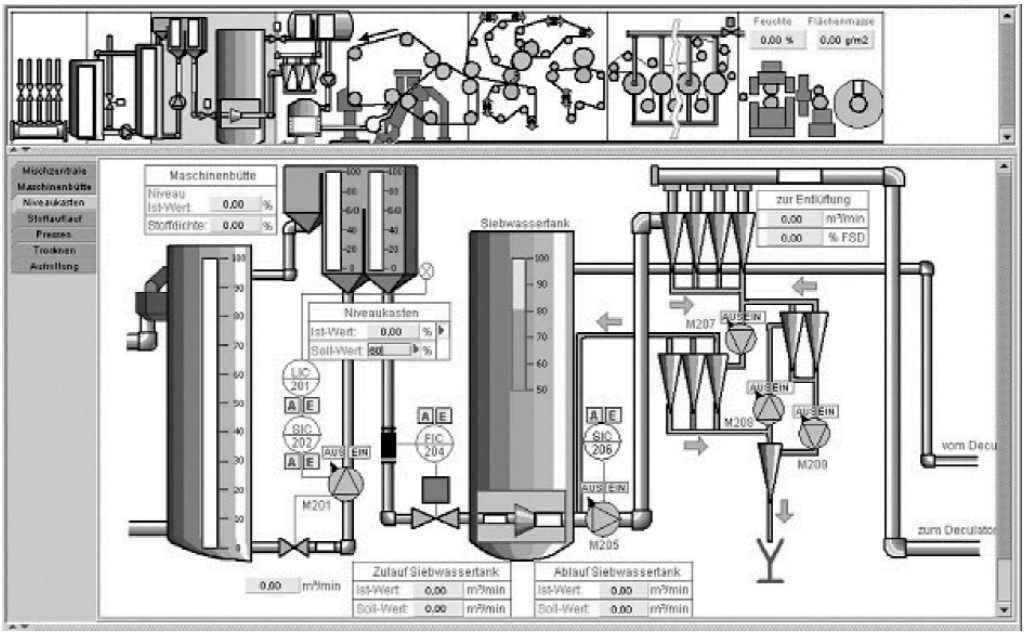

Illustration 2: Example for a simulation (paper industry)

One interviewee mentioned the following to the question of must-haves of an e-learning-system:
Such a system has to include "[…] a function about the way that such a paper machine works; how do specific aggregates function, what influence can I take […], what am I able to regulate with my aggregates, what can I regulate with chemicals, what do I cause when operating with an aggregate in a specific way, just cause and effect. This would have to be available without a question. What happens when I press a but-

ton […]. Above all cause and effect have to be integrated in such a computer program. […] Such a one-to-one simulation would be the best or the simplest " (Machine operator, LFP).

Simulations in the form of compact containers for microcontent are perfectly appropriate for the illustration of complex interrelationships and of the knowledge about problem solving in an extensive and catchy way, as it is needed these days not only in the production industry. The skilled workers of a paper mill have to know, as the quote above expresses, why something has to be done and what kind of impacts this action has on down streamed processes. "[…] what operates a product or how does it operate, this was not known by the workers 15, 20 years ago" (Refiner, LFP). In contrast to former times the skilled workers of today have to be in a position to think systematically and networked.

To acquire this knowledge gets more difficult because the paper machines are increasingly planked. The regulation of the machines happens through a process control system, which is located far away from the actual machine, as one foreman of the paper mill described. The mode of operation of the machines gets increasingly descriptive and less transparent. Right here simulations can help to offer entangled knowledge about the plant and its operating mode. As "in a [textual] documentation there is point 1, point 2, point 3 […] but there are no personal experiences or mistakes I once made" (Refiner, LFP). Personal experiences and mistakes can only be made by oneself – and simulations make it possible to experience this valuable knowledge. Thereby it is important that the knowledge is transferable to daily business. This goal can be reached, as René Härta (2002, 67) postulated, by a "HtightropeH HwalkH between the reduction of complexity and the mapping of complexity". If that is done, simulations are the right way as also Wolfgang Ebert (2004, 42) stated. He claimed that by means of simulations faulty operations and the resulting potential damages of the machines can be avoided as far as possible.

Simulations do not only offer entangled knowledge in compressed form but have effects on motivation and helpful learning for which Clark Aldrich considers the cyclical content responsible: "With cyclical content, every mistake seems to a player, in retrospect, avoidable. […] Every failure is an invitation to try again" (Aldrich 2004, 25f.). In every circle of the game the qualification of the learner is improved by micro-modifications and the learner makes an effort to improve even more which corresponds to the necessity of lifelong learning.

5. The pieces of the puzzle have to interlock

As regards a puzzle, it must be clear what needs to be done with the individual pieces of the puzzle and what the goal of the game is. The set goal should be evident, operation and control should be designed intuitively and "quite simply" (foreman of the paper mill, LFP). Since autonomous learning is made possible by simulations, it has to be considered, however, that even people who are not used to learn autonomously and who have no competencies in navigating through complex and hyperlinked contents (Röll 2003, 46 and 74), are able to use the wide range of learning supply. Correspondingly usability resp. accessability and didactical aspects have to be guaranteed simulations, because they are not motivating as such. In addition the individual microlearning elements have to be related to the overall view, so that the learner is not cognitively overburdened by orientation and navigation. The relation between the individual pieces of the puzzle should be recognizable through the picture which they should fit in, by referring to connected elements, like for example in a program a procedure calls another.
The previous knowledge of users plays another role. There are puzzles made of large pieces, which can be put together more easily than puzzles with smaller and a larger amount of pieces. Some puzzles can be solved easily as each part can be arranged according to its pattern. Other puzzles consist of many pieces of the same colour and shape which makes it more difficult to solve the game. Similar to a puzzle a learning system has beginners, advanced learners and experts. The individual learning elements should therefor reveal which target group is addressed, so that the learner can select the suitable content. This classification and indication can be achieved by meta data.

6. Playful learning – learning by working

I am convinced that there are different ways of teaching learning contents adequately. The decision which style of representation should be used, should depend on the given content and purpose and as well on the target group.
For the examination area and the thesis of the project "Learning For Production", simulations have turned out to be ideal for the representation of knowledge about the run of events and the complex contextual knowledge in a way that it can be internalised during shift work within micro time units.
These processes of internalising knowledge have many similarities to puzzles, which I tried to point out, but there are significant differences too: a puzzle is framed and the number of pieces is limited. (Micro-) Learning means that more and more small pieces

can be added and the "sculpture of knowledge" can be expanded further. New motives can be added and old ones can possibly be destroyed. The process of joining together pieces is potentially unlimited in the learning process. The individual "sculpture of knowledge" can easily grow with the pulse of time, it can change and adjust itself.

There is no perfect way of creating learning materials. But with the help of simulations it is at least great fun to find out what kind of learning potential is available. The playful attempt should represent a first step towards a close to work and human training, a further education which allows the learner to be "quite a man when he plays".

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Analysing and Reporting on the Implementation of Electronic Learning in Europe (ARIEL) (Projects and Practice: Learning Spaces, Mobile Learning, Microlearning)

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Abstract: This paper is based on an international joint project called ARIEL (Analysing and Reporting on the Implementation of Electronic Learning in Europe). The research focuses on the observation, analysis and forecasting of e-learning in SMEs, its use and its likely evolution, providing relevant information for policy making and for European education stakeholders. eLearning offers a number of advantages to SMEs however the take up is relatively slow. Incentives offered by Government and support groups will facilitate the awareness and alleviate cost barriers, however the culture within SMEs needs to adapt to embrace eLearning and support its implementation. The author believes that eLearning can be adapted to suit the varying needs and requirements of SMEs and aid in its pursuit of a competitive position in the marketplace.

Keywords: eLearning, mobile learning, SMEs, Small Medium Enterprises, Training, life long learning, eLearning, mobile learning, SMEs, Small Medium Enterprises, Training, life long learning, observatory research

Introduction

With the integration of the European market gaining in speed, the accession of new members to the EU will provide new foreign business opportunities for small and medium-sized enterprises. However, such cross-border activities require cross-cultural and language competence as well as a broad knowledge of markets, administrative procedures, rules of conduct, and more.
E-learning is expected to be an important means in transferring the required knowledge and qualifications in an up-to-date, cross-cultural and multilingual way. In particular, its ubiquitous nature offering flexibility in time and location could bring advantages for SMEs. However, many small and medium-sized enterprises are reluctant in partaking in eLearning initiatives and, in general, use e-learning implementations much less frequently than their bigger counterparts. This is the background against which ARIEL analyses e-learning supply for small and medium enterprises. It focuses on applications promising to impart competencies needed by enterprises facing the challenges of the integrating European markets.
The project investigates e-learning supply for small and medium-sized enterprises concerning didactic approaches, benefits and fields of application. Another of its themes is the evaluation of the impact of past EU programmes in the field of electronic learning. On this basis ARIEL will build scenarios of the future development of e-learning in Europe. An important part of the project activities is the dissemination of the results to SMEs, providers of further education, regional economic development agencies and political actors in the countries involved. For this purpose the project will also establish a multilingual website.

Partners

As an international joint project ARIEL is carried out by five European partners. The overall project coordinators are the Institute for Work and Technology (IAT, Germany) the specific tasks of IAT include research and analysis with a regional focus on West-Europe (e.g. France, Belgium, Netherlands, Germany). The key competency of IAT is eLearning for target groups, training needs, professional usage of computer systems in SMEs and organisation and qualification aspects of SMEs.

Veb Consult Srl (VEB, Italy) is another partner on the project with specific tasks comprising research and analysis with a regional focus on South-Europe (e.g. Spain, Italy and Greece). Key competencies include pedagogical concepts in vocational training, human resource development, tourist sector and SME consulting.

The third partner is the Educational Media Research Center, University of Limerick (Ireland) particular tasks include research and analysis with a regional focus on North-West-Europe (e.g. Scandinavia, Portugal, Great Britain and Ireland). Key competencies of EMRC include Computer Science, data-base technology, re-usable content and training organisation in SMEs.
The fourth partner is the University of Györ (Hungary) precise responsibilities include research and analysis with a regional focus on Hungary and further accession countries. Key competencies of the University include distance learning and SMEs in transforming economies.
Finally, University of Craiova (Romania) whose explicit focus includes research and analysis with a regional focus on Romania and Bulgaria. Key competencies include distance learning, Network construction and SMEs in transforming economies

Aims

ARIEL's tasks include systematic gathering of relevant information concerning ongoing eLearning activities in Europe, in-depth analysis of these activities and dissemination of information to targeted audiences. ARIEL focuses on eLearning solutions and concepts for SMEs which aims at improving their work and support their amalgamation into the European market. In addition to the observation of the general eLearning trends there will be special reports on certain sociological, pedagogical, technical or economical key issues like eLearning and blended learning applications in SMEs.

ARIEL project phases

2004
1. Kick-off phase
2. Sorting and evaluation of relevant projects
3. Interim report to the Commission

2005
4. Identification of success factors for different target groups; workshops
5. Development of general and national scenarios for prognosis
6. Elaboration and evaluation of scenarios; workshop with international experts
7. Final report to the Commission

ARIEL commenced in January 2004 and has duration of two years this paper looks at the results to date concerning the impact of e-Learning for SME. The first step was the sifting of projects already carried out in the area of eLearning in SMEs, this information was collated from www.elearningeuropa.info website. Data was collected from 842 projects, these projects were then classified. The projects were ambiguous and had varying descriptors of depth and content, an email survey was conducted with project leaders to establish the target groups, aim of project and results in order to surmise its relevance to the ARIEL project. Telephone interviews were then carried out to establish comprehensive information on the findings and outcomes of the projects. The first year of ARIEL provided an overview of the strength and weaknesses of those EU-funded e-learning project which aimed at SME or SMO as their target group or one of their target groups. The results from this phase of the project were disappointing due to a low comeback rate. However, those that did collaborate provided valuable information and insight into the findings and outcomes of their projects. Due to the poor response from this phase emphasis was placed on devising scenarios to isolate the future role of eLearning in SMEs.

Scenarios are narratives of alternative environments in which today's decisions may be played out. They are not predictions. Nor are they strategies. Instead they are more like hypotheses of different futures specifically designed to highlight the risks and opportunities involved in specific strategic issues. (Ogilvy, J. and Schwartz P. *Plotting Your Scenarios,* 2004). ARIEL is currently developing scenarios based on the the differing stages of eLearning in SMEs, this will allow frameworks and models to be developed to capture the best approach in targeting and carrying out eLearning in SMEs in future research.

Expert meetings with eLearning and SME experts will be conducted to enlighten on the situational analysis and learning needs assessment of SMEs.

Lessons learned

The results of the analysis of the EU funded projects did not provide us with a valuable contribution to e-learning in SME and SMO that was anticipated. From our experience of observing other projects we draw the conclusion that an oberservatory should have a more universal approach. Observations can be helpful if they are not restricted to best or good practises but comprise bad practise and mediocre practice also.

In future projects it is believed that a public sphere or forum in Europe discussing the problems of SME- and SMO-development would be advantageous. An idyllic public platform would comprise the relevant stakeholders of SME and SMO in Europe and

would serve as a collection for successful solutions as well as the many cul-de-sac of IT-development, -application and -implementation for the world of SME or SMO.
The observation of the e-learning projects did highlight one organisational and technical point which clarifies that SMEs resources are scarce and it is not a priority for them to administer vocational training. So only those solutions will work which take these constraints into account. Universities and e-learning providers who are used to dealing with big corporations may find it difficult to cope with this precondition. From a pedagogical point of view one respondent highlighted the need to 'Keep it simple does not mean keep it boring! "The quality of the content is the most important, [be it] e-learning or not e-learning." (Interview) E-Learning provider have to be knowledgeable about the needs of SME or SMO and have to engage in establishing a relation of trust. Trust is a keyword and trust in e-learning-technology is problematic because the e-learning-supply-side is not transparent for SME or SMO and e-learning-solutions are not really standardized out-of-the-box-applications. Therefore personal relations between the supplier and the SME- or SMO-representatives are important.

Recommendations

One problem of the policy of funding in the sphere that ARIEL observed seems to be a loose-fitting between the strategic aim of the EU (Lisbon-strategy), to which the funding of e-learning-projects is committed, and the actual work that is done in the projects. A stronger coupling could raise the need of a social dialogue concerning SME- and SMO-development viewing the funding policy of the EU as one of the tools for this development.

Acknowledgements

This paper is a working paper on ARIEL, information is sourced from ARIEL website http://www.ariel-eu.net/ and other ARIEL documentation

From a young Academic Institute a Broad Minded Approach: The Working and Learning Environment of the ALaRI Intranet Tool (Case Study) (Projects and Practice: Learning Spaces, Mobile Learning, Microlearning)

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Introduction

The aim of this paper is to present an innovative approach to the working organization and learning environment in an academic learning and research institute, experimented at ALaRI (Advanced Learning and Research Institute), the institute at the University of Lugano, Switzerland, promoting research and education in embedded systems design since 1999.
ALaRI institute is the outcome of the synergic interaction between three principal actors: European academia, American academia and international high-tech industry with the aim of fostering academic-industrial collaboration in the field of embedded systems design. Within this context, ALaRI avails itself of an international teaching staff, providing two master programs in embedded systems design, differently tailored, [1] and open to participants coming from all over the world. Every year about 28 candidates are selected to attend the master's degree programs at Lugano.
Each member of the international teaching staff (about thirty professors) joins the institute at Lugano only during the period of his/her course that normally is distributed over 1 or 2 weeks. In fact, both master programs consist of intensive cycles of lessons concentrated during the professors' short physical presence. Then several works and applied research projects are assigned to the students and followed by remote interaction with academic supervisors as well as with mentors belonging to the industrial world. Thus, during the master's programs students are trained to work both on their own (and in team work) and interacting remotely with their supervisors (academic members and industrial collaborators) to develop research projects leading to final master's theses.
In order to coordinate the workflows in such a very dynamic environment, a particular web workplace became necessary. Here the different users can cooperate together in an asynchronous way, in order to check and review the on-going projects, update their

milestones and state-of-the-art, save and share together the same documents in progress. For this reason users need an information system that ensures data security and grants confidentiality of private information to the persons strictly involved in the same project. They also need an information system in order to upload, co-share, and access to public documents and final available information at the end of the master projects; the accumulated information contributes to increasing the knowledge acquisition of all the community.

Such needs led to the creation of the ALaRI intranet tool, a web-based remote application accessible from the ALaRI web site (www.ALaRI.ch/intranet). Through the intranet, new social and technological dynamics have been developing at the institute, integrating learning in presence with remote cooperation in a complex and distributed reality. In fact the ALaRI intranet has been the answer to face a problem common to several institutions, such as universities, companies, and various organizations, about creating a workplace fully operative, ensuring an interactive participation of all its members within a steady, sturdy and secure environment.

Further the increasing need to communicate between actors with different roles and who can stay in remote places requires facilitating their cooperation in an asynchronous communication approach, with respect to training, team working as well as to all the phases of work planning.

Through the analysis of this specific case, the reader will discover the conditions and the reasons that have led to designing, implementing and updating the ALaRI intranet platform to satisfy new educational needs, but also to exploring its troubles and limitations from a usability and communication point of view.

The paper consists of four sections. The first one presents the ALaRI environment, the institute's activity, and its principal actors. Particular emphasis is on the conditions and the reasons that brought to create the intranet tool, underlining the problems occurred andfaced up with its building, and highlighting the interrelation between this technology and the learning scenario.Then the principal actors are introduced considering their different roles as intranet users (i.e. Scientific Council, Teaching Staff, Sponsors, Industrial Collaborators, ALaRI Staff, Students, Alumni, and Guests). It will be explained how they can use and access the intranet tool; what benefits and advantages they gain, and moreover how this learning environment has been improved.

The second section illustrates the ALaRI intranet application and its functionalities. A detailed requirements analysis was performed to define the several services of the system, according to the users' different goals in the ALaRI environment. This system is mainly an information system, with a knowledge base to produce and organize the construction of micro-contents and micro-learning objects about embedded systems research. Thanks to its flexibility, the intranet also provides multi-directional navigational patterns among different topics with heterogeneous services, tightly integrated.

An analysis of ALaRI intranet usability and communication issues is proposed in the third section. Here some troubles, due to interface design of the tool and consequently to workflows, affect the various different users. On one hand there is considered the users' point of view, reporting some real use cases, and reflecting on a series of interviews and contextual inquiries within task driven scenarios. On the other hand there is carried out a technical
evaluation of the intranet tool, also highlighting its limits and deficiencies. This leads to suggest possible improvements to better integrate and optimize the use of the tool in the ALaRI community.
Finally, in the last section, some conclusive reflections are provided, evaluating the social and technical relevance of the whole system, its knowledge dynamics, and the changes that have affected the ALaRI learning environment from several perspectives. Particular attention will be given to the user experience and to the construction and the development of the co-shared and re-usable knowledge on which also the community identity is based. Last but not least, the tight collaboration between the institute and the industrial world will be considered.
The paper aims at presenting practical experiences occurred within the ALaRI academic environment, through the introduction and the use of its intranet tool, as new media technology. From these experiences a plentiful research material arises to investigate new workflows and a new idea of the community workplace.

1. The ALaRI workplace: its activity and the principal actors

In 1999 ALaRI (Advanced Learning and Research Institute) was created at the University of Lugano, Switzerland, with the mission of promoting an innovative teaching and research program in embedded systems design. In fact, ALaRI has been the first European institute to offer in such area a cross-disciplinary education, involving fields from electronic engineering to computer science, and including as well the development of personal skills, such as team work and complex-project management. ALaRI has been able to bridge the gap between software technologies and electronic engineering, by both exploring cutting-edge topics and addressing its research toward real life design issues, generated by actual technical and electronic industrial requirements. In particular, its investigations focus on security of mobile systems, on pervasive computing and on low-power design.
Within this framework, ALaRI's challenging target is to prepare high level, specific profiles in embedded system design through educational opportunities such as its master's degree programs, vocational training and seminars. It relies on an international teaching staff, consisting of lecturers coming from European and American

academia and research centres, as well as experts from high-tech multinational companies.

Every year participants from all over the world are selected to attend the two master programs at University of Lugano: one is the Master of Science in ESD based on the new European guidelines and covering two years of study, that welcomes bachelor school graduates or students with at least 180 credits (ECTS) [2] – equivalent to three years of study – in a technical or scientific track; the other is the Master of Advanced Studies in ESD, an intensive one year program designed for graduates and candidates already in employment (these last also may follow the program's courses on a different and personalized schedule, involving them part-time and spreading their activities over two years).

The language of tuition is English. Both programs start each September and end in July.During the programs, students acquire theoretical background and practice with design tools. The teaching is organized into teaching units ("modules") [3] whose length may go from 12 to 36 hours, inclusive of theory, exercises and practice. Modules end with an individual evaluation that may include home assignments and a module project. With very few exceptions, lecturers (about thirty) are present at the institute in Lugano only during their period of teaching.

Research projects run in parallel with conventional studies and complete the students' training, leading to the final master theses (i.e. reports on the projects that constitute the final master dissertations). The applied-research projects concern actual industrial research, design activities and technological needs; they are assigned to each participant early in the academic year, and checked periodically by the Industrial Partners of the AlaRI community. Both academic and industrial experts tutor the development of each project.

Several parallel projects may complete a larger research activity, where practical experience in teamwork allows participants to grasp the problems of design management from the perspective of work organization as well as financial relations.

In this context, two main difficulties had to be tackled. One is the interactions between students and international lecturers, because of the limited physical presence of the lecturers at the Institute. The other is the need to coordinate the workflows among the several actors at ALaRI during the academic year.

The above problems led to designing and building of the ALaRI intranet: a web-based remote application accessible from the ALaRI web site – www.ALaRI.ch/intranet – capable of supporting and managing the relationships between and among different actors around ALaRI community in a truly distributed reality and through methodical interaction. The greatest merit of this information system is to integrate heterogeneous services within several areas, accessible from remote places and in an asynchronous way (Negri & Bondi, 2004), besides facilitating the cooperative interaction between teaching staff and students (Dillenbourg & Schneider, 1995) [4.]

Why was it necessary to build another web based asynchronous tool instead of using one of the so many existing asynchronous tools for web based cooperation? The reasons are simple.

First of all the ALaRI intranet was conceived as a part of a broader tool. Its designers aimed at increasing and improving the application step by step, facing the many different demands of the institute and of its actors, as they appeared, with the purpose of broadening and boosting the management of all the ALaRI activities on a unique remote platform.

The second reason was that, when the ALaRI intranet building began (during the academic year 2002-03), there was no asynchronous tool available that truly responded to the ALaRI real needs. There was no ad hoc application complying with ALaRI requirements, and it was found to be less expensive to create a new one. Moreover, as third reason, in 2002 the existing tools were neither modular nor integrable, and interfacing them with each other was far from easily and efficiently feasible, if at all.

Further the nature itself of the institute as centre of academic research and addressed to the development of the scientific knowledge drove the ALaRI steering committee to entrust the ALaRI intranet building to internal persons in order to realize a tool suitable to this specific environment.

In order to better understand the demands of the ALaRI institute, it is useful to have an overview of the profile of all its principal actors involved in the learning programs, and of their mutual interactions by means of the AlaRI intranet.

The Scientific Council includes some members of the teaching staff as well as other stakeholders in the initial ALaRI creation. Basically, it is in charge of the ALaRI strategies; as a consequence, it can access all master research projects, ongoing or already developed, as well as to all ALaRI intranet data.

The Teaching Staff consists of professors and experts who hold courses at the ALaRI institute. They need to have electronic teaching materials available, to install course software, and to assign marks through the intranet services.

Often they also provide students with academic supervision of some master projects, checking and evaluating the reports uploaded on the intranet platform. They can access only the private documents of those master projects which they supervise. Further, they may be interested in students' curricula, both for the assignment of projects during the masters' courses, and for employment after the end of the masters.

Sponsors interact continuously with the students during all the period of the project development. They lay down the initial project specifications, they define the milestones and the deliverables of their supported projects, working with and supervising the team from remote places. Further, they also can be interested in accessing students' curricula on ALaRI intranet.

Industrial Collaborators are industrial entities having relationships or agreements with the ALaRI institute and that can be interested in developing some projects, or in con-

sulting the curricula database. They can potentially become sponsors. Industrial collaborator not involved in any project can only access to public reports, people directory and career centre.

Students are all the participants attending the two master programs. They can perform different activities on intranet, working alone with the available teaching materials of the courses, or working with their team, supervisors and tutors about the master project they are assigned to: it means sharing together the ongoing results of the projects, uploading new reports respecting the milestones, and providing the state-of-the-art of their work. Further, an intranet area with public documents of previous projects is accessible to students, and here they can also upload relevant materials and other documents interesting for the development of their research projects. In this way the intranet tool can become the main instrument for building their research projects. Moreover they can upload their curricula and letters of intent with their future expectations, making them visible to teaching staff, sponsors and industrial collaborators. Finally, they also have the possibility of applying for little on campus part-time jobs, posted by ALaRI staff, with the aim to cover basic leaving expenses during their stay away from the family.

ALaRI Staff consists of persons working in ALaRI institute, and covering several roles, from the Scientific Director and the ALaRI Manager to tutors (PhD students supervising some students' master projects), and intranet administrators (maintaining and updating the system, assigning part-time jobs to students). They also have access to all documents of all research projects and to other data.

Other persons involved in ALaRI community are the Alumni: all ALaRI former (graduated) students, who can be generally interested in accessing the most recent public materials on intranet and private reports of their former master projects. Such a privilege is granted for a few years after their graduation. Then, they can also keep visible their curricula and keep consulting possible job offers.

Finally there are the Guests, who are persons outside the ALaRI institute and its network. They may be interested in some activities in ALaRI research and work environment, and may find some opportunities accessing the public reports of master projects and other public documents.

In order to coordinate all these different accesses, each user has got an own access, by means of the log in of his/her own username and password, so that only he/she can view his/her personal data and those linked to his/her teamwork, but not the data of other entities. In this way it is possible to grant reserve about private documents of the research projects and personal data information. Further, according to each user profile, also the services accessible on intranet are different.

In the following section a brief description of ALaRI intranet functionalities is presented.

2. The ALaRI intranet application, workflows and functionalities

The ALaRI intranet is first and foremost an interactive information system, through which ALaRI people can carry out asynchronous communications from remote places. As mentioned above, the intranet is based on an advanced data filtering system that assures different views of the data and of the several services according to user's profile.
It means that different menu bars can appear with more or less areas of services, depending on the status and on the various requirements a typical profile needs to perform his/her activity. Only the Scientific Council and the AlaRI staff have access to all services and information, being responsible of the correct use of the intranet application and in charge of the general supervision of the various activities.
The heterogeneous services in the intranet system are based on five main general areas, concerning: people directory, master projects management, career centre, part-time jobs, and knowledge base area.
Further an intranet Policy and Help Index online are available to illustrate to the user the whole structure of the application, the services offered to him/her and how he/she can access, such as a sort of electronic manual. Then, some sections are in a period of improvement, such as Template area, or still under construction, such as Grades area.
Here below, a brief description of all these areas with their functionalities is reported.
The people directory is required for user accounts management, and it consists of two sections: My CV and People of ALaRI. In this last one all the names of current and past users are collected (in alphabetic order or grouped by category). Here it is possible to see general information, such as name, e-mail and other details (if available) about all people in ALaRI - current and past students, teaching staff and their affiliation, or sponsors and industrial collaborators, scientific council and ALaRI staff. In My CV each user can upload his/her public curriculum, filling in pre-defined fields. Some users, such as sponsors and alumni can choose whether to hide their public CV or not.

If hidden, it is visible only to ALaRI staff and to Scientific Council. Further, students can also upload their private CVs and letters of intent that are visible only to ALaRI staff, Scientific Council, Sponsors and Teaching staff. The master projects management is dedicated to the remote cooperative teamwork: this implies updating master project data, checking them, uploading private reports and having visibility of all public documents and materials.
The area consists of three specific sections: Projects & Research, My Project, All Projects, differently visible according to the types of users. In fact, for instance, students can see the My Project and All Projects sections. In My Project, each student

can interact with his/her own teamwork, loading and updating his/her project report; while only his/her supervisor/s can check the data and the work developed, and only the sponsor of the project can access it, setting the milestones and controlling the state-of-the-art. The persons involved in a specific project can choose whether to make the uploaded reports private (i.e. confidential documents, only visible to the people working on the same project) or public. Instead, in All Projects all users' profiles have the visibility over all public materials, i.e. public reports documents and project descriptions. Then, the Projects & Research section is visible to AlaRI staff and Scientific Council. From this one, they can access all documents they whish.

The career centre is the room where sponsors, industrial collaborators and teaching staff may post job offers and browsing students' or alumni's private curricula and letters of intent (if they have uploaded them), and in turn, students, and even alumni, can apply for jobs. The job application is visible only to whom has posted the job, and later it can be hidden to stop the application process.

The part-time jobs area is devoted to post and apply for simple on-campus jobs. They concern useful activities for the institutes and they are posted by ALaRI staff and performed by the students who whish to apply for them. Here the students can see what the job is about, how much it is rewarded [5] and by what time it is requested to be performed, so that they can freely choose whether apply for it or not on the basis of their possibilities in order to not interfere in their studies program. Moreover all jobs performed and the tokens assigned can be seen by AlaRI staff; whereas each student can keep trace only of his/her own situation (part-time jobs carried out, tokens assigned, and so on).

Finally, the knowledge base area is composed of two sections: the ReSearch[6], and the Library. This last one offers a full list of all the materials present in the physical and on line library of the ALaRI institute. If the material is only in the physical library, it is also indicated whether it is borrowed or not.

The ReSearch section is getting more and more important. This is the research documents repository of the AlaRI institute, and it is increased year after year with micro-contents and researches about embedded systems design.

Here it is possible to consult, collect and select documents of interest, previously uploaded by the user himself/herself or by others. Further, students can browse the documents linked to their own master projects, including those documents uploaded also by others of the same teamwork. Moreover, students, but also other user profiles, can create a personal project workspace, uploading own authored articles or adding other scientific material (or linking additional scientific papers), considered relevant for the own bibliography material of the master research project. Besides, the documents here collected can be characterized by detailed meta-data, including both document-specific data, and project-specific data (documents can be associated to

one or more projects and tasks, flagged for reading and so on). Thus, what makes this section very useful and important is the possibility to exploit the synergic work of students, supervisors and sponsors, providing all ALaRI actors with the acquired knowledge of the entire community. In fact users accessing the sharing knowledge can re-use the single collected objects about embedded systems design to improve productivity in learning and research of the master projects, also saving precious time.
Finally, the Template section is accessible only by ALaRI staff, and here it is possible to collect and to make use of several documents, such as administrative ones, ALaRI presentations, and also documents related to students, for instance about visa permission, health, military services, various certificates, and many others.
The last one, the Grades section is devoted to the registrations of students' marks. Here the single lecturer can access and assign directly the mark to each student. It is important to underline that each professor can see and access only the online page for uploading his/her own grades (a professor cannot see the grades assigned by other professors in other subjects to students); and each student entering the Grade area can only and exclusively see his/her own evaluation in the various subjects, and download his/her up-to-date transcript. Obviously, any student cannot see the evaluations of his peers.

3. A critical analysis of ALaRI intranet communication flows

The building of the alari intranet started at the end of 2002, and during its development various services were added due to the increasing needs and requirements of the several ALaRI actors. As of now, the intranet offers a very useful support of asynchronous coordination for many activities of the institute, but it is also important to recognize that some workflows between and among the various actors through the intranet application could be improved. In fact, some lacks of the system stood out during an analysis of the intranet usability and its communication flows, through technical evaluation and interviews with some users.[7]
Performing some abstract tasks, technical usability aspects of the intranet have been considered, such as content, navigation quality, interface design (i.e. semiotic, cognitive elements and graphical design), and technological performance (Triacca, Bolchini, Botturi & Inversini 2004); and also heuristic evaluation and usability experts' emerging requirements (Nielsen 1999).
From the inspection analysis, it stood out that as far as contents are concerned, there are problems of arrangement that can compromise the efficacy of the intranet communication. For instance, in the section dedicated to the research of a project, there are too much information crowding the page, so that it looks like a book page to be read carefully rather than an intranet page with immediate and intuitive services. Or,

for instance in Library and ReSearch area, there are long list of mixed documents, not divided by subject or type of text, or by author.
As for the navigation quality, it should be easy the access the information within a same topic with a few clicks, but for instance at present on the page Guiding Themes from Projects & Research area four clicks are needed to reach public documents, when instead this path could be simply reduced to two clicks.
Then, about the interface design, we can consider some problems from the semiotic aspect, such as the lack of conventional and intuitive symbols showing buttons to click on and links, as instead we are used to recognize on web pages (in fact on ALaRI intranet click buttons are represented as little blue triangles in little white squares). Or some problems regard the choice of the most suitable label names, since their meanings are carrier of the contents they cover, but it happens that certain labels do not help users understand their contents, such as the title ReSearch.
Aspects concerning cognitive difficulties are about overloaded information and redundant terms on a page, such as on the same ReSearch page. Then, the main criticism concerning graphic elements is that the layout of the intranet pages is too similar to a text book rather than a web page: icons and images are few and the page layout is too squared and stiff. While the site is principally built by and for engineers and technological persons, who want to have essential simplicity, it should also help users point out key-activities immediately, and not force users to read the web as it were a book page.
Finally, technology aspects reveal troubles about clear feedback messages both of errors and confirmation. In fact, it would be useful to provide a feedback error using a natural language, not in code, showing what the error consists of (Norman 1988), and also messages confirming the successful of an operation (for instance the correct uploading of a document).
Later on, the interviews with the users (chosen at random among students and teaching staff) were very useful to confirm the problems found in the previous analysis and revealed also new elements worthy of attention. In fact, the contextual inquiries performed through task driven scenarios helped focusing the attention on the most important actions to do. They confirmed problems about the lack of clear feedback messages, moreover when an error message occurs and it is not understandable what it is necessary to do in order to repair it. Further, users complained about documents put on intranet in open order, not categorized and collected in order of type or authors, so that it becomes difficult to find those of interest. Or they noticed that in some cases it is necessary to go back to previous online pages to complete an activity (using back browser button because there is not any one back button on the intranet page), just because there is not any technical way (e.g. available button) to confirm the completion of the activity. Also users had some difficulties with the meanings of certain

labels, such as the difference between Main Projects and Master Projects, and so to understand what their contents are about, running the risk of losing confidence in the site. Then, users underlined the lack of some information in the section dedicated to upload the own curriculum, or when it is not present the name of an author near the project, in order to contact him/her if the project is considered particularly interesting. Finally these interviews with the users were very helpful because there stood out that some troubles were not only due to some technical flaws of the intranet, but also due to lack of cooperation among the different actors working on the intranet system.
From both analyses, the technical evaluation and the interviews with the users, it is evident that, besides some technical usability problems of the intranet, experienced by users while trying to properly interact with it, there are issues concerning the whole cultural organization of the system. The intranet becomes the point where the AlaRI technology and the social and cultural context of the institute intertwine.
Technical problem can be solved paying more attention to technical aspects of the intranet, such as content arrangements, graphic elements, pages accessibilities, clarity of labels meanings, and so on.
Then it becomes necessary to reinforce the co-shared social meaning of the intranet system, as support of the network of communication and of the organization services. The platform was thought and built by designers, according to their own technical view, without pay attention to the social and communicative aspect of the system. Instead now it is crucial to re-think and re-view the intranet with the participation of the actors themselves and their collaboration with the designers, in order to develop a common and co-shared meaning of the intranet system.

4. Conclusive reflections

The ALaRI intranet tackles common problems to other organizations and institutes, in order to create a work environment fully operative, ensuring interactive participation of all its members within a steady, sturdy and secure place. It intends to facilitate the increasing need of communication between actors with different roles and who can stay in remote places, considering cooperative interactions in an asynchronous way. In particular, this is evident as far as concern people training, team working and also all the phases of work planning.
Therefore, the use of the ALaRI intranet is characterized by a great flexibility that makes it possible to work on the information itself, to manipulate and create other elaborated information. In such a way, the intranet allows its users to become the principal actors of it, being able to modify and transform their activities into their organization by means of the intranet platform itself (Castells 2000).

This system offers a very unique and innovative approach. It reflects needs and requirements of our global society, trying to reduce the complex process of knowledge acquisition and data elaboration, and improving efficiency and effectiveness of the knowledge sharing process.
But in order to work properly, the intranet needs the active cooperation and interaction of all its actors who, in turn, require easiness of use and immediate understanding of the available services.
Its very quick development has been focused on the building of useful technical functionalities, but without paying a suitable attention to the usability of them. Negative consequences imply not only that users cannot achieve their goals with satisfaction, but also compromise the development of a real community identity whose principle of organization is based on the information system itself (Wenger 1998).
Finally, the ALaRI intranet aims at laying a bridge between the academic milieu and the industry world: the need of constant interactions between professors and students, and further with the industry is strongly alive, both to train students with skills really requested from the real-life market, and also to try to anticipate industry needs in research fields, offering industry a fruitful ground where invest resources (economics and time) to add value to their products.

Notes

[1] One master is devoted to postgraduates and junior candidates already in employment (one-year postgraduate master program); while the other is for students provided with a Bachelor degree (two-year graduate Master of Science program).
[2] The European Credit System (ECTS) is adopted throughout.
[3] Units may be basic (all require mandatory attendance) or elective (participants are required to choose a number of electives covering a predefined total of credits).
[4] Within remote learning, a distinction has been made in the literature between a collaborative learning model and a cooperative learning one. The former addresses situations "in which two or more subjects build synchronously and interactively a joint solution to some problem" whereas the latter is "a protocol in which the task is in advance split into subtasks that the partners solve independently" (Dillenbourg & Schneider, 1995).
[5] A certain amount of tokens corresponds to each job. Each student can earn from a minimum of half token to a maximum of seven tokens every month, applying for the part-time jobs posted. Usually 1 token corresponds to a work over 2 or 3 hours and its value is 50chf.

[6] This title, as other labels on the intranet, has created not few confusion that will be discussed in the following section dedicated to the critical analysis.

[7] Here I have reported just a synthesis of the outcomes from the technical evaluation and from the interviews with AlaRI users, since I had not enough pages to describe in details all the particular lacks that have been found.

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