Microlearning: an emerging field in science
(Foreword)

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I had already the pleasure and the chance to witness the starting of this conference series on microlearning last year. It is always extremely exciting to observe the emergence of a new field in science, in this special case a new field due to the interaction between science, technology and our modern communication society. I was impressed by the contents of the first conference and in particular by the conference proceedings, which to my great pleasure were published in our university publishing house, called *i*up (*innsbruck* university press).

Thus our special thanks go to those who brought this important conference series in the field of microlearning to Innsbruck. Clearly we have to thank Prof. Peter Bruck, head of the ARC Research Studios. The ARC Research Studios are a success story in themselves. They are enhancing the Austrian innovative and competitive ability in the area of information and communication technology. The collaboration between the Austrian Research Studios and the Leopold-Franzens-Universität Innsbruck (LFUI) has already generated innovative and competitive research results, which have had an impact on the national and international scientific community; incidentally not only in the area of information technology but also in the field of biotechnology.

Secondly, let me thank Prof. Theo Hug, Associate Professor and member of the successful faculty and institute of education at the LFUI and at the same time Head of the ARC Research Studio eLearning Environments. The studio is an important research centre for the LFUI in terms of generating new knowledge in the field of microlearning. Moreover Prof. Theo Hug was initiating and is now coordinating the new research network "Innsbruck Media Studies (IMS)". This future platform of excellence has the goal to enlarge competences in the field of new media at all levels of the University, including our research and teaching activities. Recently, some of these activities have been presented in the frame of a successful LFUI Media-day workshop, demonstrating the plethora of e-based research and teaching activities at the LFUI. Thanks to all of these activities of Prof. Theo Hug and colleagues at the LFUI today's conference (the second in a row of international conferences on microlearning) is taking place here in Innsbruck and I take this fact also as a sign of recognition of the successful work of the media studies community in Innsbruck.

Last but not least, I have the pleasure to welcome all the keynote speakers attending this conference coming from various countries in Europe and from outside of Europe. Let me thank you for participating at this conference and for contributing to this new and strategic research field. It always pays off to meet and discuss with colleagues, even if the information is communicated only in micro-units, the learning may be macro.

Tilmann Märk, Vice-Rector for Research, LFUI

Welcome to Microlearning 2006
(Foreword)

Heidi Möller

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Dean of faculty of education

Thanks for inviting me to open this microlearning conference 2006, together with my dear colleagues.

As a dean of the faculty of education, you would think that I should be enthusiastic about new forms of learning and teaching, and about new digital possibilities of knowledge management.
But I'm not, and there is a great deal of internal resistance towards all those experiments of eLearning. I love to teach in big groups in a lecture hall setting, and I have lots of didactical ideas to make lectures interesting and interactive using big group moderation techniques. Also, I love to do lessons in small courses, where you can discuss more profoundly and watch the development of the students' personalities. It's great to be in direct contact with them, and to watch them developing creative potential.

I have strong reservations that this could be all over now.
eLearning as a cheap possibility of saving money in the area of teaching? Isn't it that what this is all about?

Perhaps you think that this is just a gender problem, that women don't like to play with new technical equipment like computers? Elfriede Löchel's[1] studies have shown that an almost erotically relationship with computers and other technical stuff is found more often in the male world. According to her, women often look at these things as a dangerous threat, like a wild beast that has to be tamed.

1 Löchel, Elfriede (2001). Inszenierungen einer Technik. Frankfurt/M.: Campus

I hope very much, that this conference will convince me and perhaps other critics, that these concerns are not justified. I'm sure that there are many colleagues who have a very critical view of eLearning, but who just don't want to speak up. For many, it may seem old-fashioned not to be enthusiastic about new teaching methods, and hence they engage in something like hypocrisy management in looking at those new forms of learning and teaching, believing that they have to go with the mainstream.

I hope that this conference will be very successful and that it may also convince me of the positive aspects of these new techniques. In any case, I will try to do what I always did and recommend to everybody: be prepared for life long learning.

Thank you for your attention.

Welcome to EAMIL Workshop Day 2006
(Foreword)

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Media education and eLearning are timely and welcome elements of teaching and research activities at the University of Innsbruck's Institute of Educational Sciences. The Institute is therefore delighted to be associated with this interesting and well-prepared event, which focuses especially on micro-learning.

Informal learning – that is, learning that takes place in everyday life as an integrated and often unnoticed part of ongoing activities in family, work and leisure contexts – has drawn increasing research and policy interest in the past five years or so. This interest is linked with the need to re-think education and training for a knowledge society. The current rediscovery of the learning continuum (formal – non-formal – informal learning) contrasts with the strong emphasis placed on formal learning in the first modern era, which led to a relative under-recognition of non-formal and informal learning. The idea of the learning continuum not only re-introduces greater balance in this respect – it also encourages renewed reflection on the ways in which different mixes of learning features are conceptualised and classified. When we look closely at real-life learning exemplars, it rapidly becomes clear that they cannot necessarily be defined as unambiguously formal, non-formal or informal. Rather, they represent a cluster of features that, taken together, fall somewhere along the learning continuum and not into a discrete typological category.

The bulk of educational research in this area relates to workplace learning and in particular the kind of informal learning at the workplace that is the main source of continuing (vocational) education and training (C[V]ET) for low-qualified employees, many of whom are distanced and disengaged from formal learning environments. Micro-learning in everyday contexts, including working contexts, is an interesting addition to this field of applied research. The Seibersdorf eLearning Research Studio here in Innsbruck has focused in particular on micro-learning applications for use with mobile telephones. This is not only a practical application that could proves attractive to employers and commercial training providers, but it is also an exemplar for understanding more about the pedagogy of learning in everyday life.

The rapid development of mobile devices means that mobile telephones themselves are probably best described as an interim technology, rather like fax machines in the early 1990s. One might then ask whether it makes sense to develop micro-learning applications for devices that, in their current form, do not have a long-term future. However, this very fact reminds us that for everyday citizens, the driving-edge of technological innovation is not within their experience or reach. Focusing on mobile telephones is therefore grounded in everyday realities: this is an approach to learning provision that brings learning to learners in a practical and realistic way.

One might add that mobile telephone based micro-learning users could be viewed as a kind of 'pedagogic kindergarten' for eLearning via other channels. In focusing on the learning potential of everyday gadgets, micro-learning applications also have the potential for designing low-threshold learning opportunities. These may succeed in attracting citizens who need to improve their skills and competences in key areas for living and working in today's Europe – for example, language learning – but who do not, wish to or cannot take advantage of conventional adult education and CVET provision. For most of Europe, we are here talking about many people: a majority of adult Europeans do not participate in recognised, visible and recorded kinds of learning.

Developing the conceptual and empirical links between micro-learning, the learning continuum and lifelong learning for all also fits well with the Institute's Research Group Education – Generation – Life-course, which focuses on intercultural and comparative research on learning for active citizenship, non-formal/informal learning, and new forms of learning for a knowledge society. The Institute of Educational Sciences looks forward to continuing positive cooperation and wishes the European Academy for Micro-learning well for the future.

What is Microlearning and why care about it? (Introductory Note)

Peter A. Bruck
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General Manager

Microlearning06 is a platform for looking at and discussing the impact and development of all those technologies and practices where micro-contents are used, produced and circulated. The developments of computers, Internet and mobile phones in the last ten years have transformed our living, working and learning environments to such an extent that we are actually continuously engaged in the used of micro-contents and in microlearning.

"Microlearning" has become the most common everyday practice in the information society. It's the way we breathe in information and exhale communication. We do it when reading and writing e-mails or mobile texts, blogs and wikis, or when we google and podcast, set up aggregations & feeds. The new I&C technologies move us rapidly in this new environment and we are learning willingly and intuitively as well as sometimes quite unwillingly and exhausted to use the technologies and integrate them into our practices. Depending on our age we have varying degrees of fun and pleasure. "Micro-contents" are the text bits which we produce and circulate in new, loosely coupled formats and structures. They make up the new bases of eLearning, knowledge management, and information acquisition in corporate and educational environments. We no longer write long papers but design multimedia presentations, we do not exchange essays but excel sheets, we coordinate our activities and dates not with letters but SMSs. The emerging new digital micromedia ecology delivers and calls for the design of innovative experiences, processes and technologies: personal and dynamic, casual and volatile, complex and effective.

The proceedings of this conference *Microlearning06* provide a selective view on life in the global Information Society, driven by Information and Communication Technologies.

The amount of approachable information is rapidly increasing. The working environment of the individual is rapidly changing. The same goes for the global market environment of organizations and institutions. There is no foreseeable end to this spiral. Permanent Learning is the only answer for individuals, organizations and institutions. To meet this challenge, it is indispensable making much more intensive use of the digital infrastructure which is based on PCs and Laptops, on the Web in general, and, increasingly, on many kinds of smaller networked mobile devices. The papers in this book confront a reality where eLearning is possible for anyone anytime, anywhere, at their own pace, with their own scope. Given this reality we have to confront the fact that there is a considerable difference between the ongoing learning with the new ICTs which is often termed as "informal" and the organized learning formalized in courses. While the informal learning works very well, the formal is not. This observation results a series of questions: Why has formal eLearning never lived up to it's promise? Why do individual "life long learners" as well as managers in "learning organisations" still have massive problems keeping people motivated and courses effective? Why is the eLearning adaption rate especially in Small & Media Enterprises still abysmally low? Why are the drop out rates in many eLearning programs and strategies terribly high? How can we profit more from the new ubiquitous learning possibilities? For many observers and analysts formal eLearning seems to be too big and too static. Proprietary platforms, quite expensive to buy, are often not adapting to the personal needs of the users nor do they keep up with the rapid evolution of web technologies. Many contents look quite old after a short while, many platforms quite clumsy and unattrakctive only after a year or two. Large units of digital course material which was expensive to produce become too quickly obsolete and the rapid change of markets and knowledges outpace the installed base. In the view of the Research Studios Austria, there is one main problem: it is macro. Macro-platforms, macro-contents and macro-learning do not succeed. Thus, we have invited people from all around the world to try out an alternative and start with a micro as a point of departure and as an end for the means of learning.

Microlearning: A New Approach

Research Studio eLearning Environments in Innsbruck has learned its own lessons with macro and not succeeded to find practicable solutions to the questions posed earlier. Thus we began to think "micro" in terms of learning, contents and architecture. We changed our perspectives. We did not want to force learners to plug themselves in into an inflexible Learning Management System, but wanted to change the format of content and the way it is delivered to fit into the user's daily digital experience. Very small pieces, loosely joined, fed into the personal stream of communications and tasks. An additional, unobtrusive flow of "microimpulses"that may easily be ignored when the time is not right, or may nearly just as easily be answered with "microactivities".

This is also the idea behind the *Knowledge Pulse*® application the Studio has been developing both for web-based PCs and web-enabled mobile phones and other mobile devices. And this is the wider concept the Studio has been following in its research agenda: a better understanding of and a deeper research into the pedagogical as well as the technological implications of "micro-content" and "microlearning".

At the very same time, in the last three years, when we were taking this new direction, the world of digital information and eLearning has been changing dramatically.

The Internet went into another powerful metamorphosis, from relatively static portals and pages to meme-sized and dynamic "micro-content". At the top Google was taking over the dominating role from Microsoft in IT. And at the grassroots level a hundred flowers began to bloom: New practices (like "blogging") called for new technologies (like "feeds") and new applications ("social software") led to new experiences.

This is the state of things that has been captured by the first two Microlearning Conferences. It is a conference series on eLearning, with a heavy focus on m-learning, and knowledge management. What really makes it quite unique, in addition to the intensive and intimate workshop atmosphere, is the different "micro"-perspective that is successfully blurring borders and bringing together people from fields that hitherto have been isolated from one another: managers and pedagogues, IT developers and experts in corporate training, visionaries and practitioners.

While *Microlearning2005* has staked the claim, successfully introducing a concept connecting "microlearning" with "micro-content" and "microinformation", *Microlearning2006* has been able to concentrate on the "big picture", laying a special focus on the newest developments of the "Micro Web" (a.k.a. the "Web 2.0"), the "Semantic Web" and "eLearning 2.0". The fact that this event has been sponsored by the education/learning departments of *Intel* and *Nokia* is proof of the impact of the "micro"-idea.

These proceedings of the Microlearning2006 conference give you an impressive overview of practical and theoretical aspects of Next Generation eLearning. As you will find, from being embedded in the contextual framework of the micro-learning approach these ideas and projects are gaining additional meaning and coherence. Additional material is archived at the conference website at *www.microlearning.org,* including invited presentations of keynote speakers like Stephen Downes, Thomas Vander Wal, and many more.

A New Digital Gap

Continuous Partial Attention. Personal Info-Clouds. Rapid Learning. Google Learning. Nanolearning. Personal Learning Environment. eLearning 2.0. The increasing popularity of keywords and buzzwords like these in the international eLearning discourse is proving that the *Microlearning* conference series has hit the center of problems to be faced by an "Information Society" still struggling to become a digital learning society. But with the rise of micro-content-based web applications and technologies, we also see the opening of a different kind of Digital Gap. Our conference has shown an amazing amount of increasingly mature concepts and technologies, which in one way or another will transform workplace learning, corporate training and institutional education in the future. But there were also intensive discussions about the difficulties in integrating such innovative ideas into the daily practice of organizations, institutions, and "lifelong learners".

For learners, organizations and for education and training providers it is not just about investing or not investing time and money in another new ICT based solutions making high but seemingly vague promises. It is an environmental change, and early adopters will be best prepared for future challenges. To close the gap between research and development, what would be needed is some space to experiment and some time for iterative development. But education and training providers, and individual learners too, want something that works and they want it now. They got real training needs, they want something that makes their life easier. So we will have to somehow re-build the ship on sea. The modular *micro*-approach typical for the new generation of eLearning may be especially well suited for such a challenge.

Next year's conference will again go one step further ahead in exploring the impact of micro-content and microlearning in changing the environment of the majority of "digital workers" and learners. Scholars, researchers and practitioners who are interested in these important and fascinating questions are invited to contribute. Join us at *www.microlearning.org,* the virtual node of a network of innovation and a community of practice that will be gradually expanding.

Micromedia & eLearning 2.0
(Introductory Note)

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At the *Microlerarning2005* conference, we have sounded out new concepts, practices and technologies related to microlearning. Unlike microteaching, the exploration of the world of microlearning is still in its infancy. But a new paradigmatic understanding on micro levels of learning processes in mediated environments is emerging and being worked out.

Yesterday, some aspects of this paradigmatic understanding were presented during the workshop day of the European Academy for Microlearning[1]. The pre-conference event offered valuable insights into game-based learning,[2] the design of micro-learning objects, and the relevance of semantic web developments for eLearning microlearning?

Now, we want to invite you to explore some further aspects in the area of microlearning and related fields. This time, we have put the focus on "Micromedia & eLearning 2.0". The reason for this is not that we have already exhausted the full potential of the microlearning discourse– and are now moving on to other micro-buzzwords. The opposite is the case. But the deeper we get into the complexities of the "micro," the more interrelationships, connections, areas of tension and transition we find:

- *interrelationships* between cultural and technological developments (e.g. mod tools and modification cultures)
- *connections* between economic and technological developments (e.g. micro-markets in processes of glocalization)

1 Cf. http://www.eamil.org/
2 Cf. the contribution of Peter Krieg in this volume. The introductory note of Lynne A. Chisholm is also referring to workshop day of the European Academy for Microlearning.

- *transitions* of media and learning cultures (e.g. media generations and the interplay of media technologies, media events, genres and formats, as well as corresponding social settings and modes of reception, interaction and cognition).

Of course, there are various areas of tension. For example, if you look at learning cultures and socialisation in highly "mediatized" societies, you can observe conflicting and incoherent developments. On the one hand, we have rather traditional learning cultures and institutions on all levels of education – trying to conserve and perpetuate forms of school learning and to accommodate learning technologies to these forms. This affirms the primacy of bureaucracy, technology, administration and implies a reduction of the manifold ways of learning to special "course-types" or pedagogical designs. As a bit of a joke, one might imagine a future historian looking back one day on the early years of microlearning, and finding a representative thesis title like: "Blackboardization and closed mental institutions – a comparative discourse analysis of eLearning after the millenium".

On the other hand, we have smart media developments – "Things that think"[3] as researchers at the M.I.T. Media Lab would say – and we have a variety of informal developments and new cultures emerging. Some key terms and phrases are "networked knowledge and ludic spaces," "playful identities of new media generations" (cf. Schäffer 2003, Raessens 2006, Volkmer 2006) or "game-based educational models" as discussed in the education arcade.[4]

What we have is a new "simultaneity of the non-simultaneous" (Jürgen Habermas) in the field of media education, media culture as well as in technology and economics. For example, teachers as members of certain media generations are teaching pupils and students who are members of completely different media generations. Personnel directors of enterprises who have been educated with print media have to deal with multimedia, mobile learning, and cross-over media dynamics today, and so on and so forth. In this complex situation, converging and diverging processed and new trends have emerged and it becomes apparent that some of them can be bundled in terms of micromedia and eLearning 2.0.

3 Cf. http://ttt.media.mit.edu/ (accessed Oct, 2006)
4 Cf. http://www.educationarcade.org/ (accessed Oct, 2006)

Well, those of you who have read the essay of Stephen Downes (2005) and who also heard Norm Friesen's summary[5] of the pre-conference workshops may come to the conclusion that we will have to focus on eLearning 2.1 now.
Let us put aside the discussions about continental or British versions of eLearning 2.*zero* versus US versions of eLearning 2**.***oh* for the moment and look at the term 'eLearning 2.0' more basically. I am sceptical about these kinds of terms. A term like 'eLearning 2.0' suggests that it makes sense to describe "releases" in the domain of learning as is done in programming. It suggests that we can have such finite and well-defined "progress" in the world of learning, too. Here I have my doubts. Perhaps we can understand such descriptions better if we think of them as loving gestures towards new gadgets, as techno-fetishistic expressions, or as an attempt to play the funding game to finance projects in a similar manner as IT departments do it.

How about possible meanings of eLearning 2.0? Some say it is synonymous with microlearning. Others say that eLearning 2.0 is just eLearning on the semantic web. But we have at least to distinguish between visions and concrete options for today's learners and institutions. Looking at the slogan "Making Semantic Web *real*" of the Digital Enterprise Research Institute (DERI)[6] and its specific project goals, we can easily see that the potential of the next generation of computing has yet to be fully realized. Otherwise, we are left with claims of eLearning 2.0 referring to technologies already available such as the use of XML instead of HTML, Resource Description Framework (RDF), process ontologies, Radio Frequency Identification (RDIF) technologies, dynamic web-sites, P2P technologies, blogs, podcasts, e-portfolio software or social software in general. Some of these existing possibilities are referred to as structured content, explicit labelling, and user generated multimedia content, or as learner-centred designs, the decentralized organization of learning, as networked knowledge organization, to social networks, or to interactive web use in general. It seems that those who earlier defined eLearning platforms as software and not primarily as social spaces now tend to more technocentric viewpoints again. On the other hand, much of the current discourse about eLearning 2.0 can be characterized in terms of foregrounding learning issues in relation to technological issues. It looks as if a new awareness may be arising with respect to forms of knowledge, pedagogical needs, pedagogical topics and their eigenvalue.

5 Cf. http://learningspaces.org/n/papers/eamil.ppt (accessed Oct, 2006)
6 Cf. http://www.deri.org, http://www.deri.at/about/mission/ (accessed Oct, 2006)

Obviously, along with that quite a few wheels are being reinvented, and some eLearning specialists remind me of groups of neuro-psychologists affirming the most platitudinous pedagogical truisms, only now with the latest neuro-physiological data.

And what of micromedia? As far as I can see, much of the initial discourse is focussing on microcontent and "atomized" media environments. This is plausible insofar as in higly-mediatized societies we can observe increasing circulation of instant knowledge (Hug & Perger 2003), fragmented media offerings (e.g. in the context of cyberjournalism, infomediaries, weblogs, music file sharing services) and information streams increasingly intermediated by computational entities positioned more-or-less arbitrarily along them. But all of this appears foreshortened if we think of microcontent or micromedia simply as "small" media offerings, minimized media supply, "smart media," or small apparatuses or screen sizes. Both the micro and the media have to be considered carefully. In fact, this situation is quite similar to the microlearning discussion that immediately preceded it. Depending on frames and domains of reference, measures of micro, meso and macro vary. They are relational concepts. So, with respect to learning, it may refer to building up and organizing knowledge, changing behaviour, attitudes, values, mental abilities, cognitive structures, emotional reactions, action patterns or social orders. In all cases we have the chance to consider micro, meso and macro dimensions of various views on more or less sustainable changes. Needless to say, we are excited about the approach we are developing in Innsbruck and we think the concept of Integrated Microlearning® (IML)[7] as one of the most promising concepts in the field of microlearning.

The argument of the relational character of micro, meso and macro aspects also applies to the micromedia discourse. Of course, we have to distinguish clearly between media concepts, too. Apart from perceptual media such as space and time and other philosophical media concepts, we can distinguish at least between (1) technologies of production, storage and distribution, (2) semiotic instruments of communication (picture, image, language, writing, music), (3) media offerings arising through the use of communication media (texts, websites, programs, etc.) and (4) media organizations, media institutions and intermediated institutions. In addition to that we have to deal with symbolically generalized communication media (e.g. acceptance, power, love, money) *sensu* Niklas Luhmann (1997: 316f). The micromedia discourse focuses on micro levels of selected media concepts or processes of (re)mediation and medialization as well

7 Cf. http://ele.researchstudio.at/, http://www.knowledgepulse.com, http://www.microlearning.org

as (if less frequently) on complex interplays between symbolical, technological and societal formations. Thereby, questions of formability, adaptability, granularity, interactivity, individual use and joint practice just are as important as questions of the emergence of patterns and structures and questions of the aggregation, recombination and (re-)contextualization of parts, pieces, fragments, and facets.
The *Microlearning2006* conference and its proceedings progress our understanding of these complex issues. One of the most striking aspects of the discussions is the fact that dynamics of centre and periphery, that give-and-take between the margins and seemingly stable institutions seem open to new developments – these dynamics seem to be leading to unexpected processes and results. If I look at the resistance of many educational institutions to reform during the last decades, there appears to be some new hope for fruitful change.
Last but not least, I have to say "thanks" for contributing to the success of the conference and the proceedings. The *Microlearning2006* conference, the pre-conference workshops and also the proceedings are the fruits of many people working together.

My thanks go to all contributors, especially to

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Learning in Micromedia Environments?
(Introductory Note)

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Like last year, *Microlearning2006* has been a quite an unusual event again: A conference not building on a existing institutional network or a long established discourse, bringing together people from very different fields that rarely have contact: Software developers and academic educators, researchers representants from big corporations (Intel, Nokia, IBM) and small innovative start-ups.

In this case actually the Common Denominator is a specific subject: The new microcontent-based environments that have been emerging in the last 5, 6 years are now calling for new ways of learning and acquiring information. This is both true for the PC/WWW-platform system and, increasingly, for mobile devices and especially mobile phones. Even now, in a global perspective more people are already accessing the Internet with mobile phones than with PCs. In the near future this will sharply accelerate the current trend towards micromedia, microcontent and microlearning.

We have to learn to live in a new digital microcosm. Work, knowledge, communications … all is falling into small digital fragments, loosely joined and permanently rearranging to form a multitude of new patterns, tasks and threads. And this is true not only for the "digital natives" and the early adopters, but also for the digital mainstream relying on e-mails, Google and mobile telephony, and increasingly even for the globally and socially underprivileged people who in the age of the desktop PC would have failed to jump over the Digital Divide, but now are embracing the mobile phone as a powerful tool to access networked data.

"Microcontent" stands for self-contained and "meme-sized chunks "of data that are individually addressable and processable both by computers and by humans[1]. Initially, this trend has not even been linked to the use of handheld devices with micro-screens, though these became widely used exactly at the same time (in 2000/2001) when blogs and wikis layed the ground for the rapidly evolving microcontent infrastructure of today. The effects on learning practices and learning theory affect the new "Web 2.0" applications and practices "eLearning 2.0"[2] as well as new mobile data services ("m-learning")[3].

Microlearning is not something that has still to be invented. At an informal level, it is already being practiced by knowledge workers and 'life long learners' that have no choice but to try and get the information they need out of the World 'Wild' Web. In such a situation, traditional macro-sized eLearning has not only often proved to be too expensive, too static and too ineffective. It is also a matter of the 'media experience': It just doesn't feel right to people used to the information snippets of Google and the e-mail inbox.

Now it is the challenge for educators and system designers to systematically develop new patterns and strategies for microlearning. This makes it necessary to understand the evolving new kinds of learning experiences, and to further enhance and enable them with the right tools, applications and contents.
The development has just about started, and we will see a lot of microlearning in the years to come, no matter whether is called by this name or not. This conference series

1 For details on the definition of "microcontent" see: Lindner, M. (2006), Use These Tools, Your Mind Will Follow. Learning in Immersive Micromedia and Microknowledge Environments. ALT-C 2006 13th International Conference Research Proceedings, ALT Oxford (forthcoming).
Leene, A. (2005), Microcontent is Everywhere. Retrieved February 16, 2006 from http://www.sivas.com/microcontent/microlearning2005/microlearning.pdf; In this Proceedings volume, see the paper of Arnaud Leene on "The MicroWeb".

2 Downes, S. (2005), E-learning 2.0. eLearn Magazine, Online 10/17/2005. Retrieved 06/26/2006 from http://elearnmag.org/subpage.cfm?section=articles&article=29-1
Alexander, B. (2006), Web 2.0: A New Wave of Innovation for Teaching and Learning? Educause Review, 41, 2 (March/April 2006), 32–44. In this Proceedings volume, see the paper of Fiedler/Kieslinger and the short papers of Molnar and Krieg.

3 Alexander, Bryan (2004b), Going Nomadic: Mobile Learning in Higher Education, Educause Review September/October 2004, 39, 5, 28–35
Alexander (2004a), M-Learning: Emergent Pedagogical and Campus Issues in the Mobile Learning Environment, EDUCAUSE Center for Applied Research Bulletin, vol. 2004, no. 16 (August 2004); See also in this Proceedings volume the papers of Miettunen/Mattila, Gugerbauer, Frankl, Ketterl u.a.

is not about creating buzzwords. It is about a fundamental change in the underlying structure of our digital environment, and its possible and necessary consequences.

At *Microlearning2006* invited speakers gave an overview of the the new microcontent ecologies and "InfoClouds" (Thomas Vander Wal, Arnaud Leene), of new mobile technologies for making information "ubiquituous" (Roger Fischer, Simo Hoikka), of new ways of learning (Stephen Downes, David Smith, Michael Kerres) and new types of knowledge (George Siemens),

And as you can see in this proceedings volume, our call for papers has been answered with a lot of significant, high-quality contributions, with a scope of subjects from practical to theoretical approaches on innovative eLearning and m-learning, from papers approaching the subject from a humanities perspective to papers discussing the usage of Semantic Web technologies fro microlearning and microinformation infrastructures.

MicroContent is Everywhere[1]
(On Microlearning)

Arnaud Leene
MicroContent Musings[2] (France)

Abstract: MicroContent is a new phase in the development of Internet. After sites and web-pages, MicroContent defines an even smaller content fragment. MicroContent Items are content fragments that focused, self-contained, indivisible, structured and addressable. These attributes allow a new phenomenon on Internet: mixing and mashing. There are multiple ways how MicroContent can be combined into larger macrocontent containers, such as web-pages, applications, DVD's, etc. Although we are at the very early stages of this development several mashing parameters can be described. MicroContent mashing allows the audience to become the producer and will have impact on many content usages, such as learning.

1. Introduction

Internet is coming into a new phase. There is a new way how content can be created and consumed. The center of this phase lies around fragments of content. There has been recognition that web-pages and web-sites do not consists of a single blob of content, but of *"small pieces loosely joined"* (Weinberger, 2002). And the pieces are even smaller than Weinberger described. And what happens when we free these small pieces, these fragments from their confining macrocontainers?

Freeing MicroContent from its container allows for all kind of new ways of using, re-using, hashing, mixing and mashing content. Content gains new meaning in new contexts, well beyond the intention of the original authors. The mashers, the context

1 The contribution of Arnaud Leene is referring to the pre-conference workshop day of the European Academy for Microlearning.
2 http://www.sivas.com/microcontent/musings/ (accessed Oct, 2006)

authors define a very personal view of the MicroWeb. The context author defines what is relevant for him, for his view of the web, how he wants to see and use content. This context will create a personal homepage, or a start page that mimics his personal interest. And in the case of a personal homepage, the context author republishes his context. The context author also creates his own content in the form of a blog on his personal homepage. The context author can add blog posts from others to his page. He can add bookmarks following some algorithm from another source. He can present images taken from yet another source and following rules set by him. He can show the music tracks he is listening to, etc. etc.

This description of a start page is nothing new. Already in the Internet high days in the end of the nineties the home page was extremely popular. However something has changed. The tools have improved and more importantly the way we look at content has changed. Some people (O'Reilly, 2005) call this the web 2.0. Web 2.0 is unfortunately a very ill defined concept. However one of the key elements of this concept is MicroContent and its usage.

In this paper I will present a theoretical framework for MicroContent and its usage. Based on this analysis I will present a view of the MicroContent future.

2. MicroContent

2.1 Historic View

When working with the Internet and being involved in it's further development, we often have the impression that we are creating something new. This is however far from the truth. Many concepts already exist for ages, but get a new life in the context of the Internet. And that is also the exciting thing of MicroContent. We are giving new life to content.

In the physical world one can see already many examples of MicroContent. Think of indices created by librarians in a library. Each index card functions as a bookmark to the physical item, not only for retrieving the item, but also for describing the item. Think also of business cards, which we used to exchange in real life encounters. The business card functions as a bookmark for contacting a person. And when participating in brainstorm sessions, we put up post-it notes on the blackboard to gather out thoughts. These post-its can be seen as a form of MicroContent and undoubtedly one can think of many other examples.

In the computer world we had to reinvent many real world concepts. The items were called files. The files grew from small text files to very large complex documents. A file grew to the size of a book and the MicroContent view was lost. However in the database world the need for structure lead to the concept of records. Early database management systems, such as dBase (WikiPedia, 2006) led to the creation of many end-user databases. The database was used to create records for LP collections, book collections, stamp collections, in fact any collection. Many concepts of the database world can be found back in MicroContent.

MicroContent got however a real new life with the introduction of weblogs and syndication. A weblog (or in short blog) is defined as *"a website that displays in chronological order the postings by one or more individuals and usually has links to comments on specific postings"* (Answers.com, 2006; Winer, 2003a). The fact that a blog consists of individual postings is the start of MicroContent. These blog postings can not only be published on web-pages, but also in syndication formats such as RSS and Atom. By publishing postings in these formats a user syndicates his content, so that other may re-use it.

One of the first people to use the word MicroContent is Jakob Nielsen (1998). He uses the word MicroContent to describe the titles of web-pages. This has nothing to do with MicroContent as such. But the posting is interesting as it draws attention to the structure of web-pages. The title is an essential element of that structure. Nielsen wants authors to be more aware of that title and what authors put in there. This warning can be extended to any MicroContent Item, where structure is an essential element.

The real start of defining MicroContent goes to a post by Anil Dash (2002). Before that blog post people have been talking about MicroContent (Kottke, 2001), but a definition was lacking. Anil Dash defines MicroContent as *"Microcontent is information published in short form, with its length dictated by the constraint of a single main topic and by the physical and technical limitations of the software and devices that we use to view dig-*

ital content today". And this is definition still pretty good, but some aspects of MicroContent were still missing.

Nova Spivack (2003) made another attempt at a definition *"It is a finite collection of metadata and data that has at least one unique identity and at least one unique address on the network, and that encapsulates no more than a small number of central ideas, where the number of central ideas encapsulated is usually 1"*. And with this he introduced some other characteristics of MicroContent.

In the subsequent years things only complicated further as was realized that MicroContent was more than blog postings. This requires a more intricate definition based on a set of common characteristics.

2.2 Characteristics

After analyzing some 20 different MicroContent Types, I realized that a set of five common characteristics was sufficient to describe them all. I will describe these characteristics before presenting a formal definition.

2.2.1 Focus

As is already clear from the historic definitions MicroContent Items are about a single thing, a single idea, a single topic. Thus a blog posting should discuss a single subject. An image shows a single subject. A music track presents a single piece of music. Or a review presents a review of a single book.
This focus characteristic matches the *micro* part in the word MicroContent. *Micro* is an ill-chosen adjective as it is usually interpreted to mean small in the sense of the number of bytes. For blog postings this might be true. However for images, music or video one can no longer talk about a small number of bytes.

2.2.2 Structure

Unlike web-pages, MicroContent has structure. A MicroContent Item consists of multiple fields. This is most easily explained through an example, such as a recipe. A recipe has a title (the name of the dish), a list of ingredients (what is used to prepare the dish with amounts), directions (how to prepare the dish), an image, recipe source, preparation time, difficulty, nutritional values, etc, etc. This structure can be used for instance to find recipes from a certain cuisine, that are quick to prepare, etc.

When comparing multiple MicroContent Types one observes a basic set of fields that are common to most types:

- Title – a short description of the item. One can think of a maximum of 40 characters;
- Description – a long description;
- Tags – a list of descriptive words for the item;
- Author – the name of the author of the item;
- Creation Date/Time – the creation date and time of the item;
- Change Date/Time – the time and date when the item has been changed;
- Geotags – the geographic longitude and latitude of the item. This is not always applicable;
- Etc.

It might be clear from the recipe example that the structure of an item can be extremely complex. The structure might also be very simple. The blog postings produced by Dave Winer (2006), which only consist of a description and a time stamp, are a simple example.

2.2.3 Self-contained

MicroContent Items are self-contained. All the necessary information is together. It is just like their physical counter parts. When I receive a business card, I have all the information for contacting the person referenced on the business card. When I get a recipe, all that is needed is contained on that page.

Thus when we are exchanging MicroContent Items through electronic means like email, on the web or as a separate file on a memory stick, we will still have all the necessary information together. There should be no references to other information required in order to understand the item. This characteristic is the basis for re-use, mashing and mixing.

2.2.4 Indivisible

MicroContent Items are indivisble. It is not possible to break up an item into smaller pieces without losing meaning. For a recipe this is very clear. Taking out an ingredient or skipping a step in the directions will invalidate the original recipe. Taking a sample out of a song will maim the song.

2.2.5 Addressability

MicroContent Items are addressable. Addressable means that one can find an item back. With MicroContent Items on a local computer this will imply a unique filename, or when they are in a database application this will mean a unique. On the web addressability means a unique URI (Berners-Lee et al. 1998). The advantage of such a unique URI, a permalink, is that one is able to find the item back.

2.3 Formal Definition

With these five characteristics it is possible to compose a formal definition for MicroContent:

MicroContent are self-contained indivisible structured pieces of content, which have a single focus and an unique address for (re-)findability.

2.4 Remarks

The characteristics used in this definition are not without problems. I will discuss some of these problems.

Focus – the problem with the focus characteristic is that does not well define what focus means. If I have for instance an image with multiple persons on it, then it sounds logic to see the group itself as the focus of the image. However for another person it might be a single person on the image as he recognizes the person.

Focus is often a gliding scale. When writing a blog post it is very easy and tempting to add multiple subjects, thus diluting the focus. The description of multiple subjects might be logic for the author, as it reflects his associations, but it might not be logic for the reader. Similarly a large PDF document can have a single focus, but on a much more abstracter level.

Addressability – the idea of being able to find an item back on the Internet is a very attractive one. Who has not been confronted with an URL that no longer pointed to the original document. But what should this permalink point to? In what format should the resource be encoded? There are no clear requirements here. Images can be in any format (gif, jpeg, png, tiff, etc.). And the same is true for audio and video. Many MicroContent Types do not even have a formal format and the best one can do is refer to a web-page that contains the MicroContent Item. And this is what happens to blog post. This is hardly an ideal situation for re-use. Encoding the MicroContent Items within a web-page, as is done by Microformats (Microformats.org, 2006) is an intermediary solution.

Sampling – often there is a need to zoom further into a MicroContent Item. This might be useful for instance to take a quote out of the text. Probably one would like to do that with the definition for MicroContent I presented here. And the same is true in order to describe a person in a group photo. In fact what happens here is that we take a limited view of a MicroContent Item. Many clients for managing MicroContent take this approach: they never show all the fields related to a MicroContent Item. Unfortunately on the Internet there is no solution for quoting MicroContent. The only "solution" we have is copying the quotation. (by the way the sampling used in the musical arts is something different)

Metadata – the idea of structure is not new. A lot of work has been done in standardization initiatives, such as the Dublin Core (2004). In this standard formal definitions are given for many fields that we find back in MicroContent. Unfortunately such standards are not flexible enough to allow the creation of many MicroContent Types.
Metadata often refers to data about the content, as is done by the Dublin Core. When talking thus about metadata one can think of the author, the publication date, the file size, the distribution license, etc., etc. This approach is still valid in the context of MicroContent.

Volatility – content on the Internet is very volatile. One day it is there, the next it is not. Information gets changed all the time and the viewers do not know it. There is no solution to this problem yet. The only thing that one can do is to create a copy of important MicroContent Items. But it is also the attitude of the publisher. Once an item is published the permalink should not change.

3. MicroContent examples

3.1 Introduction

Now that the definition of MicroContent is out of the way, I will introduce various MicroContent Types. This overview is no way complete. In fact one can change each

MicroContent Type by adding or deleting fields. This habit starts to blur the (formal) boundaries between MicroContent Types. Nevertheless I will try to attempt to define various MicroContent Types in terms of their structure.

3.2 Blog Post

As the blog is the canonical MicroContent Type, I will start with this one. In it's purest form a blog post consists of only one field: the description. One can add to this the metadata, such as the author, the publication time/date and the permalink. This view of a blog is followed by Dave Winer (2006) and the (obsolete) Blogger API (Williams, 2001).

With the introduction of syndication standards, such as RSS (Winer, 2005) and Atom (Nottingham & Sayre, 2005), and API's, such as the Atom API and MetaWeblog API (Winer, 2003b) more fields were introduced. Without being complete I mention the fields title, sub-title, summary, rights, update time/date.

Although it is possible to create a blog post by hand with a text editor following the standards referenced above, a user usually uses a blogging service or application. This puts a blog post in the right macrocontainer (html, rss, atom, etc.), creates lists of blog items, archive pages, etc. Publishing blog posts on such a system will ping aggregators and allow for commenting on posts by viewers. In short there is a whole publishing environment around the blog post itself.

3.3 Image

A very popular MicroContent Type is the image. With an image there is no question what the field is, it is the image, whatever that depicts. However one can associate a lot of metadata with an image. Depending on the actual image format, this metadata can be embedded in the image file itself through the EXIF standard (Exif.org). This EXIF standard has all kinds of information related to the camera and the exposure. In the context of MicroContent it is nice that EXIF supports a description of an image.
Unfortunately any other metadata, such as tags and geotags must be stored external to the image itself. Also the permalink is not stored in the item itself. This complicates the self-containedness of an image.

3.4 Audio

Another popular format is audio. There is no question what defines the audio MicroContent Type. Standards such as MP3 have freed audio tracks form their enclosing container, the CD. The main field of an audio type is the audio. There are several other formats available, however from a MicroContent point of view MP3 is the most interesting as it offers the possibility of metadata for describing a track. This includes a title (track name), artist (author) and tags (genre).

3.5 Video

Increasingly popular is the video MicroContent Type. No question again what defines a video MicroContent Type. Again many formats are available (MPEG, Quicktime, Windows Media Format, Real). And most of these formats support metadata, such as the title of the video, a description, etc.

3.6 Recipe

The recipe MicroContent Type allows readers to prepare dishes. These can be meals, desserts, drinks, etc. The main fields of this type are a list of ingredients and directions for combining those ingredients. Usually a title is associated with a recipe item.
There are no real formats for recipes. Although a formal format exists, RecipeML (Formatdata, 2001), it never caught on due to licensing issues. And everyone stuck with proprietary formats defined by Recipe Management Applications.

3.7 Event

An event is an occurrence or happening at a given place and time. This description defines already the structure of this MicroContent Type. There must be a begin time/date and an end date/time. And there must be a title (usually called summary) for that event item.
The iCalendar standard (Dawson et al, 1998) is usually used to define anything around calendars, such as events. It is a very complex standard, but easily applicable to the Event MicroContent Type. The Microfomats (2006) definition uses the simplified approach.

3.8 Review

The review MicroContent Type is a fairly new one, although the creation of reviews is done for ages. The main characteristic of a review is that it is about something, i.e. a

book, a movie, a dvd, an website, etc. This is the vital field. Additionally one can add fields, such as a rating, comments, the author of the review, etc.
A formal definition for a review is created by microformats.org (Çelik, 2006).

3.9 Bookmark

Finally I will mention the bookmark. In its essence a bookmark has a single field: an URI (Berners-Lee et al., 1989). To this URI one can add a title, a description and tags. And it has metadata such as the author, the creation date and the update date. On the Internet bookmarks often do not have an associated permalink (see del.icio.us for instance).
There are few standards for bookmarks. Usually the export format by the Netscape browser is used. More recently the XBEL (Python XML SIG, 2006) standard has been created.

In practice it is very hard to distinguish between bookmarks and views of MicroContent Items. From time to time the two views seem to blur.

3.10 Wild MicroContent Types

All the MicroContent Types that I discussed, have a (reasonably) formal definition as a basis. We start to see however that these formal definitions are not sufficient for actual users. Many service providers create their own definitions by adding fields to existing MicroContent Types or by creating new Types altogether. I call this wild MicroContent.

An example is for instance a review that refers to a geographical object. In those cases one would like to add a longitude and latitude to the review. This is not supported by the formal definitions, but already used in practice. And there are many other examples.

4. MicroContent Mashing

As you have seen MicroContent are fragments of focused content that can manipulated independent of each other, due to their self-contained format. The structure of MicroContent makes traversing collections of content easier. But it really becomes interesting when we start combining MicroContent. I will describe several ways of combining MicroContent.

4.1 Collection

The most basic way of combining individual MicroContent Items is through the creation of collections. A collection is a group of items that have one or more properties in common. And what is more common than the MicroContent Type of a MicroContent Item? Thus one can have a collection of recipes, a collection of images, a collection of audio tracks, etc.

For managing a collection of MicroContent Items one needs a MicroContent Client (Leene, 2006). This can be an application on the computer or a service available on the Internet. I will discuss an application for managing audio tracks and a service for managing bookmarks.

4.1.1 Managing Audio Tracks

Many MicroContent Clients exist for the management of Audio Tracks. I will discuss the application iTunes created by Apple (Apple, 2006), as it has a very rich feature set.

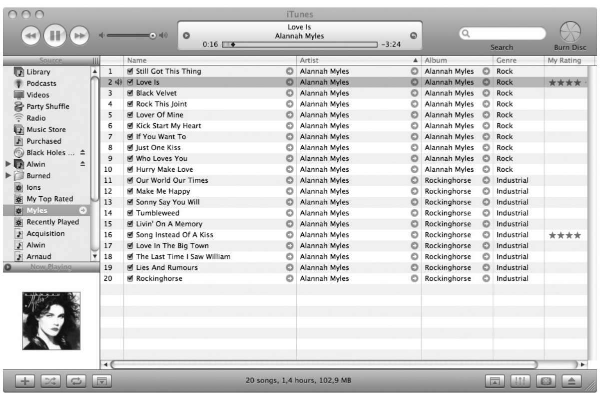

Figure 1: main interface of iTunes application

A MicroContent Client interface consists of at least three parts, called panes: a View pane, an items pane and a Lists pane. A pane is a rectangular part of the interface. The View-pane shows the content of a MicroContent Item. In this case the content are the controls for playing the song and its related metadata, such as song name, artist name, album name (In figure 1 at the top of the window). iTunes has a secondary View-pane where the image of the album cover is shown (bottom left of the window). Which MicroContent Item, and related metadata, is shown depends on what is selected in the items-pane.

The items-pane shows a collection of audio tracks in tabular format (in figure 1, the right part of the window). Each item will be represented in a single row and each row holds multiple columns with metadata of the audio tracks. In figure 1 the columns show the track name, the track length in seconds, the artist name, the album name, the genre of the album and a five-point rating. Usually the user can set which metadata is shown in which column, move the columns around and set which column should be used for sorting the items. Which items are shown in the items-pane depends on the List selected in the Lists-pane.

In the case of figure 1 one can see a List called *Myles* in the Lists-pane (the left part of the window). The Lists-pane is where the structure of MicroContent Items is really used. The List *Myles* is called a smart list, which content (the items) depends on rules set by the user. The rule for the List *Myles* was that the artist name should contain the string 'Myles'. By combining rules related to multiple fields of a MicroContent Item one can create very complex collections.

The other lists shown in the Lists-pane depend on such rules. For instance the *Library* list contains all tracks available on the computer. The Podcasts list contains all the tracks of genre 'podcast'. The *Black Holes…* list shows the audio tracks on an inserted Audio-CD. *Burned* is a group of lists and *Alwin* shows the lists of the user 'Alwin' on the local computer network. *Acquisition* is a handpicked list where the user has added each item by hand. And the *Music Store* list is a directory of audio tracks on Internet, which the user can download to the computer after buying them. One sees that not only the metadata of a MicroContent Item is relevant here, but also its location on the network.

The iTunes application allows a user to manage his audio MicroContent Items. He uses the application to view and listen to items independent of their location, to create Lists of items for listening or burning CD's, to add new items by ripping them from CD's, adding them by hand or buying them in the Music Store. It offers a very rich feature set, which is not surpassed by any other MicroContent Client (Leene, 2006).

4.1.2 Managing bookmarks

The other example I want to discuss is a service (del.icio.us), which allows a user to manage his bookmarks.

Figure 2: user web-page of del.ico.us service

In figure 2 one can see a snapshot of my web-page on del.icio.us. There are two main parts. The largest part is an items-pane in a tabular format with a single colum. Each row shows a single bookmark. For each bookmark, the title as link, some comments, tags and the publication date are presented. The table shows the bookmarks in reverse chronological order with the most recent bookmark at the top.

The pane at the left shows the tags that I have used. Clicking on a tag will show the bookmarks with that tag. This works like a smart list. One can however also see that the functionality of the del.icio.us service is very limited when compared to the iTunes application.

4.2 Aggregation by type

The del.icio.us service points already to another method of combining MicroContent Items: aggregation. Where collections are limited to a single user (my music, my CD's, etc.), aggregation combines MicroContent Items of multiple users.

What the del.icio.us service makes interesting is that one for instance can see that other users have bookmarked the same bookmark, that one can browse bookmarks of other users and that one can see the bookmarks of all aggregated users for a specific

tag. This social aspect is not present in MicroContent Client applications (although in iTunes one can see music of other users on the computer and/or local network).
Thus in del.icio.us one can see the most recent bookmarks aggregated over all users, the most popular bookmarks and tags, the bookmarks of your friend network, etc. This social aspect of this service is ideal for discovering new bookmarks, new MicroContent Items.
The del.icio.us service is unfortunately a closed service, it shows only the bookmarks created by registered users of del.icio.us. This is a limitation. Del.icio.us is not the only bookmark service available on Internet, there are many more (furl.com, backflip.com, mybookmarks.com, etc.)

A more extended service would aggregate MicroContent Items for any user from any site. This would be similar to a search service like Google, which aggregates all web-pages. Due to the lack of definitions for the bookmark MicroContent Type, this is not yet possible for bookmarks. However for the blog MicroContent Type this is possible.

Technorati.com is such an aggregation service. It aggregates blog postings from all over the Internet. This aggregation is independent of the hosting location of the blog. All that is required is an RSS-formatted file of that blog. Unlike search services the Technorati service does not gather blog postings, but is informed of new posts through the ping-back protocol. Each time a user creates a new post, the Technorati service is informed through a ping and will retrieve the new post.

Figure 3: Technorati.com webpage for the tag MicroContent

The page in figure 3 shows all recent blog-posts, which contain the tag *MicroContent*. The blog posts are shown again in a single column tabular format. For each posting one sees the title of the post as link, the author, the blog name as link, the posting date and a summary of the blog post.
Note that most of the other content on the web-page is unrelated to the MicroContent tag, such as the advertisements, today's most popular. Only the related tags and the MicroContent posting per day picture are relevant information. And this unrelated context in a web-page is what usually sets a service apart from an application.

4.3 Aggregation by field

The Technorati and Del.icio.us services are examples of services that aggregate MicroContent Items of the same type. It puts bookmarks with bookmarks, blog postings with blog postings, etc. And many services work on this principle. Amazon.com aggregates reviews of it's users, Flickr.com aggregates images of it's users, etc.
A more advanced way of aggregation is by using information held in the structure of MicroContent. This can for instance be done by using the keywords or tags of an item.

Figure 4: web-page for the tag "MicroContent" on rel8r.com

The service rel8r.com (figure 4) combines MicroContent Items from multiple sources based on common tags. It aggregates MicroContent from a limited set of sources: del.icio.us, technorati, flickr, upcoming.org and craigslist. Thus it combines bookmarks, blog postings, images, events and listings into a single list of MicroContent Items. This approach is ideal if one wants explore MicroContent around a single subject.

Figure 5: Alkemis.com web-page for New York

One can take this even a step further by combining multiple fields. In the Alkemis.com service tags and geotags are combined for MicroContent around cities (figure 5). The service combines webcams, blog postings, events, traffic cams, police radio, etc for specific city tags such as 'nyc' and the corresponding geographic locations. The latter items are shown on top of a map of the city.

4.4 Handpicked aggregation

And this approach is taken by all web-pages. The web-page designer determines what content appears where on a page. However this task of contextualizing content can no walso be done by the end-user through a service such as netvibes.com.

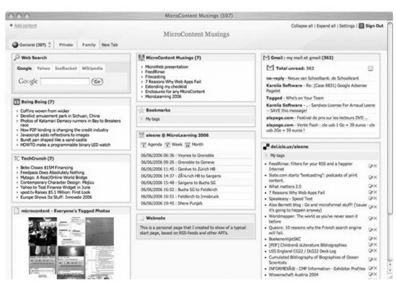

Figure 6: My personal start-page on netvibes.com

A fairly new category of services, called personal start-pages, allow a user to define a web-page that can be used as personal starting point. Such a page shows all the information a specific user wants to see. Such a page consists of 2-3 columns and each column contains multiple boxes. Each box, nowadays called widgets, contains content taken from somewhere else or created by the user. In figure 6 a web-page is shown that I have created on netvibes.com. You can see boxes with titles of postings for some blogs, a box with my recent bookmarks on del.icio.us, a set of photo's from Flickr.com tagged 'microcontent', recent email-messages on Gmail, events from an iCalendar feed, etc.

The only relation between all the boxes is that they are handpicked by the end-user. Each box is basically a list with MicroContent Items. Only the events box is more complicated and shows the structure of this MicroContent Type. What is shown however only depends on the design of a box. A box could easily become more complicated and show each MicroContent Item in all its glory.

4.5 Linking MicroContent

Aggregating MicroContent based on type, fields or by hand is still a very simple way of combining MicroContent. When aggregating MicroContent thus, there is no real relation between MicroContent Items themselves.

Any MicroContent Item might contain a link to another item. Ideally such a link would be found as a field in the structure of an item. In that way an item can point to another item, which in turn can point to another item, etc. The linking between all these items can be called a MicroWeb.

An example of such a MicroWeb can be found in the comments-part of a blog. The blog post is the base item, the first comment then points to the blog post, the second comment then either points to the blog post or comments on the comments, etc. In this way a thread of comments can be created.
Normally these comments appear on the same web-page as the blog-post. However with blogs one no longer has to use commenting systems, one can also blog comments on a personal web-log. Services, such as Technorati.com, will show whether anyone has linked to a specific blog-posting. By following these links one can follow the commenting threads around a blog-post.

4.6 Merging MicroContent

Another example of MicroContent linking can be found with book reviews. The heart of a book review is a title, a description (review) of the book and a rating. These three fields show what a reader thinks of a book. Naturally it should be clear what book is reviewed. This can be done through a unique identifier such as the ISBN- or EAN-number of the book. But one can also add a link to a web-page that contains the book. Usually a link to a unique page 0n Amazon is used, thanks to the Amazon ASIN numbers. The information of a book, such as the title, the author, ISBN-number, publisher, etc, can be seen as a specific MicroContent type. The book information also contains a link to the image of the book-cover.

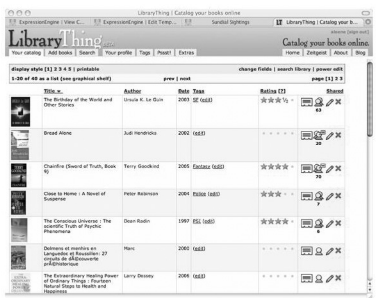

Figure 7: the List view page at Librarything.com

Book review clients usually merge these three MicroContent Items, into a merged item. This can be seen in figure 7. The web-page shows a tabular view of reviews. Each row shows the cover image, the title, the author, the publication year, tags and a rating. Thus each row merges three different MicroContent types. In fact the first 4 columns are grabbed from external web-sites, such as Amazon.com. Only the two last columns are created by the user.

4.7 Other mashings

I only discussed a few ways of combining MicroContent. Undoubtedly many more will pop up in the future. One will see aggregation of other MicroContent Types, such as Edgeio.com for listings. And one will see other rules for combining MicroContent, such as SuprGlu.com (based on the author). Naturally the hand-picked options will grow as fast as the number of MicroContent Types grow.

5. Future Directions

When we look at bit further in the future we might wonder where this is all leading to. For one thing I expect the number of MicroContent Types to grow exponentially. It will grow so fast that one will stop to standardize on the Type level. The only solution is to standardize on the Field level. If it is possible to define standards for various fields, then it would already be possible to create a large number of standard MicroContent Types. We only must think on a smaller atomic level.

Currently there exists a dichotomy between the service and application world. The application world lives on the local computer, and the services world lives on the Internet. Both worlds know different speeds of development. The Internet is much faster, but less elaborate. I expect that these two worlds will merge more and more. We already see that applications add service aspects thanks to the API's of services (WebNoteHappy, 2006; DeliciousLibrary, 2006). There will be a very tight integration such that we can drag&drop MicroContent Items from the Internet to the local application and vice-versa (Live Clipboard, 2006).

The mashing part of MicroContent is for the moment the realm of the Internet. On the application front not much is happening except the merged MicroContent options. I expect this mashing to continue. And we see already amazing mashes appearing (Programmable Web, 2006). The Google Earth application (2006) warrants a special mention here. The application has created a canvas for putting any geographical MicroContent Item on it. I hope we will see more of canvasses on the desktop.

We are only at the beginning stages of the MicroWeb, the connecting of individual MicroContent Items. For traversing this MicroWeb a web-browser is still the most effective method. I expect that other, yet unthought, methods of traversing this MicroWeb will appear.

6. Conclusion

In this article I defined the term MicroContent as "self-contained indivisible structured pieces of content, which have a single focus and an unique address for (re-)findability".

This definition is flexible enough to describe a large number of MicroContent Types and might well explain any wild MicroContent Type a end-user will come up with.
Instead of using a formal definition, it is much easier to explain MicroContent by using examples, such as a music track, a picture, a blog posting, etc. These example MicroContent Types show what people can already do with MicroContent now.

I showed various methods for combining MicroContent. This mashing is a very exiting consequence of publishing content in MicroContent Formats. It frees content from their context. With modern tools users become context authors themselves by combining the MicroContent that fits them. This will change current business models and add new ones. And more importantly it will change the culture of media consumption in ways not yet forseen.

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Microlearning and (Micro)Didaktik
(On Microlearning)

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Abstract: In research associated with curriculum and cognition, questions of content and context have been both important and problematic. Cognitivism has traditionally seen cognition, content and context as separate; and recent attempts to overcome this separation (e.g., situated cognition) have been criticized for being insufficient (e.g., Lave, 1988). Curriculum designs in North America have conventionally sought to be "teacher-proof" (Westbury, 1998) especially through integration with standardized testing, and have attempted to restrict instructional and contextual adaptation. Although more recent developments in cognitive science and curriculum development (e.g., design-based research, learning objects) attempt to address these issues in various ways, the ongoing proliferation of forms and opportunities for learning (e.g., mobile learning, micro-learning) invite a more radical re-thinking. This paper explores the possibilities for such a re-thinking presented by *Didaktik*, an area of research familiar in the German-speaking world, but little known beyond it. The paper begins by presenting a historical overview of the term "didactic' from both English and German-language perspectives. It then explores through comparisons and examples, how connections between content, context and learning made in this research tradition point to the possibility of a "microdidaktik." This is a didactic approach in which the intertwining of practice, content and context are understood and fostered between learner, teacher and content, on a "micro" level, and in terms of the relationships of what is known as the "didaktik triangle."

1. Introduction

The term "didactic" brings with it a particular cross-cultural complexity and ambiguity that has challenged scholarship in the past. At the same time, it presents a rich opportunity for cross-cultural exploration. Such an examination may be useful not only to native English readers, but also for understandings of microlearning and aspects of education more generally – especially as curricula and accreditation coordination become issues of increasing international concern.

"Didactic" and its German cognate "Didaktik" point not only to a common Greek root, *didaktikos* (apt at teaching), but also bring with them varied and sometimes surprising histories and associations. These are the subject of the first part of this paper. It begins with an overview of this history, contrasting the didactic tradition with research in the English-speaking world, and above all, with the still-dominant tradition of cognitivism.

The term "didactic" has an ambivalent and largely colloquial history in the English language. But it is marked by a very lively and scholarly history in German. (Its equivalents in the Nordic and Flemish languages have enjoyed similarly significant histories and academic associations.) The academic and theoretical significance of the term "didactic" in German-speaking countries is only infrequently mentioned in English-language publications; but there have recently been signs of growing interest, especially in the area of curriculum studies (e,g.; Hudson et al. 1999; Gundem & Hopmann, 1998; Westbury, Hopmann, & Riquarts, 2000; Kertz-Welzel, 2004).

Didaktik, Bildung, Geisteswissenschaften

In the German-speaking world, "Didaktik" designates a sub-discipline of Pedagogy *(Pädagogik)* that is concerned with the theory of instruction, and more broadly, with theory and practice of learning and teaching (e.g., Weniger, 2000). Defined in these very general terms, Didaktik does not appear in any obvious way to delimit an area of scholarship that is not already covered by fields in English-language scholarship such as instructional design, curriculum, and perhaps especially, educational psychology.

What differentiates Didaktik is not so much any formal definition, but the overall orientation of the field, its interrelationship with other disciplines, and the organization of its subordinate specializations. The relationship between Didaktik and what would be its English-language equivalents is orthogonal and disjointed, not simply opposed on some points and in agreement on others. As Ian Westbury explains, Didaktik is embedded in a unique practical and cultural context – representing a "very different intellectual system" that has developed from "very different starting points," and for "very different intellectual and practical" purposes. As a result, even the simplest introduction cannot help but highlight differences in cultures and in ways of thinking that are perhaps too easily papered over in discussions about technologies and pedagogies in English-dominated eLearning research. In itself, the relationship between Didaktik and its Anglo-

American counterpart(s) is also important evidence of the heterogeneous and culturally-determined nature of education and of understandings of learning and development generally. As such, it presents on its own a significant counter-argument against the redefinition of these phenomena in terms of natural-scientific paradigms (e.g. brain-, learning-, or cognitive-science) that would claim to rise above cultural or historical influence.

The relationship between Didaktik and didactic involves not only cultural, but also linguistic differences. (The German word Didaktik is capitalized here, as are all German nouns in general.) For example, Gundem and Hopmann observe,

> many of the meaning-conveying educational concepts, terms and words of the German-Scandinavian language area [related to education and Didaktik] lack counterparts in English – and resist exact translation. Indeed the term Didaktik itself with its comprehensive intertwining of action and reflection, practice and theory, is one such untranslatable concept. (1998)

Two further, untranslatable yet indispensable terms are *Bildung* and *Geisteswissenschaft*. Both underscore the overall philosophical and humanistic orientation of Didaktik. Bildung, on the one hand, designates "'the character-forming surplus beyond mere knowledge and skills' that is at the centre of didaktik" (Künzli, as quoted in Westbury, 1998; 60). The term denotes an excess or a remainder that is not captured by standardized testing, performance measures or learning outcomes. Its meaning may most readily find illustration in the word *Bildungsroman*. This imported literary term refers to the novel of education or formation – of which *Adventures of Huckleberry Finn* or *To Kill A Mockingbird* are prominent English-language examples. As the themes and developments in each of these novels suggests, Bildung refers to a dialectical process of becoming an individual (on the one hand), and becoming part of a society and culture (on the other): "Bildung is understood," as one of its modern proponents, Wolgang Klafki explains, "as a qualification for reasonable self-determination, which presupposes and includes emancipation from determination by others" (Klafki, 2000). Some recent scholars of Bildung describe such a broad, dialectical process in terms that come close to definitions of "socialization" or "social reproduction" articulated in anthropological and critical-theoretical studies of education in English. Weniger, Mollenhauer, and Klafki, for example, all speak of education in terms of "intellectual encounters" between generations, or the identification and representation of aspects of ones culture for the purposes of inter-generational mediation (Weniger, as cited in Künzli, 2000, 46; Mollenhauer, 2003; Klafki, 1986). Klafki phrases this as a question that he sees as important for every topic and every teacher: "What constitutes the topic's significance for the students' future?" (as cited in Kertz-Welzel, 2004). Instead of understanding such a selection and representation process strictly in terms of the reproduction of hegemony, as confined simply in the private sphere of the family, or more rationalistically, as the transfer of competencies (Lave & Wenger, 1991), this process is instead understood as public, and as both necessary and positive.

Geisteswissenschaft, literally the science of the mind or spirit, serves as academic nomenclature in German-speaking countries to designate what in English is commonly referred to as the Humanities. But unlike the English term, *Geisteswissenschaften* include psychology, linguistics, and importantly, education (i.e. Pädagogik and with it, Didaktik). Also significant is the inclusion of the term for science, "Wissenschaft" in this compound word. English is one of the few Western European languages to reserve the term "science" (and with it, intimations of the rigour, status, and authority) generally for the natural sciences. While English-language research and scholarship in education have correspondingly been compelled to justify themselves in (natural) scientific terms, a different dynamic has unfolded in many research in northern continental European countries. German research in Didaktik has favored dialectical, normative (i.e. explicitly ethical), anthropological and even aesthetic approaches, paying relatively little attention to the successive waves of behaviourism and cognitivism that have washed over English-language educational theory. While the likes of Thorndike, Skinner and Miller enjoy canonical status in the annals of American educational research, the influence of the philosophers such as Habermas, Hegel, and Rousseau often seems paramount German educational texts. This general emphasis is reflected in the subdivisions or different models of Didaktik, which reference theoretical frameworks ranging from Bildung through Habermas' communicative action to Luhmann's constructivist systems theory:

– Didaktik (or more recently, critical-constructive Didaktik)
– curricular Didaktik
– Didaktik of learning and teaching theory
– cybernetic Didaktik
– communicative Didaktik
– subjective Didaktik

- constructivist Didaktik
- subject-oriented or disciplinary Didaktik
- action-oriented Didaktik[1]

(Adapted from Wikipedia, 2006)

Naturally, an introduction to these individual disciplinary models is beyond the scope of this paper. However, to highlight linguistic and other differences, this paper gives special emphasis to critical-constructive understandings of Didaktik. But before turning to these and other aspects of Didaktik, it is important to consider briefly the significance of the term "didactic" in English.

2. Didactic in English: Dewey's Loss and Thorndike's Gain

The freighted character of this term in English-language education research can be difficult to explain or isolate unequivocally, but can be illustrated though reference the short history of the phrase "guided didactic conversation." It was originally coined by Börje Holmberg, an administrator of distance (i.e. technologically mediated) education institutions in Sweden and Germany. Used to describe the dialogic relationship between learner and teacher that includes "both real and simulated communication processes," the phrase has come to be associated with well-developed self-instructional material (e.g. informal study guides) and with the planning and guidance of student work in distance education contexts. Linked with Dewey's notion of "interaction," Holmberg's notion of "guided didactic conversation" has gone on to play a pivotal role in Michael G. Moore's prominent educational theory of "Transactional Distance." Despite this fact, Holmberg, in a recent presentation to an American audience, describes his initial formulation as a strategic error:

> unfortunately, I talked about the didactic conversation. I don't like the expression didactic conversation because didactic, to many English speaking people, particularly in the U.K., means that if you do something in a didactic way, you lay down the rules, you tell people what things are. It's also a sort of authoritarian approach. And

1 Unless otherwise noted, all translations of this and other German texts are those of the author.

> my approach is something entirely different from something that is authoritarian. (2004)

At best, the English term "didactic" refers to instruction (rather than the more substantial processes such as, "education" or "development"), and often applies to a kind of moralizing instruction that accompanies entertainment. It carries a strong secondary significance, variously characterized as "making moral observations" or as "excessively instructive." (e.g. Merriam-Webster, 2006; WordNet, 2006).

But at the same time, it is apparent that the term was not always understood so narrowly. For example, Walter Doyle "refers to the term didactics … with the astonishing remark that a chair of didactics was created at the State University of Iowa in 1873." (Kansanen, 1999, 27). Moreover, we know that educational luminaries contemporary to this development, such as John Dewey, were enthusiastic readers of didactic theorists such as Herbart and Lotze – names long since forgotten in the annals of English-language research.

What led to this forgetting? One American observer has a simple answer: "One cannot understand the history of education in the United States unless one realizes that Edward L. Thorndike won and John Dewey lost." (Lagemann, 1989). The implications of this statement are easily illustrated by considering the legacy of these two figures: Thorndike studied animal behaviour early in the 20^{th} century to understand human learning, and his work anticipated both Skinner on operant conditioning and current connectionist research in neuroscience and cognitive psychology. To him we owe the now familiar terms "mental map" and "learning curve." Dewey, on the other hand, is counted as an important member of the pragmatic school of philosophy, and as a key early 20^{th} century writer in the American progressivist tradition in education. Although he has been ascribed the role of the "patron saint" of American education, it sometimes appears that this designation is more honorific than substantive. As Langemann observes,

> If Dewey has been revered among some educators and his thought has had a greater influence across a range of scholarly domains – philosophy, sociology, politics, and social psychology, among them – Thorndike's thought has been more influential in education. It helped to shape public school practice as well as scholarship about education. (Langemann, 1989)

Correspondingly, Dewey's work receives relatively little attention in educational technology research. Moreover, where it *is* referenced – e.g., Dewey's aforementioned notion of "interaction" in Moore and elsewhere – the implications of his sophisticated pragmatism are disregarded.

Dewey's loss and Thorndike's gain is further confirmed by the trajectory of Thorndike's influence. His research, and its natural-scientific and quantitative impulses, can be said to delineate the overall path taken by research in North American educational research. This may be especially the case in educational technology, where the history of research in learning is conventionally presented as a progression through two paradigms, both clearly prefigured in Thorndike's work: the behaviourist paradigm (firmly grounding research in the natural sciences, basing theories of learning in behaviour observable in both humans and animals), and the cognitivist paradigm (understanding mental function in terms of computational models, including connectionist ones).

3. Didaktik Technology

The ultimate purpose of explicating the different understandings associated with the term "Didaktik" up to this point has been to explore their relationship to Internet and Web technologies in general, and microlearning in particular. The two diagrams provided below can serve as starting points for such an exploration. The first, from Morrison, Kemp and Ross (2001), shows the steps for designing instruction and instructional content. These steps are often utilized in the design and implementation of educational technologies, and identical or similar diagrams are to be found in instructional and curriculum design textbooks. The second is the "didactic triangle," variations of which can be found in almost any German-language introduction to Didaktiks (e.g., see Meyer, 1988).

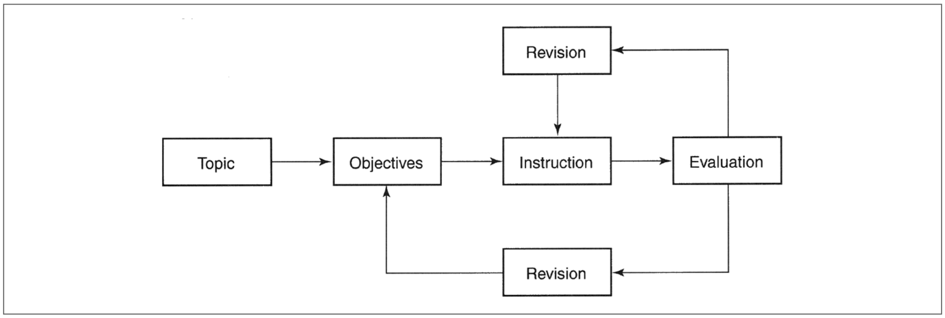


Figure 1: "A Typical Instructional Design Model"

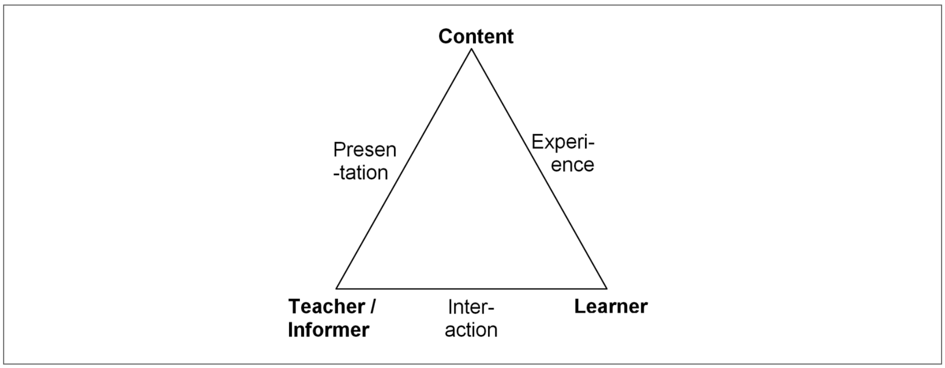


Figure 2: The Didactic Triangle

Like the empirical English-language and dialectical, continental traditions from which they respectively originate, the two diagrams relate to one another orthogonally, but a number of differences in overall emphasis are clear: The "instructional design model" emphasizes a goal-oriented instructional development process, with linear, systemic and procedural steps involved in such a process. Significantly, the purpose of this process is the revision or adjustment of instruction and objectives for an objectively "given" content or topic. The "topic" component in this diagram is not subject to feedback from any other components in the system, and could, in theory, be operationalized as any kind of content or subject. In principle, the instructional "output" of this process is ultimately perfectible: Once instruction and objectives for a given topic are revised to maximize the results of evaluation, a stable end-state may be reached. Finally, as the arrows in the diagram indicate, the relationships between each of these steps are all reducible purely to function, in terms of inputs and outputs. As Westbury (2000) interprets North American curriculum approaches generally, one could say that it is the *system* depicted in the diagram that is primary, and student, instructor and subject are all subordinate to it. (However, instructional designers would likely object that the user and her requirements generally represented through initial or iterative needs analyses).

Regardless of the variations and interpretations applicable to the instructional design model, it depicts a system whose ultimate goal, *qua* system, is its own equilibrium, and its final outputs. On the other hand, the didactic triangle can be said to delineate a set of relations whose dynamics are dependent on tension and contradiction, rather than on equilibrium or entropy. In this sense, it does not describe a process or set of relationships that are somehow perfectible. Instead, it describes a process that has been characterized as both conversational and dialectical:

> The instructional process is a dialectical, internally contradictory, complex and often also conflict-rich process. Teaching and learning are not related simply as "giving" and "receiving" are related to one another. Between learning and teaching processes, there exist manifold tensions. (Klingberg, 1982)

In the context of the Didaktik triangle, tensions between and combinations of contradictory opinions and positions can be integrated to arrive at a position which supersedes the two. So, for example, the position of the individual and that of her society can be superseded through the gradual development of a self whose independence is realized in the context of social participation. These types of educational processes can also be described in terms that are broadly conversational – for example as a relationship between a self and an other (self) in which the difference between self and other is simultaneously respected and addressed. Indeed, Klafki asserts the effective identity of dialectic and dialogue: "the logic of dialogue is a dialectical logic" (1973). Didaktik scholars such as Klafki highlight understandings of conversation articulated by the likes of Martin Buber and Hans-Georg Gadamer –both of whom emphasize the irreducibility of conversation to predictive logic or, indeed, to the control or intentions of either conversant:

> We say that we "have" a conversation; but in reality, the more authentic the conversation is, the less it is the possession or will of one or the other interlocutors. So

> the authentic conversation is never something that we can want to control. Instead, it is in general more correct to say that we end up in a conversation … No one knows in advance where such a conversation itself "ends up." (Gadamer, 1960)

It is likely, in fact, that it is this kind of conversational interaction that Holmberg had in mind in coining the phrase "guided didactic conversation." The role of the teacher in *guiding* (to use Holmberg's term) but not controlling this conversation involves not only interaction with students, but also the selection and use of appropriate content. This implies that a dialogical dynamic also applies to the teacher's "presentational" relation to content, in which aspects of culture are selected for (and excluded from) emphasis as part of a more general process cultural mediation or reproduction. Unlike the instructional systems diagram, content is neither objectively given nor neutral in relationship to other components in the Didaktik triangle. Instead, content can be said to be interpenetrated with the dialectic/dialogical character of the other terms in the triangle. Indeed, this dialectic/dialogic dynamic can be said to interpenetrate the relationships between all of the terms in the Didaktik triangle. This includes the student's "experiential" relationship with content, which can also be understood in terms of an encounter between self and other. Such a relationship can additionally be understood in terms of the emphasis on experience in Dewey's intricate pragmatics, as described, for example, in his *Experience and Education or Art as Experience.*

Finally, all of the relationships in the Didaktik triangle should also be understood, as mentioned earlier, in terms of a "comprehensive intertwining of action and reflection, practice and theory" – an understanding of theory and practice in which the relationship between the two is an object of explicit concern and reflection. By comparison, in the instructional design model, this same theory-practice relationship is addressed, but not directly problematized, in terms of the feedback processes provided through evaluation.

4. Learning Objects

The implications of both of these very different instructional approaches for technology can be further explored by considering their application to one specific technology, or technical format – learning objects; "chunks" of digital, multimedial instructional content. Learning objects have been defined variously; most generally (and originally) as "any entity, digital or non-digital, that can be used, re-used or referenced during technology-supported learning" (IEEE, 2004). Perhaps more practically, learning objects have also been understood as modular, interchangeable, and reusable resources that are available over the Internet and the Web. This paper will first look at examples of particular learning objects (or rather learning object collections) that are associated with each tradition. This will then enable a detailed consideration of the kinds of relationships between technology and instruction that are characteristic of both traditions or approaches.

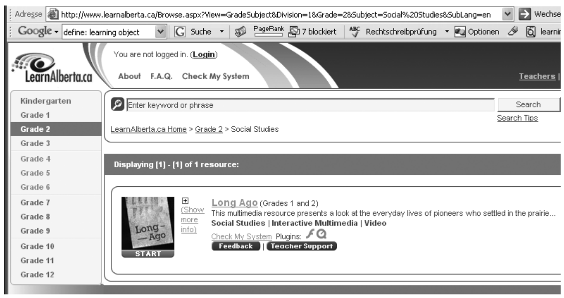
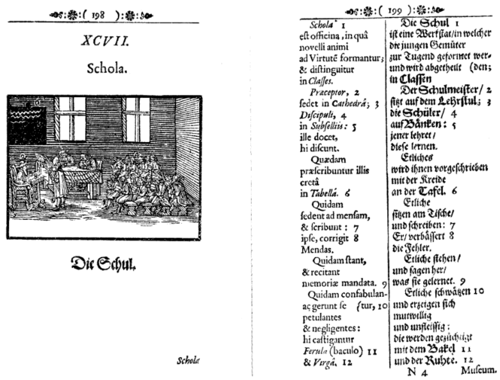


Figure 3: LearnAlberta.ca collection

Within the context of the "typical instructional design model," the learning object is first and foremost understood as an "instructional" product resulting from the combination of a topic and one or more learning objectives. In more elaborate models, these stages of the process are generally further decompartmentalized and extended through the introduction of further components. These might involve, as William Ried explains, the "selection from the total content available to be learned, 'display' of that content, and 'control' of the learning process" (1998). But "[w]hat is *authoritative*" in these stages, Reid stresses, "is not so much content [itself] as … how [it] can be assembled, sifted, itemized and made available for selection by or on behalf of the student" (1998). Such a characterization of selection, combination, display and control is remarkably reminiscent of descriptions of what has been envisioned for learning objects, especially in the context of K-12 curricula development and in training settings. One educational ministry in Canada, for example, has spent tens of millions of dollars on such a collection

(Alberta Government, 2005). The end product is the provision of organized access to "multimedia learning resources that are correlated to Alberta Education's [that ministry's] programs of study" (LearnAlberta.ca 2006) and to very specific educational outcomes for individual subjects and levels of study. (See figure 3 for an image from this collection.) A similar emphasis on the centrality of selection, itemization and controlled presentation can be found in other descriptions, above all in those concerning the use of learning objects in training and in contexts using what is known as the "SCORM" architecture:

learners can be uniquely identified, content can be specifically personalized, and learner progress can be monitored, supported, and assessed. Technologically and technically, researchers are making progress toward realizing the personalized learning dream with adaptive learning object technology. (Martinez, 2001)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Quidam	Etliche
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& recitant	und sagen her/
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& negligentes:	und unfleissig:
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& Virgâ. 12	und der Ruhte. 12

N 4 Museum.

Figure 4: Example of a topic from Comenius' The Visible World.

In such descriptions, information and communication technologies, and underlying curricular, training or instructional conceptions relate to one another in terms of mutual interpenetration or even identity. The technology and the design process or system itself are nearly indistinguishable: both are purposive-rational devices, utilizing a particular set of means to effect a particular outcome or output, all according to empirically-established causal or associative relationships. This output, whether we are speaking of instructional systems or the technology through which they are realized, is supposed to be maximally effective instruction. Moreover, the way this is conceptualized allows for the processes of selection, delivery and presentation to be undertaken either through human intervention or automated processes (hence the "personalized learning dream" and the goal of "teacher-proof" curricula). Characterizations of the near identity of instructional systems and technology are further supported by the fact that such systems diagrams can be used either to map out the relationships between computer systems components, or the compartmentalized expertise of design and curriculum experts.

Given that a learning object can be considered as "*any* entity, digital or *non*-digital" (emphasis mine), an example of a learning object "project" or "collection" long seen as exemplifying the Didakik approach is considered here: That of Johannes Comenius, entitled "The Visible World" *(Orbis sensualium pictus; Die sichtbare Welt)*, originally published 1658 –using the contemporaneously "new media" of print. The book consists of 150 small lessons (loosely, 150 multimedia learning objects) for children, each providing an illustration of settings and activities accompanied by explanations in the linguistic media of German and Latin. The page shown above is one of the first in the collection, and depicts an adult (or teacher) showing to child (learner) various things in the visible world around them. This image and the corresponding text serve to frame the content of the book as a whole, making this content into something that is shown to the learner by the adult teacher. Klaus Mollenhauer explains the "preeminently Didaktik function" of the images and texts in this collection by emphasizing above all the connections within and between them:

> No one thing is presented individually [in this collection] but instead, each individual thing, each activity, is shown in its interrelationship with other things and activities. Underlying this is a critical intent: [Specifically, to counter] the factual … principles of representation [proper to] the encyclopedia … which was becoming fashionable at the time. (Mollenhauer, 2003)

So what makes this "learning object" exemplary from the perspective of Didaktik are the context and connections established both within it, and with the other objects in this collection. What gives the object its Didaktik value, in this sense, is its context – as provided by other content, the non-neutrality and non-modularity of the context it presents. Finally, what makes this "object" valuable for education is the fact that it is really not an interchangeable chunk of disinterested content, an object that can be itemized, disassembled and reconfigured with any other object.

This example of didactic content reveals quite a different relationship between technology and educational intent than that existing between instructional systems and the curricular resource collection described earlier. Compared with the diagram of the instructional design process – which is thoroughly interpenetrated with the technological – the print-based "learning object" example provided above illustrates only two discrete points of contact between technology and instruction: First, in its multi-medial, multi-linguistic presentation illustrates the role of technology as a medium contributing to the student's experience of a particular content. Second, as suggested (somewhat indirectly) by the depiction and framing of student and teacher in Comenius' text, this technology can also its role as a medium connecting learner and teacher. The capability of Internet and Web technologies to provide potentially "rich" teaching and learning materials and flexible communication between teachers and students has, of course, received significant attention (in various ways) in both German-language and Anglo-American literature. Both literatures have also emphasized how the hypermedia environment of the Web can provide students and teachers with a range of synchronous and asynchronous communication opportunities, and can contextualize and interrelate content in unique and powerful ways. (It is perhaps worth noting that some German-language sources have suggested that that a specifically didactic quality can be conferred on such hypermedia through "systematic and therefore clearly structured navigation" [Swertz, 2005]. However, in this and other conceptions of the Didaktik value of the Web as content, the "general background" context presented by the Internet and Web as wholes remains problematic.)

5. Technology: Experience, Interaction, and Content

One of these points of contact – perhaps most orthogonal to the Anglo-American frameworks – is the relationship of technologies to Didaktik not as a tool or means for enhancing relationships between triangulated terms, but as *subject matter*. Information and communication technologies (ICTs) are always relevant to Didaktik, in other words, also as content. In the words of Klafki, information and telecommunication technologies constitute one of eight "key problems" for our era: "For a future-oriented education system, we need… a tiered, critical, information- and communications- technological curricular foundation as a part of everyone's education" (Klafki, 1996). (The other "key problems" identified by Klafki include those of peace, the environment, social justice, multiculturalism, and –hearkening back to Buber's notion of dialogue – an "I-Thou" relationship in teaching and learning. [See Klafki, 1996]). The key problems of ICTs –together with the seven other key problems or themes – is as much a part of Klafki's understanding of critical-constructive didactic as are the categories of curriculum (Lehrplan) or Bildung, and it has significant consequences. Perhaps most notably, this question gives the use of technology in instruction a self-referential or reflexive character. It implies that the use of technologies in instruction and education is not simply about making use of a particular function that is indifferent or neutral in its relationship to content and to pedagogy generally (e.g. see Friesen, 2004). It ensures that this application of technology is instead (also) about a learner's "participation… in their [own] highly mediatized culture and society" – to use Kerres' and de Witt's definition of "Media-*Bildung*" (Kerres & de Witt, 2002). The matter of going beyond function to the question of participation in a highly mediated, technological culture and society is always at least tacitly present as a "background" theme or issue in the application of technology in education. However, the key question of ICTs, or the "message" inevitably brought along with the medium is all too easily unheeded, unthematized or unproblematized. There is no arrow in the typical instructional design system, other words, that would point to its own character as a technical system, and enable this to be considered as a specific "topic." Overcoming the blindness of the system to its own technical (and social) character needs would enable designers and others to engage in more directly social and participatory implementation. Explicit recognition of the inevitable character of the medium as the message would encourage a more open and critical consideration of its non-neutrality concerning content, instruction and pedagogy generally.

But it is the dialectical and dialogical characteristics of the interrelationships in the Didaktik triangle that is perhaps the most important – and limiting – factor in considering the interrelationship of technology and Didaktik. It is these that also help us to see (finally) the possible outlines of a didactic of microlearning. The dialectical/dialogical quality of the relationships between all of the elements in the Didaktik triangle is pivotal in defining both the potential and limitations of ICTs in education. One illustration of this that is of direct relevance to microlearning is to be found in discussions related to content. In more than one German-language discussion of Didaktik and ICT's, the rather general character of Didaktik understandings and models (e.g. the Didaktik triangle, Habermassian models of communicative action) is seen as creating significant difficulties: Namely, these models are seen as too general to provide guidance on the specifics of the design and implementation of these technologies for particular contexts and contents:

> A big problem...is that traditional pedagogical-didactic models either are too coarse-grained or that they have no direct relationship to the possibilities of new, interactive media. Only very recently have there been attempts to flesh out the characteristics of didactic scenarios that are relevant to web-based learning. Representative of such attempts is work by Meder and Schulmeister. (Baumgartner, 2004)

Both of the examples cited in this passage (Meder and Schulmeister), deal with the development of ontologies or classifications for tools, knowledge-forms and activities for learning. These kinds of classifications will be familiar to anyone who has been exposed to educational metadata, especially Learning Object Metadata and IMS Learning Design. However, as has been noted by those involved in standards and their implementation, such approaches to the design and reuse of didactic scenarios are associated with practical paradoxes (e.g. Wiley, 2004; Downes, 2003) and can conflict with typical economies of scale for educational organizations (Friesen, 2004).

As indicated earlier, the dialogic character of the relationships in the Didaktik triangle are such that they cannot be controlled or manipulated by either the teacher or student for own ends. As common phrasing suggests, student and teacher "enter into" these relationships; and these relationships are subject as much to their own particular dynamics as they are themselves subject to the participants' designs. Some important implications of this for a microdidactic can be identified using the terms supplied by a researcher most familiar in Anglo-American contexts. These are taken from Lucy Suchman, and her book-length study, *Plans and situated actions: The problem of human machine communication.* Suchman's essential argument is that the titular categories of "plan" and "situated action" need to be reconsidered, and that rationally "'planned' character of our actions is not… inherent [in these actions] but is demonstrably achieved." What Suchman means by this is that plans are *not* realized in reality not through events that inevitably unfold "according to plan," in a pre-arranged and methodical manner. Instead, plans serve as rough guidelines for activity that become complete only after they are realized in action. Plans are realized in the form of situated actions, which are improvisatory and unforeseeable ("unplannable") in advance. In her own words, Suchman's "primary concern in [the book is] to suggest a "shift in the status of plans from …control structures that universally precede and determine actions, to discursive resources produced and used within the course of certain forms of human activity" (2003).

What is of primary concern for this paper is the similarity of improvised and impredictable situated activity to the "conversational" dialogical/dialectical character of Didaktik relations. If plans are just guidelines or *a posteriori* descriptions of what occurs in situated experience, conversation and action, it then follows that instructional and Didaktik objectives, patterns and sequences need to be viewed with caution – especially when understood on the micro-level of dialogue and dialectic. Just as plans change in their status when they are viewed in terms of the particularity and variability of situated action, Didaktik and instructional plans, structures and patters acquire a new status when the focus is on the micro-level. Didaktik and instructional plans, structures and objectives, too, become discursive resources produced, used and limited to in particular teaching and learning contexts. On the micro-level, then, the dialogical/dialectical character of Didaktik relations make plans and designs not just difficult, but also possibly counter-productive.

6. Conclusion: Towards a Microdidaktik

This last point regarding the adequacy or even possibility of micro-level descriptions, plans, or by extension, didactical structures is perhaps the most significant for a potential microdidaktik. It points to the importance of assiduously *avoiding* the imposition of structures and limitations on local, contingent micro-level activities. Technologies operating at this level instead need to be flexible and accommodating of such improvisation: Cell phones, for example, become more effective not by specifically supporting the micro-structures of conversational interaction, but by providing affordances to support situated and improvisational action that are part of conversation: hands-free operation, SMS, email, video and other conversational "modalities," for example. This implies further the importance of understanding not only the relationship of the micro, of improvisation and conversation, to the macro, instructional plans, learning objectives, but also consideration of a kind of meso-level where they might be seen as interacting.

A second potentially important contribution to Didatik of microlearning is the interrelation of Didaktik and technology on the level of content – in other words, the "problem" of technology as "key to our epoch" (Klafki, 1986). Not only does this relationship serve as an arresting or counter-intuitive illustration of the non-neutrality of both Didaktik and Didaktik contents, but it underscores the unavoidably of cultural, historical, economic and generally problematic character of technology – a character which is all too easily forgotten when technology is considered on its own, function and instrumental terms. To again use the cell phone as an example, the same physical or technical device can be said to be constituted differently in different contexts: Especially in parts of Europe and Asia, economic and social factors have emphasized its text messaging functions at the expense of others; in parts of Africa, it has taken on the character of a fixed-location device, used by entire towns and neighbourhoods as the primary means of remote contact (e.g., see Plant, 2001). At the same time, this technology fits in with and builds on patterns of uses established historically by the land line phone and other communications technologies (e.g. Hutchby, 2001; Arminen, 2005). As McLuhan famously said, the medium as the message; and the messages sent by the appropriation of technology in education are manifold and powerful. Only by paying attention to these messages, and by understanding technology as a cultural and historical "problem" as well as a functional solution, will it be possible develop further a didactic sensitive to the vicissitudes of situated, contingent micro-activity.

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Challenges for a Microlearning-Driven Process of Knowledge Creation

Modes of Knowing and Creating Knowledge in Microlearning Environments

(On Microlearning)

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Abstract: Any kind of learning always is rooted in different modes of knowing. This paper aims at developing a vision in which microlearning is not only embedded in a knowledge ontology, but also in a whole process/cycle of knowledge creation: i.e., by starting from observations, via constructing relationships, rules, etc. and meaning, to developing the potential of realities and creating new realities, as well as reflecting the whole process a whole cycle of knowledge creation will be developed. It will turn out that microlearning strategies are particularly interesting and beneficial for almost every stage in that process – microlearning as a process of knowledge creation. The epistemological challenges for such a framework will be outlined in detail in this paper.

1. Introduction

Whenever we are dealing with educational processes we are confronted with various forms of knowledge. In most cases these types of knowledge remain implicit and unquestioned. They just appear as one chunk of knowledge (e.g., definitions, questions, arguments, explanations, instructions for acting, image, etc.) in the course of a teaching/learning unit. In most cases the meta-data about this knowledge is not considered very important.

However, if we take seriously that educational processes are intrinsically knowledge-driven, it is necessary that these questions concerning different types of knowledge receive new attention. Recently various approaches, which can be summarized by the notion of "knowledge didactics", have been developed (e.g., Auinger and Stary–2005, Swertz 2004, standardization processes in the educational field, etc.). Most of these approaches take into account didactical, pedagogical, or web/technology-specific issues as well as refer to specific traditions in the field of education.

Apart from these issues, it is also necessary to consider epistemological as well as cognitive issues (cf. Peschl 2003, 2005). This is of special relevance in the context of *microlearning*, because this type of learning often is applied in more "existential fields" or in context sensitive fields (e.g., "learning pulses" in specific situations). That is why it is necessary to consider the question of knowledge-typologies or "knowledge-ontologies" from a new perspective taking into account the role of reality, which kinds of (cognitive) interaction are applied to reality, which types of interaction lead to which types of knowledge, which "domains" of reality are covered by which types knowledge/interaction, what can be done with that knowledge, etc. and how these types of knowledge creation can be embedded in microlearning settings. It is important to take these questions into consideration especially in the context of microlearning, as – in many cases – microlearning is embedded and realized in scenarios where direct interaction with reality(i.e. the phenomenon of interest) and situatedness (of the learning process) in reality are primary sources for the process of learning and of knowledge creation/construction.

2. Modes of Knowing and Knowledge Creation – a Microlearning Perspective

Hence, if we take seriously that knowledge is the main resource, source, as well as the main product of learning processes, we have to develop a "knowledge-based" approach taking into account the special features and possibilities which are offered by the microlearning-paradigm. The process of (micro-)teaching/learning will be re-interpreted in the light of an individual and collective process or *cycle of knowledge construction and knowledge creation.*

In order to understand and improve learning/teaching processes according to the microlearning-concepts, we have to take a closer look at the modes of knowing and levels of knowledge that are involved in these processes first. Table 1 gives an overview over these modes. This table identifies three domains describing (i) the level of knowledge (in the sense of which realm of reality/the phenomenon this level refers to), (ii) the cognitive activities which are necessary to construct and explore this realm, and (iii) the characterization of the knowledge which is the result of these construction processes. In the section to come these forms of knowing, knowledge, and knowledge creation will be brought into the context of microlearning.

Table 1: Levels of knowledge, modes of knowing, and the (cognitive) activities necessary for developing these modes.

Level		*Cognitive activity*	*Resulting knowledge*
1	**Behavioral level**	• Observing • Detecting & registering • Describing	• Description of the observed object, its behavior(-al dynamics), its external and superficial properties (e.g., material, etc.) • List of observed properties ("data", "facts", etc.)
2	**Level of (emerging) patterns of behaviors and relationships**	• Searching for, constructing, and "discovering" regularities and patterns • Projecting patterns • Quantitative induction • Constructing patterns • Single-loop learning	• „Explanation" of the observed behavior by making use of internal mechanisms (which are postulated and "projected" into the observed behaviors) • These mechanisms are said to be responsible for generating the constructed (behavioral) patterns (i.e., these mechanisms are the „pattern generators") • "Know how" • "Recipe knowledge" & algorithmic knowledge
3	**Level of causes and the "source"**	• Searching for, constructing, and discovering causes, meaning, finality, etc. • Activity of "radical questioning" • Discovering/constructing the intangible dimensions of reality • Discovering & constructing the "deeper source", the "substance"	• Understanding the observed phenomenon • Understanding its meaning and the "source"/causes which are behind the mechanisms • Knowledge about the intangible dimension of the observed reality • "Deep knowing/knowledge", knowledge about the core of the reality • Knowing "from within" • "Metaphysical knowledge" (in the sense of knowing the "substance")
4	**Level of potentiality, change, and design**	• Exploring, discovering, and developing the potentials of a reality • Making use of and bringing "deep knowledge" and the mechanisms to the domain of application • "Facere" and design • Changing reality according to knowledge	• Artifacts, technology • Social, scientific, and cultural realities • Organizations • Visions + their realizations
5	**Level of reflection (of the causes, source, patterns, processes of knowledge construction, etc.)**	• Reflecting • Reframing • Radical Questioning (your mental models, premises, etc.) • Reflecting the learning and construction process itself • Reflecting the design-process itself • Double-loop learning	Knowledge about the following questions: • What are the assumptions/premises behind these causes/source? • What are the mental models behind the observed behaviors, patterns, and the source? • How can these premises and mental models be changed and which effects would these changes have on the understanding of the whole phenomenon/reality?

As can be seen in Table 1 each domain of reality is "covered" by a specific form of knowledge and by a specific "cognitive activity" – this is not surprising: from a constructivist (e.g., Foerster 1973; Glasersfeld 1984, 1989, 1995) as well as cognitive perspective (Peschl 1994) it is clear that cognitive processes are responsible for generating discriminations in the environment (e.g., Maturana 1970, 1991) leading to particular forms of knowledge.

2.1 Why Observations and Facts Do Not Suffice

What is the starting point of any process of knowledge creation? Normally, we start with perceiving a phenomenon via our senses. Level 1 concerns these "superficial" properties of the phenomenon of interest: our primary observation, perception, and cognitive processes bring about a rather superficial and singular (in the sense of referring to a single concrete object or phenomenon) kind of knowledge in a first step. This knowledge is realized as a list of observations, descriptions of behaviors or behavioral dynamics, a list of data, facts, etc. It is not about more general and universal properties of the observed phenomenon, but describes this phenomenon on its *behavioral level* as it presents itself to our senses. Both from an intellectual and cognitive perspective the resulting knowledge of this process is not really very interesting, as it deals only with particular singular events/phenomena leading to descriptions which do not show any patterns or regularities of the observed phenomenon.

Taking this descriptive knowledge as a point of departure and progressing in the processes of knowledge construction, we are reaching the level of *(emerging) patterns, trends*, and *relationships*: they are not "directly perceivable" with our senses. In order to arrive at that level more complex and active construction processes are necessary. Normally, this is the domain of the (natural) sciences, where relationships are constructed by relating facts and descriptions, and behavioral patterns begin to emerge. I.e., these patterns are the result of more or less complex inductive and constructive processes (in many cases being realized as statistical procedures). Most so-called (scientific) explanations are situated on that level: they offer cognitive, mental, or even physical mechanisms explicating the relationship between hidden (theoretical) structures and the observed behavioral dynamics of a phenomenon. These mechanisms are assumed to be "responsible" for generating the observed phenomena (compare, for instance, Maturana's concept of scientific methodology; Maturana 1980, 1991) – by offering such a mechanism one can also offer an explanation for the constructed patterns and regularities by providing this pattern-generating mechanism. Hence the resulting knowledge mainly is concerned with the "how" and the dynamics of the observed phenomena. In many cases it has the form of "recipe-knowledge" (i.e., more or less complex structures of if-then rules). The cognitive activities leading to this kind of knowledge have strong structural similarities with the processes of theory/hypothesis construction well known from the natural sciences (e.g., Peschl 2001). From a learning perspective, these construction processes can be considered as epistemological optimization aiming at finding the best possible level of functional fitness (in the constructivist sense; e.g., Glasersfeld 1984, 1991, 1995); they are realized in a single-loop learning cycle (Argyris and Schön 1996; for a detailed argument see Peschl 2005, 2006).

So far, we have come to the point of overcoming the level of descriptions by constructing relationships "explaining" how the observed behavior comes about on a material level. On level 3 we are going one step further: on that level more qualitative issues are at stake. While level 2 was mainly concerned with rather quantitative and measurable matters, level 3 construction processes aim at the realm of a phenomenon going beyond its material, measurable, and tangible properties, such as its meaning, finality, etc. Philosophically speaking, this level concerns the exploration and the construction of causes (for instance, in an Aristotelian sense [1989]). It can be reached by applying intellectual tools, such as radically questioning, exploring the meaning, or trying to reach "deep understanding" of a phenomenon. The resulting knowledge, in a way, is the *source* for a deeper understanding of a phenomenon – i.e., the construction of a kind of *"deep knowing/knowledge"* (e.g., Jaworski et al. 2000; Scharmer 2000, 2001; Senge et al. 2004), knowing reality "from within". From a constructivist perspective this may sound quite metaphysically, and, in fact, it is close to metaphysics in the original sense (Aristotle 1989, Philippe 1991). However, that is *not* a contradiction to a constructivist approach. Rather, it makes a statement about how classical natural science inspired (and limited) construction processes can be overcome and be led into a more qualitative understanding of a phenomenon, e.g., by exploring its finality. From an intellectual perspective we are confronted with knowledge concerning the "core" of a phenomenon on that level. This type of knowledge which is not taken into consideration in most approaches in technology enhanced learning/teaching settings is rather difficult to acquire. It cannot be "transferred" from A to B; so, for eLearning processes it is not so much a question of how to transfer this knowledge to the student – rather the learner him-/herself has to take a path of intellectual discovery and construction in order to reach that level of insight; hence, technology plays the role of supporting this path. What this means in the context of microlearning will be shown in section 3.2f.

2.2 Going Beyond Causes – Entering the World of Second Order Knowledge Processes

It is that level of deep knowing which also reveals another dimension of a phenomenon or reality: its *potential(-ity)* with regard to change. I.e., at every point in time each phenomenon is in a certain state and that state can change over time. Hence, there exists a space of potential change(s) at every moment; a space of possible changes which can happen or which can be induced to that phenomenon. As a simple example, think of a stone which is given a new form by an artist: a process of *"transformation"* into a sculpture according to the artist's plan or knowledge. This sculpture is one possible instantiation in the space of potentiality of that stone. Only if one has a profound knowledge (level 3) about an object, a phenomenon, etc., it is possible to explore, construct, and develop the full potential of that reality. I.e., on level 4 we are changing the perspective from the mode of "contemplation" to the mode of "facere"/doing. The interesting point is that this level of knowledge does not only explore the space of potentiality, but also realizes (some of) these possibilities. I.e., we do not remain in the space of intentionality/knowledge by constructing new (knowledge) realities as a result of applying knowledge from the levels 1-3; rather new physical realities are created or existing (physical) realities are changed by externalizing or instantiating this new knowledge in(to) reality.

In a way it is a "materialized constructivism" where artifacts, design, technology, etc. are in the same way a product of this level 4 knowledge-process as creating cultural, scientific, social, etc. realities. This mode of knowledge is the key for most processes of *knowledge creation*, of *innovation*, and of finding and instantiating a *vision*.

Finally, level 5 knowledge brings in a completely new quality in the process of knowledge construction: the dimension of *reflection*. This step has the potential to fundamentally question the knowledge having been constructed so far by reflecting on the knowledge, its premises, as well as on the construction – and learning processes having led to that knowledge. The cognitive activities, methods, and "epistemological technologies" being applied in that mode of knowing include processes of deep reflection and questioning, systematic reframing, questioning the premises, ideologies, the construction processes, uncovering mental models and hidden assumptions, etc. This level of knowing introduces a completely new dynamics into the whole process of knowledge construction and knowledge creation, because it is situated on a *meta-level* and it can bring up completely unexpected results and new perspectives which have not been considered so far. This mode of knowing and knowledge acquisition is realized in the *double-loop learning* strategy (Argyris and Schön 1996) – it is especially powerful when it is performed in a collective setting. Rogers 2001 gives a good overview for the role of reflection in higher education – the author shows the importance of this concept for *all levels of knowledge* having been developed above.

3. Microlearning as Continuous Knowledge Creation

Knowledge-oriented educational processes in the microlearning paradigm do not mean that one only abstractly knows these modes of knowledge and knowing, but that these modes explicitly find their way into the design of the particular course or contents. Normally, educational processes at university level do not go beyond level 2 (especially in the natural and technical sciences) and level 3 of Table 1. If students are supposed to reach a profound understanding and a high level of sovereignty and autonomy in a certain domain (of reality/knowledge), it is necessary to consider all of these levels of knowing and to concretely implement them in a particular course or curriculum. Reducing knowledge to only one or two of these levels perhaps leads to highly specialized and efficient "optimizers" and well adapted "recipe applicators", but surely will not bring forth persons with a highly open attitude, with exceptional potential for innovation and for developing radically new perspectives, and with a high level of reflection. Looking closer at concrete settings of knowledge creation/construction it is evident that these processes are not limited to a single knowledge-level of Table 1. The knowledge-levels having developed above do not exclude each other – rather, they depend on each other and there is strong interaction between them in order to bring forth knowledge which is as rich as possible.

3.1 Microlearning Features Reconsidered

What is the relevance of this typology concerning modes of knowing and of coming to know for the domain of *microlearning*? Apart from classical forms of learning/teaching as well as from classical media-supported forms of learning/teaching (e.g., eLearing, communication tools, knowledge management tools, etc.) the microlearning approach offers features and possibilities going beyond these forms of learning/teaching. These "microlearning-features" provide solutions and procedures for the requirements of knowledge creation in the domains of knowledge having been developed above.

Here are some of these features which seem to be of high relevance for our question of knowledge creation in the spectrum of types of knowing (see also Hug et al. 2006): Learning takes place in micro steps:

- These micro steps have proven to be the basis for a learning success with a high level of sustainability (e.g., Hug et al. 2006);
- Furthermore, these microlearning steps facilitate the process of deep understanding and creation of profound knowledge, if the microlearning process is embedded in an appropriate learning design/setting (e.g., Peschl 2005, 2006);
- Microlearning offers the possibility of *ubiquitous learning* and by that
- supports a continuous process of learning over a longer period of time;
- Ubiquitous learning and mobile technologies provide the basis that microlearning can be realized as situated learning (situatedness) implying learning from direct interaction with reality;
- Due to a continuous accompanying character of microlearning these technologies can be applied also in the field of in the personality (development) & existential issues.

It is not a particular feature which is responsible for a successful process of learning or knowledge creation. Rather, it is the combination of these features bringing about the high impact of the microlearning paradigm. If these features are combined explicitly considering the meta-structure of knowledge processes (e.g., the typology of knowing having been developed in Table 1) this paradigm becomes even more powerful.

3.2 Microlearning Technology as Enabler for a Cycle of Knowledge Creation in Different Modes of Knowing

What is the potential of microlearning technology from a knowledge-oriented perspective on learning/teaching and knowledge creation? What are the specific features and knowledge-tools that microlearning can provide, what are the specific challenges, and which knowledge-tasks can be supported by that paradigm? Having in mind the differentiation of levels of knowing from Table 1 we will investigate the strengths and assets (as well as some of the weaknesses and possible problems) which are brought about by the microlearning paradigm. It will turn out that it does not suffice to understand these levels of knowledge/knowing as static domains, but that they form a *process/cycle of knowledge creation*, if they are integrated in a process model – microlearning provides a framework in which such an integration can take place.

3.2.1 Observations and Behavioral Level

The very first step of knowledge creation concerns the processes of observing, collecting data, gauging, going "out in the field", creating descriptions of observations, etc. From an epistemological perspective this is a "hot spot" for the process of knowledge creation as these data are the basis for almost all the other forms of knowledge. That is why it is particularly important to take a closer look at these processes and at how these processes could be improved by applying microlearning techniques.

Microlearning plays an important role in that stage of knowledge creation as many learning processes are based on observation and data collection. Every observation is a micro-step in the process of learning and theory/knowledge construction. The process of observation is essential for almost every empirical study or experiment especially when it takes place in the "field" – the microlearning approach can support these processes in the following ways:

1. Due to its ubiquitous features and in combination with mobile technologies the microlearning paradigm can be used for providing *context information* as well as theoretical foundations for the observation process. The user can use this information for getting some knowledge about the (theoretical) background of the specific learning and/or observation task.

2. Above this background information the knowledge provided may *guide his/her observation.* I.e., the process of observation itself is supported by microlearning technology giving instructions "where to look", what to look for, etc. – this process can be understood as *"augmented observation process"*. In many cases – especially if the learner is not experienced – this leads to more precise observational data. Furthermore, in combination with the theoretical background knowledge the learner gains deeper insights, as he/she can *make more sense* out of what he/she has observed.

3. Microlearning technology allows the user to *collect more data* than normally necessary: taking images or recording audio files which are – at first glace – not necessary for the particular empirical study may turn out as valuable context information in the process of processing and re-assessing these data.

4. Microlearning technology supports the process of documentation of observational knowledge; e.g., by providing structured forms for documentation.

The point concerning the "augmented observation process" has a problematic side as well: *theory-ladenness* is the biggest enemy of any observational process (e.g., Hanson 1958)! Due to precise instructions guiding the process of observation the learner my miss interesting or relevant details of the observed phenomenon which are not covered by the observational pattern/grid being implicitly provided by these instructions. Hence – according to the level of expertise – it is necessary to find a good balance between the narrowness of instructions leading the process of observation and the openness for the observer's unbiased receptivity.

3.2.2 Relationships and Emerging Patterns

At that level of knowledge microlearning is challenged to support the process of constructing relationships and spacio-temporal patterns as well as of theory construction. The particular contribution of microlearning consists in the following tasks:

- In this regime microlearning does not consist in transferring "knowledge nuggets" from A to B. The learning challenge is a task of *knowledge construction.* Microlearning should develop concepts for designing the learning task in such a way that it can be completed in "micro-construction steps" (as an example see Peschl 2006a);

- Providing tools (e.g., statistical tools) for generating relationships and correlations;
- Providing tools for visualization of trends and to support the dynamic generation of relationships (e.g., by visualization);
- Providing tools for making explicit the implications and dynamics being generated by these relationships, mechanisms, explanatory schemata, models/theories modeling the observed behavioral dynamics, etc.

3.2.3 Causes – the Power of "Micro-Questions"

This level of knowledge construction has close relationships to philosophical investigations. The process of *questioning* is a core (cognitive) activity at this level – that is an activity which cannot be "outsourced" to a computer or to automated processes. The goal is to discover, construct, and attribute the meaning, the finality, etc. of a phenomenon. These intellectual activities are intrinsically tied to cognitive processes. Hence the role of microlearning is not so much that of "immediate knowledge production" or of a knowledge provider, but that of supporting and *enabling* these cognitive activities.
Support for the process of (radical) questioning. Microlearning is the ideal strategy for *continuously supporting* the process of questioning by *providing a stream of questions* depending on the current learning *context* ("micro-questions"). These questions (+ their possible answers) enable the learner to go more directly and more deeply to the core of a phenomenon and bring forth knowledge about the intangible and "hidden" dimension of a reality.
Documentation of the process of questioning. By presenting these questions it is a relatively simple task to provide a structure for collecting and aggregating the emerging knowledge.

Support the development of an attitude and a *"habitus" of questioning*: due to its ubiquitous and continuous character microlearning turns out to be a highly efficient strategy for developing attitudes and habitus. I.e., these are (cognitive) predispositions and activities which are very deeply rooted in the human person and which cannot be learned like skills or facts. Hence it is necessary to *persistently train* these attitudes in micro-steps of learning and repeating. Microlearning strategies, such as "microlearning-pulses" are an effective means for developing these attitudes; for instance, the attitude of questioning can be trained almost in every everyday (or scientific) situation and leads to high competence in creating knowledge on the level of causes. Furthermore, this attitude of questioning is highly valuable not only for the specific domain where it is trained in, but also for any intellectual activity in general: it cultivates the learner's openness, receptivity, and readiness to deeply dig into the profound understanding of a phenomenon.

3.2.4 Creating New Realties & Innovation

As has been shown above, this domain of knowing contains two aspects: (i) *discovering the potential(-ity)* of a reality and (ii) actually *realizing* this potential in a concrete action by transforming an aspect of reality and/or by producing a concrete result. Both fields offer interesting possibilities for the microlearning approach:

Here again, microlearning is not concerned so much with the task of knowledge transfer, but with supporting and augmenting the process of individual and collective knowledge creation as well as construction of reality. What is the epistemological challenge of discovering the potentiality of a reality/phenomenon? (a) To understand the core/"substance" of the object one wants to change, (b) to see what would be possible, and (c) to achieve some understanding of the consequences of these possibilities by exploring this space of potentiality. Cases (a) and (b) are very much tied to our cognitive abilities, whereas (c) can be supported in the following way: By making use of *augmented reality technologies* in combination with microlearning strategies the potentiality of a reality can be made accessible to your senses (e.g., via visualization); the user can (inter-)actively shape his/her (virtual) environment by applying simulation and augmented reality techniques – the goal is to explore the space of possibilities on the basis of a profound understanding of the phenomenon under investigation without having to instantaneously realize these possibilities. That is what simulation and anticipation (e.g., in a "Gedankenexperiment") are about. Finally the user will end up with a concrete plan.

While classical learning strategies leave the user alone by him-/herself in the moment of realizing a plan, in the moment where he/she goes out into the world and starts to bring the plan into concrete action and changes in the reality, microlearning offers a real alternative: Due to their mobile and ubiquitous character microlearning devices are present in the moment where the user gets in direct contact with the reality or phenomenon he/she wants to actually change. It is a new challenge for (micro-)learning technologies to develop strategies supporting these processes of realizing something in the physical environment; apart from instructions concerning the proper use and application of tools in order to effectively transform reality, one big advantage is the possibility to

establish a feedback-loop between the desired (idea, plan, knowledge, etc.) and the actual result in the environment and, by that, to approach a closer fit between these two domains in a stepwise manner. Furthermore, the community aspect plays in important role in that rather practical context: via ICT *learning communities of practice* can be established in which knowledge is exchanged which cannot be found in textbooks.
These microlearning processes in the practical field are not only of interest in the educational domain, but also in the context of *innovation and prototyping*.

3.2.5 Reflection

Finally, in the context of reflection microlearning offers numerous possibilities of supporting this process:

- Reflection is always based on the knowledge, documents, etc. having been created in the course of the learning-/knowledge construction process. In an integrated microlearning framework this knowledge can be brought into the reflection process easily, because it has been created in continuous cooperation with that system and because the knowledge is available in a mobile manner.
- Due to its mobile and collaborative character microlearning supports a *collective* dimension of reflection both in a f2f and a virtual setting (compare also Peschl 2006).
- Due to their ubiquitous character microlearning strategies are capable of developing a habitus of *"reflection-presence"*: i.e., the ability to continuously stay in a mode of reflection accompanying the actual process of knowledge creation. Microlearning strategies do not only play the role of "reminders" (i.e. reminding the user of his/her commitment to reflection), but also actively support the process of reflection, for instance, in the form of offering a leaning journal (which can be shared with others), of questioning diverse knowledge activities ("micro-steps of reflection"), etc.

3.3 Concluding Remarks

In this paper a vision has been developed in which microlearning is embedded not only in a knowledge ontology, but also in a whole process/cycle of *knowledge creation*: i.e., by starting from observations, via constructing relationships, rules, etc. and meaning, to developing the potential and creating new realities as well as reflecting the whole process we have gone through a whole cycle of knowledge creation. It has turned out that microlearning strategies are particularly interesting and beneficial for almost every stage in that process.

As has been shown in this paper each type/level of knowledge and knowing is related to a particular cognitive and or technology supported process of knowledge construction. Taking these tasks together and integrating them in a unified framework these processes form a cycle of knowledge creation. It has been shown that the microlearning paradigm provides a framework in which these modes of knowing can be integrated. The main (epistemological and technological) challenges for such a framework have been outlined in detail in this paper – some of them remain to be proven in concrete applications.

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Adapting to Changing Landscapes in Education
(On Microlearning)

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Abstract: While we are currently witnessing the renaissance of Tim Berners-Lee's original vision for a Two-Way-Web, many institutions in higher education still develop and maintain landscapes of tools and services that largely ignore the ongoing power-shift towards the individual. This paper argues that these institutional landscapes need to be reorganised and changed into *augmented landscapes,* in which the application of individually selected and maintained, multi-purpose tools and services becomes possible. Some implications for individuals and institutions in higher education are discussed.

1. Technology enhanced teaching and learning and the renaissance of the Two-Way Web

Since the late 1990's personal authoring and publishing systems that radically simplify content publication and processing on the Web have grown exponentially in popularity and distribution. Especially the wide distribution of authoring systems for Weblogs and Wikis has triggered the emergence of a whole ecology of tools and services sometimes labelled "social software".

This development could be interpreted as the expression of a counter-movement to the early years of the World Wide Web, in which content creation and publication increasingly required very differentiated knowledge and skills. It seems like we are currently witnessing the renaissance of Tim Berners-Lee's (2000) original vision for a Two-Way-Web that not only provides sophisticated means for information retrieval but also enables people hold very little technical knowledge to tap into the World Wide Web as a productive environment for publication, social networking, and collaboration.

Many lightweight, cost-efficient systems and tools have emerged in the personal Web publishing realm, including varied content management systems, content syndication and aggregation services, and a range of tracking and mapping tools of hyperlink economies and social networks (Paquet, 2003). These tools offer powerful means for the support of collaborative and individual learning activities that adhere to the patterns of contemporary information-intensive work outside of formal educational settings (see for example, Kelly, 1994), such as the formation of conversational networks (Fiedler, 2003).

This approach stands in contrast to technologically enhanced teaching and learning, which is still largely based on a „gift-wrapping approach" (Fischer & Sharff, 1998). In many cases in formal education, new media and computational tools are simply wrapped around existing educational philosophies and methodologies that treat poeple mainly as consumers, while the design and production of instructional materials and interventions is mostly reserved for professional educational authorities.

However, the traditional approach of curricular planning and micro-management of instructional materials, environments, and interventions for rather homogeneous target groups increasingly reaches its limits (Gordon & Zemke, 2000; Gustafson & Branch, 1997). The sustainability of traditional models becomes more and more questionable in the light of widespread access to information, artefacts, and patterns of meanings in almost any field. These models cannot adequately address the increasing individualization, limited predictability, and enormous situation- and context-dependency of learning needs as they occur in work processes that are largely focusing on the production of new artefacts. Outside of formal educational contexts, situational demands in many areas of work do not allow people to wait for the provision of instructional materials and interventions by professional trainers and educational authorities – instead they need to negotiate and support their own learning through non-designed instruction (Resnick, 1987). It appears that many people will have to execute instructional activities and tasks (e.g. needs analysis, selection of adequate resources, determination of criteria for success and quality, etc.), which under conventional conditions were provided by the pedagogical establishment (Candy, 1991).

This requires also a more individual and emancipated approach to the integration of ICTs into one's own workflows. Currently institutions in higher education do not support this systematically. The landscapes of tools and services that they tend to provide, or rather prescribe, are often set up as rather closed systems that reduce most people to consumers of a fixed set of selected, pre-designed functionalities.

2. Institutional Landscapes of tools and services

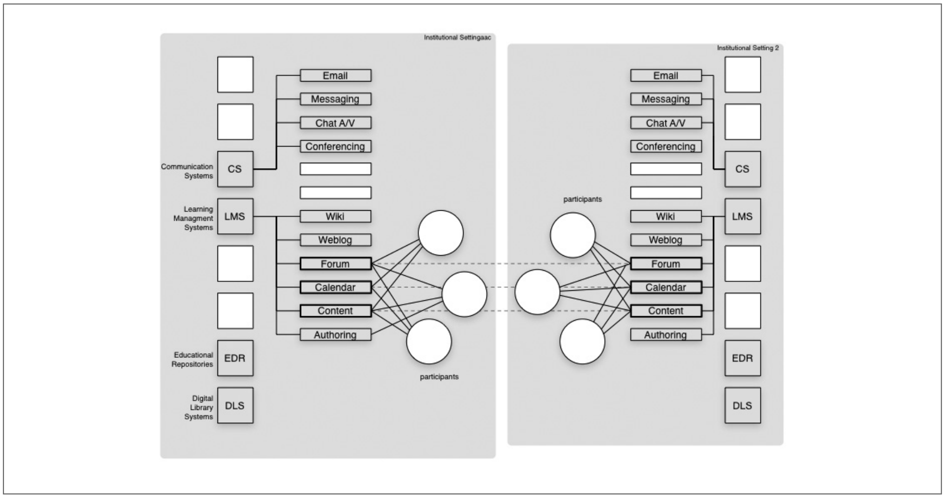

Figure1: Institutional Landscape

Figure 1 depicts the mainstream scheme where institutionally hosted and maintained Communication Systems, Learning Management Systems (LMSs), Educational (Learning Object) Repositories, Digital Library Systems, and so forth, are considered to constitute a comprehensive landscape of tools and services for the technological support of teaching and studying activities. Many institutions in higher education seem to strive for such an extensive in-house offer, though only a few organizations have been able to ensure an entirely homogenous landscape. Thus, it is quite common that various Learning Management Systems are in use even within a single institution. The same variability holds true, of course, if one compares different institutions.

This situation creates numerous challenges for all kinds of collaborative activities amongst users of different systems. Some systems might interoperate to a certain degree, but in general educators and students face considerable problems when they need or want to collaborate in a setting that transcends these institutional landscapes.

From an observer's perspective, all actors appear as „residents" who perform all necessary activities within the institutionally hosted landscape of technical tools and services. This, of course, is hardly ever an adequate description of all actors, since individuals choose to use all kinds of communication systems that are not provided and hosted by the educational institution, such as e-mail or instant messaging. However, many institutional policies are still based on the illusion that all relevant technical support and mediation happens (and should happen) within the institutional boundaries. In addition, very often security aspects are mentioned as one of the main arguments against any liberalisation and opening of the institutional landscape.

3. Individual landscapes of tools and services

In parallel to this trend of building comprehensive institutional landscapes of tools and services, recent years have seen the emergence of an "avant-garde" of people who have started to create and enhance their own personal learning environments through a portfolio of selected software tools and services (see figure 2).

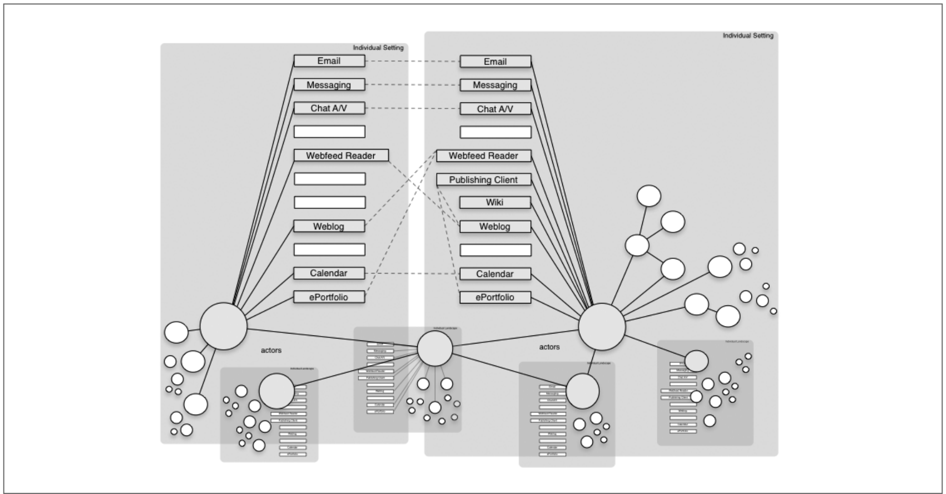

Figure 2: Individual Landscape

Individuals in figure 2 have the means and capabilities to construct and maintain their personal landscape. For example, they make intensive use of various kinds of networked tools and services to establish new relationships with others and to construct extended social networks to support their own educational projects (Efimova & Fiedler, 2004). They largely take responsibility for all necessary instructional functions, such as selecting and acquiring material resources, pacing and monitoring themselves, establishing criteria of evaluation, generating feedback, and so forth.

These people might maintain only loose connections with formal education. In some cases, their only point of connection with a formal educational institution might be an attempt to receive official accreditation for skills and knowledge they have acquired elsewhere.

From an observer's point of view these people could be described as „nomads" who wander around only following their individual interests and needs. They might periodically join projects, groups and alliances but essentially they operate mostly from a psychological perspective of autodidaxy (Candy, 1991).

4. Augmented landscapes of tools and services

At this point in time, adults who support their personal learning and change projects with their own landscapes of networked tools and services, clearly form a minority. In addition, very few formal educational institutions are ready for the accreditation of skills, knowledge, or even competencies (see Erpenbeck & Heyse, 1999) that someone acquired in informal contexts and through autodidactic activities.

Nevertheless, we believe that formal educational institutions will increasingly face people who choose to support their learning and change projects with small, loosely-coupled, personal tools and services that are networked and either live on their individual hardware or simply somewhere outside of the institutional landscapes. These people will be reluctant to change their personal workflows and preferred tools to adapt to institutionally hosted systems that essentially offer the same or very similar functionalities.

The current discussions in Europe regarding the mobility of adult learners and the related EQF (European Qualification Framework) provide further argument for this development. The EQF is focusing on learning outcomes. Adults will be able to obtain a certificate from any qualified authority by providing evidence of their competencies. It does not matter where or how the individual acquired them. These political and strategic efforts might also support a more individualistic approach in terms of technology support.

We thus maintain that institutions should start to support the emergence of *augmented landscapes,* in which individual tools and services can inter-operate on various levels with tools and services that are provided by the educational institution.

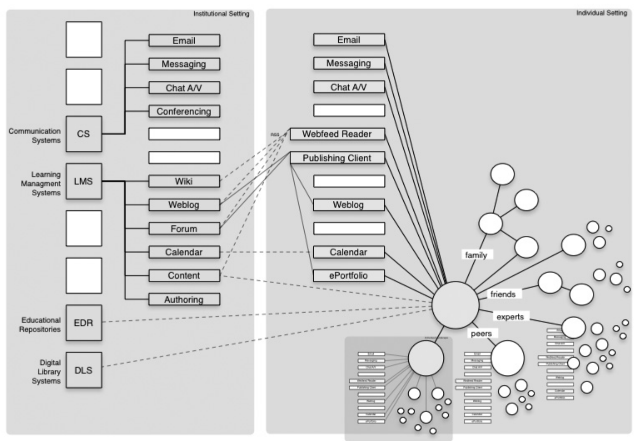

Figure 3: Augmented Landscape

While the institution would still provide some core tools and services, individual actors could then also choose from a growing variety of options of free or low-cost tools and services. Depending on their preferences, technological means, and capabilities, individuals could still decide to use specific subsets of tools and services from an institutionally provided palette, but they would be free to gradually transcend the institutional landscapes according to their needs.

From an observer's point of view these actors appear in relation to institutional landscapes either as „emigrants or immigrants" who leave or join the technological infrastructure for particular purposes. In some cases they might start within the institutional landscape where they first make us of some centrally provided tools and services, before they choose to set up and integrate a more individual landscape. Others already bring along an elaborate individual landscape of tools and services and only choose to partially make use of the institutional offers.

A practical example of such an approach can be found in the Weblog authoring realm. While it is possible to author most Weblogs via Web-interfaces and a general purpose Web browser, there is a number of specialized, desktop-based Editing clients available (Ecto, Qumana, MarsEdit, etc.) that can "talk to" numerous publishing systems via a small set of APIs that handle the necessary client-server exchange. This allows authors to customize their workflow, write and edit contributions offline, and manage the access to numerous publishing outlets. Together with Webfeed reading clients these editors form a powerful content creation and publishing workbench that exists independently of all the actual content management and publishing systems one might want to connect to.

In figure 3 we try to visualize what this could mean in a formal educational context. A facilitator could choose to support a given teaching and learning project with an institutionally hosted Learning Management System that offers, for example, the use of a Weblog, Discussion Forum, Wiki, Calendar, and Content authoring and management features. On the other side, individuals who maintain their own landscape of tools and services could simply use a Webfeed reading client to aggregate and monitor the different flows that are produced within the LMS, and an individual publishing client that could talk to all these different publishing spaces and formats (Weblog, Wiki, Forum, and so forth).

5. Implications for individual actors and institutions in higher education

Such an approach has various implications. First, responsibilities are distributed differently. All participants need to take responsibility for the selection, configuration and maintenance of personal tools and services. This includes facilitators and students. In fact, the boundaries between facilitators and students get mostly blurred, since all participants have access to the same, or very similar, set of individual tools and services. Hierarchies as the ones maintained by the classical LMSs vanish. The institution might offer a core set of tools and services but it would not try to determine entirely what people could choose. It would also ensure that everything that is offered complies to open standards and can interoperate with a whole range of tools and services that live outside of the institutional boundaries.

In addition, all actors need to build up a set of individual workflows that allow for mediated, conversational exchanges (Harri-Augstein & Thomas, 1991) around digital artefacts with peers and facilitators. These workflows should serve a whole range of purposes that are ideally not limited to the formal educational context. Again, using general aggregating and publishing tools and services make a good example for what we have in mind here.

This, of course, requires not only the development of particular skills and knowledge but also a set of values and attitudes that allow for the successful participation in more open and unstructured environments (Heyse et al., 2002) We are not arguing here that students should be left alone with this developmental challenge. Instead, we suggest that formal educational institutions would be well advised to actively challenge and support students' acquisition of necessary means. Some institutions have started to define and teach pre-requisite skills and knowledge regarding the use of ICTs and digital media in higher education. However, the skills and knowledge that are needed to operate successfully in an institutional landscape of centrally hosted tools and services, differ considerably from what is takes to set up and maintain an individual landscape.

Here we have to take some normative decisions. Do we expect adult students merely to adapt to centrally hosted and controlled landscapes of tools and services? Or do we rather maintain a perspective of (technological) emancipation, which suggests that adults should also control, at least partially, the tools and services that they integrate into their personal workflows?
In an era in which many individuals are regularly forced into self-organizing activities of various kinds, it is not really hard to find good reasons for trying to establish a certain level of self-control over networked ICTs and accompanying workflows amongst adult students. In many cases organisational affiliations do not last long enough to justify the adaptation and change of personal workflows to proprietary institutional solutions.

Instead, higher education should support and reflect such emancipating perspective through an adequate re-structuring of their landscapes of tools and services. Of course, such a move inevitably carries along a declining controllability of what people "actually" do and what tools and services they use to accomplish their personal goals. Needless to say that this runs counter to many institutional policies that are currently trying to re-engineer higher education from a business or industrial production perspective.

Nevertheless, we want to suggest that an augmented landscape approach as we have sketched it above, also offers a whole variety of educational opportunities. From a learning environment design perspective, new formats of exchange, collaboration and engagement become possible. The ongoing development of micro-formats (ref.??) and affordable, networked tools and services that inter-operate indicate a power-shift towards the individual. This has already become visible in certain parts of society and for certain working environments in creative industries, journalism, small-scale consulting, and so forth. An augmented landscape approach would offer the opportunity to set up environments that largely simulate how ICTs are already used within authentic work settings.

From a perspective of competence advancement such an approach allows for the construction of all kinds of challenging situations where individuals have to execute tasks and solve problems beyond the mere domain-specific teaching and studying. For example, self-directing, collaborating, and social-networking activities can be treated as discrete areas of challenge in contexts where mediated communication and expression are necessary and wanted. Augmented landscapes would put an emphasis on the individual's mastering of tools and services. The individual's social networking activities, for example, might be supported in a way that is not only of limited use within the immediate formal educational context but that holds the potential to be a viable solution for a range of purposes in various contexts.

In the research project *iCamp*, which is funded by the European Union under the 6th Framework Programme, we are currently addressing some of these challenges with a group of researchers across Europe. By providing individuals and institutions with a set of interoperable tools and services – the iCamp building blocks – we want to support the creation of augmented landscapes. This work in progress has already revealed some of the difficulties described above.

6. Conclusion

Though many institutions in higher education still focus on the development of rather closed and comprehensive institutional landscapes of tools and services, it sonly seems to be a matter of time before students and educators will begin to challenge this approach to technological enhanced teaching and learning on a more regular basis. The centralised, controlled manner in which many institutions try to organise and prescribe the technological infrastructure for both students and educators in formal educational programs, does not reflect the various developments that are driving the ongoing renaissance of the Two-Way Web and the necessary technological emancipation of individuals.

We believe that these institutional landscapes of tools and services in higher education need to be restructured to allow for interoperability with general purpose tools and services that can be selected, combined and adapted by individuals according to their needs and purposes. The ongoing development in the personal publishing and social software realm of various kinds of micro-formats, APIs, and desktop clients for aggregating, authoring, and publishing, point into a promising direction. The educational design and technology community would be well advised to pay attention to these trends and to begin with the re-organisation and opening of the current set of tools and services to more individualised and emancipated approaches to technology enhanced teaching and learning.

We also tried to touch upon the fact that these issues are loaded with philosophical and political questions that can only be resolved by taking some normative decisions. In higher education we see no need to reduce adults to mere consumers of centrally controlled and prescribed tools and services. In the realm of personal publishing and social software people are very well able use effectively networked tools and services that are only loosely-coupled and that partially “live” on their personal hardware and partially on a multitude of servers.

As soon as we move into the realm of higher education and the technological support of teaching and learning, the very same people are suddenly not considered to be able to execute a similar level of personal responsibility and agency any more. We think that this view is severely limiting and produces a sort of self-fulfilling prophecy for what is possible in terms of individual technological emancipation in higher education. The development towards augmented landscapes, as we sketched them out above, is in large parts already feasible and would offer various educational opportunities. We consider such a re-organisation to be an appropriate, transitional step. In our view, there are many good reasons why higher education should try hard to enable all its participants to manage individual landscapes of tools and services to enhance their own learning and change projects within and beyond formal educational contexts and institutional boundaries.

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The Learning Game: A New Approach to eLearning and Knowledge Computing*
(On Microlearning)

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"I never let school interfere with my education"
Mark Twain

Abstract: Interactive computer games are beginning to enter the educational and instructional fields under the flag of a more 'playful' approach to learning. But on a much deeper level, games herald a new computer age that is based on simulation and generative, dynamic data instead of the current approach of representation and static data. The paper traces the current computing approach to a platonic understanding of objects and proposes a new relationist approach that replaces data altogether and opens a true 'post-Gutenberg' era based on simulation. The computer, currently a static learning 'assistant' at most, could become a co-learner and dialog partner.

1. What is 'Learning'?

Learning is not just what we do in school or in institutionalized 'learning environments'. Learning is something we do all the time, in fact, we cannot but learn. Learning is the description of an observer who describes an internal process whereby our body seems to 'adjust' ('adapt') to its environment by internally constructing concepts of this environment (and of the body itself). These concepts basically enable to make distinctions between 'us' and 'them', between the learning system and its environment, as well as

* The contribution of Peter Krieg is referring to the pre-conference workshop day of the European Academy of Microlearning.

between other 'systems' and 'objects' within this environment. Fundamentally, this is what living systems do all the time in interaction with their environment.[1]

Learning has nothing to do with 'representing' the environment inside the body (the brain) like a camera or a tape recorder is supposed to do. The nervous system is not a storage device of data about the environment. The theories of representation (concepts people developed over a long period of time about themselves), where a 'correct' or 'true' representation can be checked against 'reality' suffer from the problem of who is supposed to do the checking and based on what? Since the brain only has access to states of relations and correlations between brain cells and encoded electric signals, it has no way to interpret any representation as, i.e. an 'image'. So it would require a second brain and then a third and so on …[2]

So learning can be explained as a completely internal trial and error process where successful (viable) interaction with the environment is the only criterion of 'truth'.
Among humans, there is yet another and very unique aspect to learning: Language. With the help of language (as an activity) we can induce states in our own minds that simulate whatever the 'reality' that we talk about. We can develop descriptions as linguistic concepts of the world which serve as abstractions not so much of what the world is like, but what our body has constructed to be the world. We now can interact with these abstractions, because they induce the same or similar states as the described interaction would.

In this way, we build a reality in language that we can talk about. Since we are part of this reality, we can now even speak about ourselves. This is called self-consciousness. So learning for human beings has two aspects: building behavioural concepts of the world (we usually refer to this kind of learning as *training* in a physical sense, e.g. in sports, and the teachers helping us to achieve it are referred to as 'trainers' or 'coaches') and building linguistic concepts of the world (which is mostly taught in educational institutions by 'teachers', 'tutors' and 'professors').

1 For a more detailed discussion of learning see Maturana H. R. and Varela F. J. , The Tree of Knowledge: The Biological Roots of Human Understanding, Boston: Shambhala, 1987.

2 For a discussion of the „second brain problem" see v. Foerster, H., On Constructing a Reality, in Observing Systems, Intersystems Publications1984.

But in essence (in terms of nervous activity), the two are identical: both are based on interaction with the environment. Speaking, listening or reading are activities like any other, the only difference is that we are using a tool (language) as a medium to simulate other activities. They could be called 'second order activities' …

2. Objects and Relations

Considering the 'outside world' as an abstraction of internal states and relations of the nervous system, (=a 'construction') does not necessarily require to deny the very existence of such a world. In fact, doing so requires the assumption of its existence, because otherwise no such abstraction could be made or communicated. It does, however, deny any direct access of the living system to that world. The look and feel of this world is the look and feels that the specific organs of our body are able to construct. We have only access to our own body, so the world is structure dependent on our bodies. What we perceive as 'objects' in the world are in fact relations and correlations within our nervous system that suggest to distinct one entity from others.

In the view of the philosophical school of Plato, objects are static givens and are represented in our minds as such. The primary purpose of learning and of science is to categorize and order these objects in 'ontologies' and describe their relationships.

In the Heraclitean view, which is widely shared by Eastern philosophies (e.g. Buddhism), the world is in flux, i.e. it is our minds who create 'objects', objects do not exist independently. The world according to Buddhism consequently is an 'illusion' of the mind …

The 'relationist' approach basically describes the world as relations and generates objects in a ontogenetic way. In terms of logic, ontologies represent axioms (roots, theories, prior assumptions, reference systems etc.) from which logic deductions can be made. Ontogeny is a non-logical (or polylogic) process where axioms, ontologies, theories and assumptions are reached 'bottom up' by means of inductive, intuitive or associative reasoning. Logic and Ontology are static order systems based on hierarchy. Ontogeny and polylogic are dynamic order systems based on heterarchy. They are not a-logic or against logic: in fact, logic as a system of deductive reasoning and inference is of major importance here also. The main problem of static logic is that it only allows to relate whatever belongs to a defined logic domain ('a logic'), excluding everything else. Polylogic is able to connect within AND outside a logic domain, thus providing a 'holistic' or synaptic structure where everything is interconnected while still allowing hierarchical orders. [3] Mathematically, this is usually achieved by complex networks.

3. Complexity and Interaction

Dynamic orders are complex, static (hierarchical) orders are complicated. The difference between complex and complicated is important: a complex order can only be described by two or more reference systems (logics) simultaneously. Complicated systems can be described with just one reference system, i.e. within one single logic domain. All machines (including computers) are constructed as complicated systems (mechanisms), where a defined state defines other states in a sequential linear order. Mechanisms follow strict classical logic (including variations like fuzzy or multi-valued logic). Their 'interaction' with the environment (if so constructed) enables only defined actions (output) based on defined external inputs. They thus can also be described as input-output systems that process a given input into an internally defined output.

Complex systems are not input-output systems. They interact with the environment without inputs by rearranging their internal structure in order to maintain an internally defined homeostasis (balance). Their observable 'behaviour' cannot really be called 'output' because it is not determined by input, but rather by internal structural and organizational requirements. Complex systems react to external 'perturbations' and by doing so in higher degrees of complexity can even develop expectations and anticipations of future states, which we then may call 'learning'. These anticipations are history and structure dependent, i.e. the system assumes that events in the past may happen again (in similar situations) and learns to adjust its internal states to whatever proved successful in the past. Interaction is the key to this process.

3 The concept of Polylogic is extensively discussed in the works of Gotthard Guenther. See http://www.vordenker.de

4 A short summary of Piaget's concept of adaptation and assimilation is available from Ernst von Glaserfeld: http://www.oikos.org/Piagethom.htm

4. Assimilation

The process of ‚incorporating' the world as a construction through interaction has been described by Jean Piaget as ‚assimilation'[4]. Learning according to this theory is a triadic process of assimilation (integration of differences), accommodation (integration of new differences in earlier concepts or 'schemas') and equilibration (balancing earlier and new concepts in order to gain new operational options).

Assimilation thus is not ‚input' of information, data or content in the sense of representations, but rather the registration of differences. Learning has nothing to do with the popular notion of "transmission" of information or knowledge. Quite the opposite: Knowledge and information principally cannot be transmitted, but emerge ontogenetically in the 'learner' by incorporating differences into his existing concepts. The newly developing relational structure must be stabilized through ‚training' until it can be generated at will together with the related behaviour (including effective and linguistic operations). This describes the learning process.

Training is always interactive: in play, exercise, repetitive speech etc. It becomes stabilized and located in the existing relational schemas by associative connections. Memory therefore is not a repository of information or representations, but rather the capability to generate certain relational patterns through associations with others. The idea of the brain as a container or 'hard disk drive' for orderly storage of data is a illegitimate projection of complicated technical system onto a complex biological one. Such projections are understandable on one side, because we can only understand what we can technically implement, but misleading on the other, because our technical expertise is (still) restricted to complicated mechanical systems. We still cannot technically model complex biological systems.[5]

5 On the problems of modeling biological and other complex systems see the work of Robert Rosen: http://www.rosen-enterprises.com/

5. The Gutenberg era and beyond

Most if not all current technical systems for the storage, reproduction and management of text, images and other descriptive forms (including sound recordings) are based on ontological and representational principles. They implement a platonic world view: they order representations in hierarchic order systems (like books, shelves, libraries, folders, files etc.)

The new computer based electronic order and management systems also follow these principles. It is therefore premature to speak about a post-Gutenberg era. Even the internet is nothing more today than a poorly interconnected collection of 'books' (=Websites) with hierarchically ordered contents. Even the non-hierarchical order of the books placement (the URLs) has already been introduced in libraries since the 18th century. New are only the digital representation, recording and networking technologies and the hereby achieved global access over communication networks.
The real break with the hierarchical Gutenberg principle begins with interactive simulation, such as already realized in a narrowly restricted area of computer- and videogames. Here, at least in the domain of animated computer images, no data are stored any more. Data are interactively generated from relations. Computer games display a kind of movie as user data. But unlike classical film (as DVD or analog medium) no frames as static and unchangeable images are stored and retrieved, but are dynamically generated. The individual image is not fixed, but is determined by the interaction of the player.

The difference to the traditional approach is qualitative, for here no data in the classical sense are processed any more, but data are interactively constructed and dynamically generated. The space of interactivity thus not a data space any more, but a relation space. A data space would just not be able to record and retrieve the huge amount of possible images. A generative method thus is the very precondition for interactive games.
Extending this principle to all data and data types would allow all possible applications to be interactive and eventually adaptive. Only such an adaptive and interactive computer can replace (and at the same time integrate) the Gutenberg era.[6]

6 For a detailed discussion of a purely relationist approach to data and computing see Krieg, P., Die paranoide Maschine, Heise Verlag 2005 and www.pilesys.com

6. The Game Approach

Computer games represent a much deeper innovation than even the gamer community and game industry possibly recognize:

- games provide a new interactive man-machine interface with promises for high degrees of individual personalization, flexibility and adaptivity;
- games are based on fluid and dynamic simulation and navigation, not on static and hierarchic data structures. This puts them in a new machine category much closer to the human users;
- game image data are "virtual data", i.e. data are dynamically *generated from code,* not physically stored and retrieved as static data frames. This represents an entirely new data paradigm;
- The computing space of game engines primarily is a relation space, not a data space (although traditional data are still employed also). This points towards a new *relationist* paradigm;
- In contrast to the traditional closed Turing machine concept of computing, the game concept is interactive and open to input during operation. This is just a step away from a revolutionary extension of the Turing machine concept.

Taken together, these changes anticipate a very different computer technology and computer usage in the future. There has been just one missing link: Virtualization of data so far has been largely restricted to pre-constructed image models and animations (as well as similarly constructed audio models). Arbitrary ad-hoc inputs (like text, live video and sound etc.) still have to be represented in containerized bit-sequences. This has resulted in two classes of 'citizenship' in traditional computing: code ('bits that *do* something') and data ('bits that *mean* something'). Only code can be seen as active and dynamic first class citizens, while data lead a static and containerized second class existence in current computing, causing such unresolved problems like data flood and complexity explosion. Like any class society this one also highly restricts its own growth and further evolution: Freeing data from their passive existence in data silos therefore has become a major target in computer science.[7]

7 See Ralf Westphal, Freeing Data From the Silos:
http://www.pilesys.com/new/Documents/Freeingdatafromthesilos-Pileexplained.pdf

Due to a new technology now becoming available[8] which allows to turn arbitrary input into 'pure relations', the entire range of computer applications is at the verge of becoming part of the game world. The reason is quite simple: in analogy to the brain, this new approach is not representing data in containers and silos any longer, but *assimilates* changes into a fully integrated relation space. A relation space is a connection space which only contains connections (think of a "connection machine" made of software). Anything that the machine has assimilated into such a space, it can faithfully reproduce, without having to hold it as data. A relation space also needs no index, because its connections are unique and can be reused for any recurrent piece of information. And the relation space itself is virtual, i.e. it is a logic space generated in run-time (like a computer game) and thus not restricted by physical data.

To illustrate this effect, let us imagine playing "Doom" by using "PowerPoint": instead of generating the images of the game, any possible image would have to be stored as a slide (or frame) like in a digital movie. The number of images that can be generated in a computer game is practically unlimited, however. To store each and every one of them would require a considerable chunk of our universe as storage device (while first rendering all of them would probably require the rest as computation device…). And that just for *one* game! So it is evident that only a generative approach makes gaming as we know it today possible at all.

The consequences of applying this approach to computing in general are dramatic:

- Computers would become simulation machines for just about everything: not only games, but also data driven simulations of our bodies, of complex systems in society and nature etc. Although we already can build simple models of such systems and use giant supercomputers to simulate them, these 'simulated simulations' suffer from the fact that they cannot interactively change their models and output as new data came flowing in. Unlike a game computer, where the inputs of the gamer instantly change the animated output, these simulations are not really data-driven.
- Being able to change an internal model based on external input is the basic requirement for a learning system: computers that can do such will, for the first time, become true learning machines (not like AI which is using closed internal models only)

8 See http://www.pilesys.com

- Learning is also adapting: These new interactive machines will be able to adapt to their environment including their individual user and are no longer restricted to one 'standard user'.

For the game industry this means the opening of a new field much larger than gaming. The field of data simulation is even much bigger than computing today, because it enables new applications that are still inaccessible to computers due to exploding complexity and data!

With today's games, we can take a first but tiny glimpse into the future universe of simulation computing, but we have not even begun to explore the possibilities beyond gaming. Emerging "Serious Games" or simulation based teaching and educational tools are still restricted by the "dead data paradigm", but their potential is already visible.

What also should be obvious is the fact that gamers represent a new generation of computer users whose interactions with games shape their expectations for human-machine interaction in general. This generation will not be content with static tables, hierarchic data systems or non-adaptive interfaces with their metaphors of bureaucracy. They expect fluid navigation, instant interaction, flexible structures and adaptive automation – and soon…

7. The Future of Computer Learning

Learning can be, as was done here, described as a process of adaptively constructing an environment by interactive simulation. To reproduce this process in computers, we were until now largely restricted to mathematical models, integrating few and selected data (environmental signals). During simulation, the computer had to be closed off from the environment, so new signals could not influence or even change the model. This constitutes a mechanical process, unable for adaptation or learning.
Of course such a machine still can be helpful to a learner. But it would be much more helpful, if the computer could learn also. This would allow learning in dialog, where the communicated arguments lead to learning effects on both sides. Learning computers must be able to adapt to unknown environments (e.g. a complex individual user). For this, they must be highly interactive and able to break the logic closure of their respec-

tive programs. This requires to overcome the current concept of data as redundant representations and instead to operate in a globally connected relation space. Such a computer learns in the interaction a user's preferences, needs, weaknesses and personal idiosyncrasies and can use this knowledge by properly adapted behavior.

In reverse, a human user can operate his machine in an increasingly intuitive manner, can conduct increasingly effective dialogs and get more and more fitting answers. Learning for him will not any longer be a one-sided process of exercising against a static system, but an interactive dialog with a dynamic and challenging learning partner …[9]

9 This short paper was accompanied by a powerpoint presentation, available directly from the author. Contact: kriegpeter@pilesys.com

Where do we go now?
(On Microlearning)

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Abstract: Traditional pedagogies, frameworks and roles do not seem to be working efficiently anymore in the new, connected and mediatized world with the ever-changing needs of the workplaces and the learners. This experimental paper tries to explore a path of possible directions regarding our changing pedagogy and tools while offering some best practice cases. "Path" is meant quite literally: The printed text is designed as an 'interactive' guide to online resources and online experiences. Such, the text is not in the first place describing "eLearning 2.0" from a theoretical distance, but actually provoking the reader to make the experience herself/himself.

1. Personal Introduction

About the author

Hello, it's nice to have you as a reader. Please forgive me for providing some personal introduction, but I personally get annoyed when someone tries to share knowledge, tell me a story or sell a worldview out of the blue behind the curtain of professionalism, business or academia.

My name is Daniel Molnar. I spend most of my day working at a Hungarian eLearning service company called Coedu[1]. My title at my daily job is business unit director. But you can find out a lot about me if you google soobrosa[2]. You can find me as an editor[3], a gastronomer[4], a photographer[5], an ARG player[6], a bootlegger[7], a Wikipedian[8], a

1 http://coedu.hu/(accessed May, 2006)
2 http://www.google.co.hu/search?q=soobrosa (accessed May, 2006)
3 http://newfocus.hu (accessed May, 2006)
4 http://szindbadek.hu (accessed May, 2006)
5 http://www.flickr.com/photos/b2men/ (accessed May, 2006)
6 http://perplexcity.com/profile/view.qbuild?player=soobrosa (accessed May, 2006)
7 http://www.gybo-v3.co.uk/profile.php?mode=viewprofile&u=1461&sid=62e905292f760fea9312d0e1db7c1a1b (accessed May, 2006)
8 http://en.wikipedia.org/wiki/User:Soobrosa (accessed May, 2006)

music listener[9], a music advisor[10], a music selector[11] and an eLearning professional[12]. I'm active in different social networks as an English speaking music fan[13] at myspace, a Hungarian speaking learning specialist[14] at Aktivtabla and an English speaking eLearning specialist[15] at the Minerva Virtual Community.

Orientation

Why do I enlist so many things, roles and functions of mine?

First, I think our life is more and more defined by these different, intertwining roles and our learning needs are more and more met through these communities of practice we are involved in. All these things are ubiquitously connected and pervasively proximate.

Second, I would like you to have a subjective impression of me, the writer, because I will take you to a trip that is not about me, but much about how can we, you and me, converse about some topics I think you will be interested in - although we engage in this communication asynchronously, impersonally and in a mediated fashion.

This is a journey with road signs, different paths and dead ends and I see my role mostly as a tour guide. I don't think that I have too much original thought, although I try to add some layers of thought based on my personal experience. There will be no scored evaluation, but please take some time for personal reflection. Yes, I've read all the referenced materials and I've included them because I think they contain interesting and useful insights. Most of the time I try to avoid re-summarizing the referenced pieces and most of the activities I've included consist of some reading on your own and reflection on the material read. You should answer the questions for your own purposes. Whenever it's possible I try to include different media options, but it's fairly likely that you'll get along nicely with an up-to-date Flash plug-in.

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9 http://www.last.fm/user/soobrosa/ (accessed May, 2006)
10 http://mangare.newfocus.hu/ (accessed May, 2006)
11 http://getupat9.tyrell.hu/mixes/index.html (accessed May, 2006)
12 http://soobrosa.wordpress.com/ (accessed May, 2006)
13 http://www.myspace.com/soobrosa (accessed May, 2006)
14 http://aktivtabla.hu/index.php/User:Dmolnar (accessed May, 2006)
15 http://minerva.euproject.net/go.cfm?UserID=19055(accessed May, 2006)

ACTIVITY PIA

PREPARATION

Get the latest Flash player[16]

Feel free to write me if you have any questions and you think that I'm more able to answer them than yourself armed with Google. :)

Ladies and gentlemen, this is my umbrella, whenever I keep it above my head for a while, I would be appreciating it if you got back to me and then we can proceed on our walk.

ACTIVITY PIB

SEARCH

What does ubiquitously connected and pervasively proximate mean?

Google on ubiquitously connected and pervasively proximate[17]

REFLECT

What does ubiquitously connected and pervasively proximate mean to you? Remind yourself of something you did or which happened to you and is related to UCaPP!

ACTIVITY PIC

WATCH

Watch Dick Hardt, founder and CEO of Sxip Identity talking about Identity 2.0[18]

(HTML -> Flash, Windows Media, Quicktime)

REFLECT

How could you use his communication style in a learning process?

16 http://www.adobe.com/shockwave/download/download.cgi?P1_Prod_Version=ShockwaveFlash (accessed May, 2006)

17 http://www.google.co.hu/search?q=ubiquitously+connected+and+pervasively+proximate (accessed May, 2006)

18 http://www.identity20.com/media/OSCON2005/ (accessed May, 2006)

2. Behaviourism? Constructivism?

2.1 The Context

Information anxiety

How do I feel harvesting dozens of RSS feeds, checking up websites, interesting projects, technical specifications, specialist forums? Stephen Downes hit the nerve with his presentation entitled *Riding the Wave – Personal Professional Development in an Age of Chaos.*

Stephen Downes is a designer and theorist in the fields of online learning and new media living and working in Canada. Currently he is working as a senior researcher at the National Research Council of Canada in the Institute for Information Technology's eLearning Research Group. Stephen has become a leading voice in the areas of learning objects and metadata as well as the emerging fields of weblogs in education and content syndication.[19]

ACTIVITY TCA

WATCH

Watch the presentation entitled *Riding the Wave – Personal Professional Development in an Age of Chaos*[20] (web-based presentation)

REFLECT

Do you experience similar things?

Changing literacy

Before talking about the changing pedagogy I would call in Mark Federman to share his thoughts on our changing literacy and his views of the ubiquitously connected and pervasively proximate reality.

19 http://en.wikipedia.org/wiki/Stephen_Downes (accessed May, 2006)
20 http://www.downes.ca/files/s5/804.htm (accessed May, 2006)

Mark Federman played the role of Chief Strategist and head of McLuhan Management Studies at the McLuhan Program in Culture and Technology at the University of Toronto, as well as Principal of Merrill Consulting, his private consulting office. Mark is dedicating much of his time to his current research, namely, developing an emergent model of the „corporation of the future" that is consistent with our present conditions of ubiquitous connectivity and pervasive proximity, or „UCaPP."[21]

The changing literacy can give us a very rough framework to understand why our pedagogical methods do not work.

ACTIVITY TCB

READ
Read the paper of Mark Federman entitled *Why Mr. And Ms. Smith Can't Teach: The challenge of multiple media literacies* (PDF)[22]

REFLECT
How do you feel about what you have read? Do you agree? What are your questions?

ACTIVITY TCC
READ
Read the paper of Mark Federman entitled *The Ephemeral Artefact —Visions of cultural experience* (PDF)[23]

REFLECT
Think about the story of a remarkable ephemeral artefact in your life!

2.2 The Problems

"Where do we go from here/ now that all of the children have grown up/ And how do we spend our lives/ knowin nobody gives us a damn." (Woolfson, 1980)

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21 http://individual.utoronto.ca/markfederman/ (accessed May, 2006)
22 http://individual.utoronto.ca/markfederman/WhyJohnnyandJaneyCantRead.pdf (accessed May, 2006)
23 http://www.utoronto.ca/mcluhan/EphemeralArtefact.pdf (accessed May, 2006)

Situation in Europe

I do know about the existence of a state-funded document on the current state of education in Hungary, but it has been made state secret and is only distributed to members of the administration. Still I believe that our position in Hungary is surely worse than the general situation Ilkka Tuomi summarizes in his background document.

Ilkka Tuomi is currently Chief Scientist at Meaning Processing Ltd. Before his current assignment, he was with the European Commission's Joint Research Centre, Institute for Prospective Technological Studies, Seville, Spain. During 1999–2001, Mr Tuomi was visiting scholar at the University of California, Berkeley, where he conducted research on the new dynamics of innovation networks, working with Professor Manuel Castells. From 1987 to 2001 he worked at Nokia Research Center, Finland, most recently as Principal Scientist, Information Society and Knowledge Management.[24]

ACTIVITY TPA

READ

Read the paper of Ilkka Tuomi entitled *The Future of Learning in the Knowledge Society: Disruptive Changes for Europe by 2020* (PDF)[25]

Tip: you can spare the methodological appendixes till the next chapter.

REFLECT

Describe a work-day at the level of education you're dealing with in 2020!

Situation in Hungary

Talking about my personal experience – we did a methodology project on digital whiteboards for the Ministry of Education in Hungary in 2006. Although I have to remark that I met some outstanding teachers during this project, the feedback and the interaction I encountered did not change my personal point of view on the state of education in Hungary. The problem starts with who applies to be a teacher and why. Most of the applicants do choose the education faculties because they are known to be easily feasible. According to a methodology expert I know – he is teaching methodology for would-

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24 http://www.meaningprocessing.com/personalPages/tuomi/it_cv.html (accessed May, 2006)

25 http://www.meaningprocessing.com/personalPages/tuomi/articles/TheFutureOfLearningInThe KnowledgeSociety.pdf (accessed May, 2006)

be mathematics teachers – , in a given 100 person class he would only let 4–5 people pass his exam – if methodology wasn't just one of the dozens of credits to be earned in the factory of a university that is considered quite good actually.

Right now all teachers are public servants with no monetary feedback on their actual performance. If I should summarize the state of the current workforce, I would call it at best a reverse Pareto, given the 20 % are sacred fools who love what they are doing and are also good at it. The biggest enemy of change is the teaching staff, the actual peer. Perhaps the Che Guevaras could be connected through communities of practice, but it's still a story of the future.

Personal experience

Our company has developed a learning management system with a built-in XML-based content builder application as well as an eLearning material development methodology and workflow. These developments went hand-in-hand with building a now 21-strong company that deals with full service eLearning development from software through content to training and system maintenance. These tools served quite well in traditional knowledge creation and transmission cases, definitely in typical objectivist pedagogical environments - assuming that the learning material is an object that could be transmitted to a learner without giving any interest to the environment, taking the learner as a „tabula rasa" before the transmission occurs.

During the last years I had to realize that most of my own knowledge creation and transmission cases took place in much less definitive circumstances, in constructivist pedagogical environments – assuming that knowledge is not transmitted as an object, but is constructed in the learner during some processes and activities related to that piece of knowledge.

I remember the day when the basics of calculus were „taught" to us at the university. I was a freshman coming from a 6-year special mathematics class in high school to become a computer scientist. We „learnt" calculus in high school for a semester discovering and developing its concepts for ourselves. And now I was sitting with 200 others in the Auditorium Maximus, hearing the basics in 90 minutes. The difference was hard to ignore: making love to someone or fast-forwarding a porn flick.

That time I didn't know about pedagogical theories and perhaps I was lucky to have masters, interesting challenges and projects, but I think these kinds of opportunities are given to anyone who is looking for them. On the other hand I really believe that our UCaPP world is amplifying these possibilities.

3. Connectivism

3.1 The Theory

"... everywhere that I go/ I got people I know." (Young, 1999)
Although I think Ultraversity[26] is not for me, I admit that I have learnt a lot during the time I've spent with them. (On what is Ultraversity and what was my interaction with them, see The Practice.)

New pedagogy

They gave me a good understanding of recent pedagogical theories, like the ones of Schön, Kolb, Dewey, Vygotsky, Lave and Wenger. Now you can have the „fast-forward" with the help of Tuomi.

ACTIVITY TTA
READ
Now read the methodological appendix of Ilkka Tuomi's paper *The Future of Learning in the Knowledge Society: Disruptive Changes for Europe by 2020* (PDF)[27]

REFLECT
Which theories do you like the most? Why?

Action research

Two important metaphors I've got to know there, one was action research, the other was communities of practice.

ACTIVITY TTB
READ
Read the definition of action research[28] and participatory action research[29] in Wikipedia!

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26 http://www.ultraversity.net (accessed May, 2006)
27 http://www.meaningprocessing.com/personalPages/tuomi/articles/TheFutureOfLearningInTheKnowledgeSociety.pdf (accessed May, 2006)
28 http://en.wikipedia.org/wiki/Action_research (accessed May, 2006)
29 http://en.wikipedia.org/wiki/Participatory_Action_Research (accessed May, 2006)

REFLECT

Remember a case in your life when you participated in something like PAR!

Learning by doing – now that sounded practical to me.
I have to mention that stories and storytelling started to feel suspicious to me. I asked myself again and again: „does it have anything to do with memory and learning?"

Bob Dick has been a shop assistant, an electrician, a draftsperson, a recruitment officer and a psychologist. His consultancy and facilitation primarily help people learn action research, qualitative evaluation, change management, and the communication and facilitation skills which are a foundation for these.

ACTIVITY TTC

READ

Read Bob Williams conversing with Bob Dick, a leading practitioner of action research: *In the Pursuit of Change and Understanding*[30]

REFLECT

You have a persona related to the education. You are a teacher, a theorist, a practitioner. Enlist three key events, three key themes that define who you are in this context! Also try to distill three lessons you would give to others coming after you!

Community of practice

I already knew that the school room is not the place where learning takes place. Is it a physical place, anyway, or something clever (erm) like cyberspace in John Perry Barlow's mind? („Cyberspace is where you are when you're talking on the telephone.")

ACTIVITY TTD

READ

Read the definition of community of practice in Wikipedia[31] and watch the presentation of Stephen Downes on *The Evolving Community of Practice* (PPT)[32]

30 http://www.qualitative-research.net/fqs-texte/3-04/04-3-34-e.htm (accessed May, 2006)
31 http://en.wikipedia.org/wiki/Community_of_Practice (accessed May, 2006)
32 http://www.icgd.usask.ca/DownesDCoP2004.ppt (accessed May, 2006)

REFLECT

What is your most important community of practice? How can an action research programme help its work?

On my own I started to read seemingly interesting eLearning blogs and on one of my favourites George published his views in a form of a presentation.

George Siemens is an instructor at Red River College (RRC) in Winnipeg, Manitoba, Canada. He is the Founder and President of Complexive Systems Inc., a learning lab focused on assisting organizations develop integrated learning structures to meet the needs of global strategy execution. He has been active in corporate and higher education for over a decade. Over the last seven years, his focus was primarily on technology and learning.[33]

ACTIVITY TTE

WATCH

Watch the presentation of George Siemens titled *Connectivism – Rethinking learning in a digital age* (Flash)[34]

REFLECT

Are you convinced that Web 2.0 can deliver a paradigm shift? What are your doubts and objections?

3.2 The Practice

Roadmap

After making friends with the concept, metaphor and framework of connectivism, let's see how we should start this whole thing out.

33 http://www.elearnspace.org/about.htm (accessed May, 2006)
34 http://www.elearnspace.org/media/connectivism_Web_2/player.html (accessed May, 2006)

ACTIVITY TPA

LISTEN

Listen to Stephen Downes giving his lecture *The Buntine Oration: Learning Networks in Australia!* (MP3)[35]

Alternatively you can read the transcript![36]

REFLECT

Do you think your own children will be free?

Tools

If a picture's worth a thousand words, how many words do make up a story? Now let's have a parade of the tools we see emerging to solve our needs. Ladies and gentlemen, will you please welcome to the arena Mister Bryan Alexander.

Bryan Alexander is the Director for Research at the National Institute for Technology and Liberal Education (NITLE). His research portfolio includes learning and gaming, mobile computing, and Web 2.0.[37]

ACTIVITY TPB

READ

Read Bryan Alexander on Web 2.0: *A New Wave of Innovation for Teaching and Learning?*[38]

REFLECT

What tools do you use of the ones mentioned in the article? For what purpose? What tools seem to be fine for your tasks? Why?

35 http://www.downes.ca/files/audio/buntine_small.mp3 (accessed May, 2006)

36 http://www.downes.ca/cgi-bin/page.cgi?db=post&q=crdate=1097292310&format=full (accessed May, 2006)

37 http://www.cet.middlebury.edu/~bryan/ (accessed May, 2006)

38 http://www.educause.edu/apps/er/erm06/erm0621.asp?bhcp=1 (accessed May, 2006)

Learner = e-portfolio

Few things we know for sure, one is that learning should be perceived learner-centered rather than related to an institution. Learning is attached to the learner, while the institution is concerned with providing the educative framework.

Now what we have as a metaphor for digitally representing a learner is the e-portfolio.

Scott Wilson is an Assistant Director of CETIS (the UK centre for educational technology interoperability standards), and has a special interest in standards for infrastructure and enterprise integration.[39]

> ACTIVITY TPC
>
> WATCH
>
> Check out Wikipedia on e-portfolio[40], then watch the presentation of Scott Wilson on E-portfolios! (PPT)[41]
>
> REFLECT
>
> Have you ever made something like a portfolio for yourself? Why?

Case a: ultraversity (higher education)

I've just missed the Ultraversity presentation at Online Educa 2004, Berlin, but after I've checked out their website I immediately signed up for their BA (Hons) Learning, Technology and Research. I spent the best year in my life at a higher education institute with them.

> ACTIVITY TPD
>
> READ
>
> Check out what Ultraversity is about!
>
> Choose an option:
>
> - explore their website[42],

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39 http://fraser.typepad.com/edtechuk/2004/week43/index.html (accessed May, 2006)
40 http://en.wikipedia.org/wiki/Electronic_portfolio (accessed May, 2006)
41 http://www.cetis.ac.uk/members/scott/resources/eportfolio.ppt (accessed May, 2006)
42 http://www.ultraversity.net (accessed May, 2006)

- check a short introduction, *Support Staff and Raising Standards: Implications for Schools* (PDF)[43],
- or read a study, *Online Communities – Vehicles For Professional Learning?, that solidly founds their practice!* (PDF)[44]

REFLECT
What do you think of the degree?
Do you think it is a good strategy to fund change in education?
What do you think why did I left the degree after one year?

Apart from the pedagogical basics it gave me, I really liked the practical, reflective, action-oriented curriculum, plus I'm happy to have met some real nice people there, like Andy Roberts[45] or John Davitt[46]. After a year I had to realize that getting this degree involves being an active member of the Ultraversity community of practice. It isn't hard to see the obstacles occuring – being an eLearning entrepreneur living in Eastern Europe I cannot share the practice of the teaching assistants working in the United Kingdom. I believe I learned a lot of them and about myself as well, but one year was enough.

ACTIVITY TPE
READ
The patchwork text was a very nice metaphor I encountered at Ultraversity. Read the article of Richard Winter titled *Alternative to the essay*[47] on why regular writing tasks would aid learning far better than the last-minute essay!

REFLECT
What can you use patchwork text for in your work or life?

43 http://www.ultraversity.net/download/snapshots.pdf (accessed May, 2006)
44 http://www.ultralab.net/papers/bera2002/bptbera2002.pdf (accessed May, 2006)
45 http://www.users.zetnet.co.uk/rob/homepage.htm (accessed May, 2006)
46 http://www.newtools.org/ (accessed May, 2006)
47 http://education.guardian.co.uk/print/0,3858,4687096-48826,00.html (accessed May, 2006)

ACTIVITY TPF

READ

Read the Year 2 report of Andy Roberts on Introducing a WIKI to a Community of Practice![48] I have to mention that the community is centered around cider.

REFLECT

What were the most useful findings of Andy Roberts you feel you can use in a community you're involved with?

Case b: digital whiteboard

I've already mentioned our involvement in a methodology development for digital whiteboards for the Ministry of Education in Hungary. We have worked together with more than 60 practicing teachers and tried to establish a community of practice with them. Our main technological tool was a Mediawiki[49]. Now that we continue the project we try to integrate a Wordpress blog[50] with the wiki.

(Actually we like Wordpress, because apart from being free, it has a good learning path, you can make your first WP hosted at their server, then you can have your own WP, and even a multi-user WP for institutional use.)

We were quite happy that the accredited teacher training course we got as one of the outcomes gained a lot from the peer-review processes of this community of practice.

ACTIVITY TPG

READ

Read my abstract from Online Educa 2004, Berlin, entitled *The Wiki Way – Social Software for Collaborative Content Management in eLearning!* (DOC)[51]
or alternatively watch my presentation on the project (quite big EXE)[52]

48 http://frankieroberto.com/dad/ultrastudents/andyroberts/year2/AEreport/AEtool.html (accessed May, 2006)
49 http://aktivtabla.hu/index.php/Kezd%C5%91lap (accessed May, 2006)
50 http://blog.aktivtabla.hu/ (accessed May, 2006)
51 http://tyrell.hu/~b2men/2004_online_educa_wiki_abstract.doc (accessed May, 2006)
52 http://demo.coedu.hu/wb_eng_0613.exe (accessed May, 2006)

REFLECT

What is your experience of participating in communities of practice related to education and learning?

Case c: educational games

Our company, Coedu, organized some educational games for kids in which we tried to keep connectivism and edutainment in mind. Think of a spy quest, lip-synching, movie trailer construction and constructing narratives with a cartoon editor.

ACTIVITY TPH

READ

Read my abstract from Online Educa 2005, Berlin, entitled *Connectivism in Practice – Edutainment that Works!* (RTF)[53]
or alternatively check out my presentation (zipped Shockwave)[54]

REFLECT

In which part would you liked to participate?
How would you develop these ideas?

Case d: aniwiki

When I think of connectivism, some quite surreal examples also come to my mind.
I remember when Andy Baio[55] thought he needed a Firefox plug-in to animate the history of a Wikipedia entry, so he put out a contest[56] providing 50 dollars for the best entry. I was also interested in having a similar plug-in that could give me metadata on how trustable an entry is (age, number of editors, number of edits, etc.). I dropped in some money asking for the features I was interested in. John Resig made a prototype[57] quite close to what I had wanted.
Honestly, that was my best experience in software development: matching the partners, quickly and cheaply solving a problem and giving away the outcome to the public for free.

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53 http://tyrell.hu/~b2men/2005_online_educa_edutainment_abstract.rtf (accessed May, 2006)
54 http://tyrell.hu/~b2men/2005_online_educa_edutainment_presentation.zip (accessed May, 2006)
55 http://waxy.org/ (accessed May, 2006)
56 http://www.waxy.org/archive/2005/06/27/wikipedi.shtml (accessed May, 2006)
57 http://ejohn.org/projects/aniwiki/ (accessed May, 2006)

ACTIVITY TPJ
REFLECT
Think about a piece of software you would love to sponsor with 100 euros! Sponsor it!

Case e: personal mba
Connectivism sometimes is really about just connecting.
Another nice story was when I found out that Josh Kaufman[58] had a proposal for a book called Personal MBA on Changethis[59]. I voted plus sent the link to Lifehacker[60]. Now with all the votes of the Lifehackers[61], Josh got the inclination to make the book[62] quite quickly. I think that someone else surely had posted about this or people would have voted for his proposal for sure, but making a good connection fastened things a bit.
I really think that any small connection can make a difference and if it's up to you, just do it.

ACTIVITY TPI
REFLECT
Think of two people or communities who should be knowing about each other and their goals! Connect them!

3.3 The Evaluation

I think that evaluation has turned education into what it is today.
The inclination to measure defines the framework and mindset of most of the people active in education today.
Perhaps it is a bit harsh to call in pornography as an analogy, but this way you surely won't miss my point. Porn defines sexuality through the voyeur lens of the camera in a way like education does this with measurement. As real learning occurs within the learner, all we can measure are just indirect effects of this process. You cannot record

58 http://www.joshkaufman.net/ (accessed May, 2006)
59 http://www.changethis.com/ (accessed May, 2006)
60 http://lifehacker.com (accessed May, 2006)
61 http://72.14.207.104/search?q=cache:gHn66ec8oPsJ:www.joshkaufman.net/archives/the_personal_mba/index.html+%22personal+mba%22+lifehacker+votes&hl=hu&gl=hu&ct=clnk&cd=1 (accessed May, 2006)
62 http://www.changethis.com/17.PersonalMBA (accessed May, 2006)

people making love on a video tape, just how they are having sex – and a lot of people make the mistake perceiving this recording as reality. Measurement defines education, while learning is still considered a by-product.

How can you evaluate in connectivism?
We need subtler methods, for sure. Churning rates, complaints analyzed pro-activity in communication and nurturing ability of the tutors/mentors could be starting points I see in this field.

4. The Future

I see an emerging eLearning 1.5 scene with the availability and spreading use of free, open source and good quality LMSs (mostly Moodle[63], Ilias[64] and Atutor[65]), but the pedagogy, the workflow and the content are still the same old ones.

Although I smell lots of money spent on monoliths like Sakai[66] and Open Source Portfolio[67] in the US and I really do greet the efforts of JISC in the UK on personal learning environments[68], I'm much of a believer that something really useful will come out of mash-ups and prototypes.

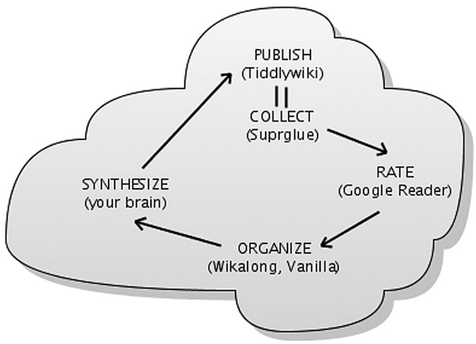
Also I wonder how the ePortfolio 2010 goal will be implemented in Europe – as it says in 2010 every citizen will have an ePortfolio.

Elgg[69] could be a good host application for chanelling the needed functionalities, but it's still a bit alpha for decent usage, plus the actual methodology and workflows are somewhat missing.

63 http://moodle.org/ (accessed May, 2006)
64 http://www.ilias.de/ (accessed May, 2006)
65 http://www.atutor.ca/ (accessed May, 2006)
66 http://sakaiproject.org/ (accessed May, 2006)
67 http://www.osportfolio.org/ (accessed May, 2006)
68 http://www.cetis.ac.uk/members/ple (accessed May, 2006)
69 http://elgg.net/ (accessed May, 2006)

I see the following pieces float around:

- Channel your sources through Suprglue[70].
- Browse the information overload with an RSS reader. Client-side Thunderbird[71], Google Reader[72] or Bloglines[73], make your bet.
- Organize while exploring. Wikalong[74] seems to be better than Scrapbook[75]. (Both are Firefox plug-ins.)
- Record, autotag (and play it back – wouldn't it be nice?) your teaching processes of a semester or a course with Vanilla[76].
- Publish in TiddlyWiki[77].



Homework for ourselves:

Forget text-only. Visualize, for God's sake. See my doodle[78] on a visual CV at Flickr. (Don't forget to play with the mouseover!)

Build KISS URIs for learning footprints: I404e-0.TTK.SZTE.HU[79] (a course), JZA3001.TTK.SZTE.HU (a student)[80]

70 http://www.suprglu.com/ (accessed May, 2006)
71 http://www.mozilla.com/thunderbird/ (accessed May, 2006)
72 http://www.google.com/reader (accessed May, 2006)
73 http://www.bloglines.com/ (accessed May, 2006)
74 http://www.wikalong.org/ (accessed May, 2006)
75 http://amb.vis.ne.jp/mozilla/scrapbook/ (accessed May, 2006)
76 http://www.vanillasite.at/space/start (accessed May, 2006)
77 http://www.tiddlywiki.com/ (accessed May, 2006)
78 http://flickr.com/photos/b2men/90218144/ (accessed May, 2006)
79 http://www.stud.u-szeged.hu/tanrend/2005-2006-2/a44/kurz44379.html (accessed May, 2006)
80 http://cypherpunks.venona.com/date/1993/06/msg00220.html (accessed May, 2006)

ACTIVITY TFA
REFLECT
Now please describe a day in your life in 2012 while learning, teaching or mentoring a community of practice!

5. Thanks

I thank Barbara Kósa[81], Médea Marosán[82] and Martin Lindner[83] for their reflections and support.
Figure done with Gliffy[84].

6. References

Young, A. R. (1999): Big Ego's. The Chronic 2001. Los Angeles, Death Row
Woolfson, E. (1980): Games People Play. The Turn of a Friendly Card. New York, Arista

81 http://www.oki.hu/oldal.php?tipus=ember&kod=2544 (accessed May, 2006)
82 http://www.ntt.hu/index.php/User:Mmarosan (accessed May, 2006)
83 http://phaidon.philo.at/martin/ (accessed May, 2006)
84 http://www.gliffy.com/gliffy/ (accessed May, 2006)

Alternative content distribution channels for mobile devices
(Mobile Microlearning)

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Abstract: Recently, the potentials of mobile devices have stirred interest in the eLearning community. This paper explores how podcasts can be used to enhance "classic" eLearning technology as well as how content can be produced, distributed and edited in a collaborative fashion.

1. Introduction

Mobile learning (m-learning) can extend the benefits of eLearning to a much wider range of teaching and learning contexts, e.g. regarding the access to information, personalized interfaces and learning anytime anywhere. Lecture recordings for example have shown to be a cost-efficient and easy-to-use way to produce eLearning content (Lauer & Ottmann, 2002) especially in university contexts. Employing lecture recordings as supplementary material in a conventional lecture has become the most widely used application scenario (Krüger, 2005) even though lecture recordings can also be used in a number of other ways (Mertens, Knaden, Krüger & Vornberger 2004). If students could use lecture recordings on a small mobile device, they can use them in completely new situations, e.g. while commuting on a bus or train.

Despite the possibilities raised by mobile devices, a number of problems ranging from content distribution to adequate application scenarios have to be considered. The most important problem is how the media can be offered to the students in such a way that most students can access them without expert knowledge or hardware they can not afford. Section 2 shows that podcasting seem to be a promising approach in this direction. Section 3 describes how podcasts can be produced using existing lecture recording mechanisms. Combining classic lecture recording and podcasts can enhance both the classic web lecture and the recording.

Section 4 to section 7 describes different content distribution channels and platforms.

2. Podcasts

2.1 Introducing Podcasts

A distribution approach is utilized with the adoption of the podcast technology. The term podcasting describes the production and the automatic download of audio data from a publisher to a subscriber over the Internet.

The word *podcast* is a combination of the word *broadcast* and the name of the popular audio player from Apple Computer called *iPod*. It is a bit of a misnomer in that it implies that an iPod-player is required to listen to a podcast. In fact, a podcast can be used with a variety of digital audio formats and can be played on almost any audio player or computer (Meng 2005). Even on mobile phones it is possible to use podcasts. The term *podcasting* describes the production, distribution and the automatic download of audio data from a publisher to a subscriber over the Internet. The typical podcasting scenario is depicted in figure 1.

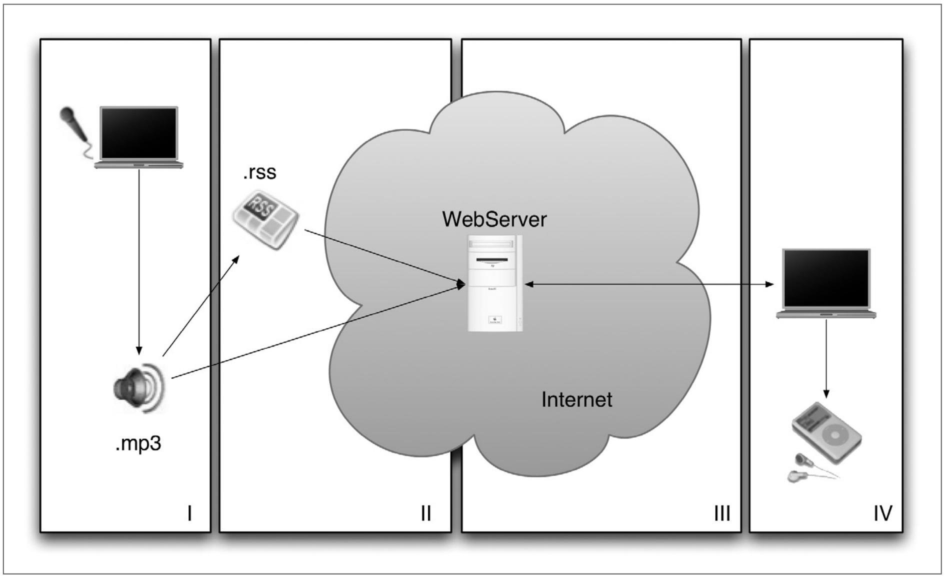

Figure 1: From the Producer to the Listener

I: Record and edit your podcast contribution.
Create an audio file with a microphone and a recording software on your computer. Convert it to space preserving and widespread MP3 or AAC format.

II: Place your contribution on a webserver. Additionally create a RSS (XML structure) file which contains a description and the URL's (links) to the audio or video files.

III: A podcast client software on the subscriber's computer keeps the user informed about new episodes and manages the data transmission.

IV: Synchronize your mobile device with the podcast client software on your computer.

2.2 Podcast Client Software

Podcast client software lets users subscribe to and manage podcasts. Podcast clients or "podcatchers" exist for many platforms. Besides software for computer platforms (Windows, Linux, MacOS, Amiga) there also exist implementations for many mobile devices (Pocket PC, Palm, Smartphone, Symbian Phones memory cards and USB sticks).

Listeners don't need to buy new music player gadgets; they can use the device they already have.

Subscribing to (or unsubscribing from) a podcast is very easy. The listener only has to copy a weblink (feed URL) to the preferred podcatcher software (or simple deletes the link).

Normally the software runs as background service on a PC and reviews the feed URL after a specified interval. Users can choose to update podcasts at a specific time (for example every day or every six hours).

If the feed data has substantively changed from when it was previously checked, the program locates the new contributions and automatically downloads them to the subscriber's computer or even to the mobile device.

With podcast technology the explicit download driven by the user can be eliminated as the data is automatically handled on the receiver's end and downloaded to the playlist of the playback device as long as the receiver is subscribed to the cast. The latest updates are always readily available with no effort required by the listener.

2.3 Enhanced Podcasts

Enhanced podcasts do not only contain audio information, but also integrate new data information that can be synchronized to the audio information. E.g. an image or an URL can be shown at a certain time concurrently to the audio information in a synchronized manner. There are software tools available to support the production process as well as the consumption of enhanced podcasts. Most of them are free- or shareware. Like usual podcasts, enhanced podcasts can be used on different platforms and devices. Players are available for Windows or Mac computers as well as for mobile devices.

Enhanced podcasts based on recorded lectures offer a very interesting approach to support the ubiquitous learning process. With the combination of a fine granulated structure of a recorded lecture (as described in section 3), an enhanced podcast allows a very precise navigation to specific content of a lecture that can be used anytime and anywhere.

2.4 Video Podcasts

The next generation podcasts are called video podcast (or vodcast, videocast). Vodcasts are the video equivalent of a podcast and contain, as the name implies, video information instead of audio. Video podcasts can contain downloadable video files but also streaming sources. Therefore it is more difficult to create a vodcast than a simple audio podcast.

The problems with the comprised multimedia contents are versatile and it is a big step from a simple audio podcast to the video content in a videocast.
Producers have to keep in mind, that there are a lot of different video codecs, formats and also resolution diversities. As a result the production and distribution depends on the capacity and features of the client device.
This seems to be one of the reasons why audio podcasts are more popular than video podcasts. Nevertheless the automatic download step of the latest episodes is certainly again a very important feature, because subscribers don't have to select items or channels on their tiny hardware displays.
The video content in a vodcast can also be split into chapters. Some podcast clients can navigate through the created chapters. An adversarial problem is presently that mobile devices (like the video iPod) cannot use this video chapter features.

3. Acceptance and Dissimination of Podcasts

Both universities, the University and the University of Applied Sciences of Osnabrueck are using an open source learn management system called Stud.IP (Stud.IP 2006).
This LMS is an inherent part in both university sceneries since 2004 (Hamborg & Knaden 2004) with about 18.000 participating students.

A survey in Stud.IP at the University has shown that 45 % out of 314 participating students would use podcast technology. 47 % indicate that they sometimes listen to lecture recordings. The rate of students indicating that they wouldn't use (or can't imagine to use) this technology was about 8 %.
In fact American universities are still encouraging the creative use of mobile audio devices in education and campus life (Duke 2005). At the University of Duke every first year student was equipped with an iPod.
So it is possible to use podcast technology for whole classes and extensive university projects.

4. Combining Lecture Recordings with the Podcast Technology

Recordings of lectures are a cost-efficient and easy-to-use way to produce eLearning content. In a university context with tight financial constraints they can only be used if the production process is automated to a high degree and a manual intervention is not necessary. At the University of Osnabrück and at the University of Applied Sciences Osnabrück, an automation approach that uses the Stud.IP LMS (Learn Management System) for content distribution is currently under development (Mertens, Knaden, Thelen & Vornberger 2005) and being tested. It is designed to feature a fully automated production chain from starting the presentation to linking it to the corresponding course. A concept for integrating podcasts into this production chain is described in (Ketterl, Mertens, Morisse & Vornberger 2006).
Building on the production chain for the web interface, slide synchronization data and images of the slides are extracted automatically from the material that is used to generate the web interface (left in figure 2). This way, one source is used for multiple output channels.

Figure 2: virtPresenter lecture recordings for different devices

The information presented in the podcast therefore closely resembles the information delivered in the web lecture. The web lecture interface offers a hypermedia navigation concepts that allows fine grained navigation in the recording (Mertens, Schneider, Müller & Vornberger 2004). It also incorporates a shared bookmark feature that can be used to externally communicate about arbitrary clippings of the recording (Mertens, Ickerott, Witte & Vornberger 2005).

This makes the podcast a lightweight version of the web lecture that adds the advantage of mobility. Students can use the mobile recording to review parts of the lecture and they can use the web interface for tasks involving search, navigation and communication. While more sophisticated navigation facilities can currently not be supported, navigation on the slide level is implemented in the mobile version.
The lightweight interface version is currently supported by Apple´s iPod & iTunes Software (described in section 6) and field-tested at the University of Osnabrueck and the University of Applied Science Osnabrueck.

5. Bluetooth

Another distribution approach is utilized with the development of a point of information (POI) for content distribution purposes (Ketterl 2004). The aim of this POI is the research and implementation of an area-restricted media service offer for mobile devices. However, first and foremost is the requirement of a content distribution service for learning purposes, which is free of charge to the user. For this reason, the POI relies on the bluetooth radio technique, as this is now readily available and capable of good performance and above all it is free of charge for the connection and transmission. Another central issue is the capabilities of our daily used equipment regarding the development and the presentation of different media contents.
The POI server is able to offer and distribute media objects of different formats. Apart from the reduced transmission range (depending on the bluetooth power class of the used bluetooth device) the only restriction is the efficiency of the mobile device. Bluetooth lets these devices talk to each other when they come in range, even if they are not in the same room.

The size of a lecture (audio) podcast is about 75 MByte and is encoded in MP3 or AAC audio format. This might be a problem for some devices, because some cell phones do not support these formats nor have enough memory to store the information. The POI-Server therefore converts the audio information to the widely supported AMR-NB mobile phone audio format. After that the POI Server sends the converted podcasts to nearby devices. This distribution approach seems to be a promising way for future mobile products, therefore the efforts in this project are going to be expanded and further developments and tests will be conducted.

6. iTunes

An easy and promising way to publish content for many devices is Apple's iTunes software. iTunes is by far the most popular podcast client (Meng 2005). The reasons for this fact are manifold. A main point certainly is the simple handling of different file types (Video & Audio: MP3, WAV, AIFF, MPEG4, Apple Lossless, M4P/AAC Protected Content, and a variety of QuickTime supported media formats as well) and several media resources (user library, streaming video/radio server).

A further point is the seamless integration of the Online Music Store. The iTunes Music Store is an online music store run by Apple Computer through its iTunes application. Apple's iTunes Music Store lets customers search within an enormous catalogue of tracks, including music from all major labels. A user can perform searches by specifying criteria such as artist, composer, title and genre. Besides the commercial music offer one can also find free of charge podcasts and video podcasts with different matters and derivations. These podcasts can be uploaded by anyone registered in the iTunes Music Store. To prevent copyright abuse etc., content uploaded is checked by Apple before it is published. This procedure usually takes around one day.

Due to this easy way of publishing, producers can use the music store to reach many listeners or viewers. The University of Osnabrueck and the University of Applied Sciences Osnabrueck have already integrated three lectures in the store.
To subscribe to one of these podcast lectures simply perform a search by name „Morisse" or „Osnabrück" in the iTunes Music Store.

6.1 iTunes University

Apple has launched a service called iTunes U (iTunes University) that provides free hosting for universities who want to make lectures and other audio or video content available to the public.

„Students expect a campus environment that accommodates their digital lifestyle, adapts to their individual learning needs, and encourages collaboration and teamwork. Introducing a way to simplify and meet all these needs – iTunes U."
(iTunes University 2005)

The new service has already been piloted at a number of universities like Duke, the University of Missouri, the University of Michigan and Stanford.
For example Stanford on iTunes provides access to a wide range of Stanford-related digital audio content via the iTunes Music Store (Stanford on iTunes 2005).
All these universities are collaborating with Apple Computer to allow public access to a wide range of lectures, speeches, debates and other university content through iTunes.
The iTunes U looks like a customized iTunes music store. University colors, photos and logos can be integrated to make iTunes U look familiar to staff, students, and alumni.
Students can access the special music store using their university ID with a password and subscribe to the classes that they want to. There is no possibility to reach the non public university content throughout the regular music store or through other tools.
Because of this features iTunes U can become a very interesting platform for universities to share content in an easy to use, closed and secure environment.

7. PmWiki

A wiki is a web application that enables any user to easily add and modify content of a collection of interlinked snippets of information. (Langreiter & Bolka, 2005)
This functionality makes wikis excellent tools for collaboration in an online environment.
There are many different wikis, called wiki clones. Wikis have a variety of features, such as user authentication, which are useful in an eLearning setting.
However, not all wiki features are enabled by default upon installation. Implementing advanced features sometimes requires the location and manipulation of individual lines of program code in the wiki source files. (Augar, Raitman, & Zhou, 2004)
User authentication is a very important feature for eLearning scenarios in a university context (e.g. to associate content to a specific person). Choosing the right wiki depends on the required features. (Tonkin, 2005) PmWiki is a wiki-clone written in PHP and a system for collaborative creation and maintenance of websites. It is easy to setup and to maintain and fits well in the existing LMS Stud.IP environment of the universities in Osnabrueck. An important feature of PMWiki is that it can be configured in a way that authors can easily upload and attach many different file types to pages. Thus it becomes possible to use even podcasts in a collaborative way.
There are two projects at the University of Osnabrueck and at the University of Applied Sciences Osnabrueck which are investigating this new collaboration approach. One is

a seminar in which members of a group of students create podcasts together in a wiki-like way of collaboration. The second project is using podcasts in preparation for course meetings. These didactic models can be applied to fields of studies where students exhibit a natural interest in creating media, music, fiction or art. Transferring this approach to other fields of study like natural sciences will not be feasible without crucial changes to the didactic design. Alongside to the mentioned projects many other pedagogical implications are conceivable (Meng, 2005).

8. Final Conclusion

This paper has presented new ways for using mobile devices in an educational context. The combination of new technologies like podcasts, bluetooth and PmWiki can lead to new application models for eLearning scenarios.

Based on an existing workflow for lecture recordings, which are offered to the students over the internet, the production chain has been extended to support mobile devices as new platforms for the playback of lecture recordings. Podcasts are gaining more and more attraction. They offer an attractive possibility for students to listen to recorded lectures e.g. while traveling. The paper has described how the production and content distribution of podcasts could be realized in a convenient way. Moreover some requirements for didactic scenarios have been presented.

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A Framework for Authoring Mobile Learning Content
(Mobile Microlearning)

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Abstract: In order to facilitate simpler ways for (m-/e-) learning content there is a need for special tools supporting the authoring process and considering both, the technical challenges of content creation (e.g. adaptation of content to various types of mobile devices) as well as pedagogic and didactic issues in content creation (e.g. what is the appropriate granularity of a unit in mobile learning). This paper clarifies these needs and presents an authoring framework which provides both types of support.

1. Motivation

With the advances in communication infrastructures and the widespread availability and usage of mobile devices, a trend in the eLearning community is observed integrating those mobile technologies also into learning environments. However, mobile learning is more than just providing access to learning content via mobile devices. New ways of learning, such as situated learning, ad hoc provisioning of learning content, spontaneous interaction in learning groups, and personalization can and should be considered. While most research in mobile learning has focused so far on providing learning environments supporting the management of and the interaction with learning content, less work has been done on providing support for authoring content suitable for mobile learning. For this reason solutions are looked for which combines the specialized knowledge of authors with authoring tools.

2. Issues in Content Creation

2.1 Technical Content Preparation

Content preparation requires both, highly developed technical standards for content presentation and delivery presentation and substantial knowledge in the content domain itself. Frequently a trade off between technical possibilities and content conversion has to be found in order to achieve the best result. Unfortunately automated support in content authoring cannot be fulfilled. Help based on content is up to now not realizable. No general concept can be defined restricting the structure and the content. Maximum ratings about the length of a document, the relative multimedia support of content units (amount of multimedia elements within a document) and other similar global parameters can be defined; however don't conform to any content. Because of the complexity of language and semantic ambiguity, semantic guidelines focusing the content are not realizable as well. Simple programs comprising as well defined technical help assistance may support not so highly technical educated authors; however these programs are not able to exploit the whole technical equipment.

2.2 Gap of Technical and Knowledge-Based Content

Except for technical reports comprising content and technical knowledge, a huge gap between knowledge-based content and technical experiences with content perception appears. For this reason compromises are looked for, bridging the gap between technical content and knowledge-based content preparation. Frequently (online) content preparation and knowledge-based content research are separated. Knowledge is provided by content-experts and prepared by technical experts. Unfortunately the content suffers due to the separation of knowledge and technical preparation. Knowledge may be ambiguous, misunderstood or simply wrong structured. The lack of mutual understanding enlarges the gap between technical and knowledge-based content and the compromises concerning the final content product are frequently not sufficient. The primary goal for publishing content suitable for mobile learning is identified in eliminating this gap between the technical and the knowledge-based part of content preparation.

2.3 Support for Content Creation

Support for content creation can be offered in various ways. As already mentioned before parameters like the length of a document, the amount of multimedia objects (images, animations, applets), the structure of the content (with XML support), and up to a certain level the meaning of the content (by semantic node names) may be documented assuming that the topic of the content is predefined. Impact on the content may be assured by content classification and predefining possible structures and templates (q.v. chapter 3.3 Content-Based Help). In order to provide adequate help for authors, a combination of various support strategies is necessary, otherwise the interpretation and preparation of content will depend on technical content structures or will provide a lack of knowledge again.

2.4 Advantages of Content Supported Learning Units

Having impact on the content itself, reduces the gap between technical and knowledge-based content and supports authors in publishing content. Additionally the possibility to publish content modules, comprising several units containing similar structures (even published by different authors) is offered. Authors get the facility to evaluate content by themselves. (Online) Content preparation will become simpler; less time-consuming, detached from up to now necessary document format rules and independent of the authors' technical experience.

3. (Didactic) Help on Content Establishment

3.1 Base (MobiLearn)

In the MobiLearn[1] project, a structured approach for annotating learning content has been developed extending and detailing existing eLearning standards. A document type definition (DTD[2]) has been established which defines structures for online content stored as XML documents to be delivered to different types of end devices (PC, PDA, phone) and to be viewed at different levels of detail (so-called LODs[3])[4].

Although the DTD defines the available types of learning objects, this is not sufficient to ensure and support their usage in a standardized way. In fact, analysis of the learning modules developed in the MobiLearn project revealed significant differences in structure, such as semantic ambiguity or even misuse of content elements. The lack of specific content authoring software caused a depreciation of the final content and raised questions for improvements. Further details about the MobiLearn project analysis are published within the thesis.

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1 MobiLearn Website: http://www.mobilearn.at

2 DTD: http://www.w3.org/TR/html4/sgml/dtd.html (accessed Oct, 2006)

3 LOD = Level of Detail (slides, script, further information)

4 Johannes Kepler University of Linz, Technical University of Vienna, J. (2002), "Description of the MobiLearn DTD"

Based on the MobiLearn project, the objective of this work was thus to design and implement a framework for authoring mobile content which should demonstrate different ways of (didactic) authoring support. The "Didactic MobiLearn Editor" has been established (q.v. chapter 5 MobiLearn-Editor).

3.2 Requisites

Necessary for content-based help are a predefined content-structure (e.g. DTD, XSD[5]), a restricted topic and a straight conceivability about the target-group. The MobiLearn project complies all these requisites (structure: *MobiLearn DTD*, topic: *media computing,* target group: *students*). Relying on the MobiLearn project, the "Didactic MobiLearn Editor" has been implemented, which is based on these requisites and demonstrates a proper way for authoring-support.

3.3 Content-Based Help

Content-based help comprises the overall workflow of content-authoring, starting at the choice of the proper authoring tool and ending at proof readings and analysis of the finished content. The impact on the content itself is restricted because of semantic ambiguity and individual authors. Nevertheless authors may be supported by producing content. Simple frameworks, only offering the necessary content-producing features facilitates the production of learning-units as well as a strict separation of file-format and content-structure. Authors must not be confused by difficult instructions, which are necessary to exploit the offered features of content-establishing tools.

Sometimes simplicity optimizes the results. Predefined structures and templates support especially new authors who have to get used to the construction of learning-units and its' application. Learning-units which are connected to a predefined structure (DTD/XSD) must be well prepared to the author (e.g. presentation of proper child-nodes). Otherwise the complexity offered by predefined structures can never be used. Content marks for highlighting and online proof-reading possibilities enrich the establishment of learning-units additionally. Structure-comparisons and -analysis with other learning-unit-modules provide a better general view and give authors the possibility to check finished learning-units with former, already published and used ones.

5 XSD: http://www.w3.org/XML/Schema#dev

4. Related Work

A couple of m- and eLearning projects have already dealt with content-authoring tools. Some of them are focused on the integration of multimedia, interactive objects and take less attention to the usability. Others try to simplify the programs in order to enable learning-content-publishing easily. Unfortunately the functionality of the authoring-system suffers from the emphasis of convenience.
The EF-Editor and the eXe-Editor are two examples of current content-authoring-tools.

4.1 EF-Editor

The Technical University of Dresden[6] and the Department for Pedagogical Psychology and Deployment-Psychology[7] published the EF-Editor. The EF-Editor (Exercise-Format-Editor) is a subproject of the "Studierplatz 2000" project. The aim of this project has been to establish knowledge actively and by communication. New learning and teaching strategies are supported by new media.
The EF-Editor enables the development of interactive objects. Unfortunately format and content are not separated, thus authors have to develop difficult structures (script-tags, media-tables,…) and have to combine Microsoft Word documents with the established components of the EF-Editor. Numerous templates (MS Word templates, EF-Editor content restrictions) have to be obeyed in order to publish learning content.
The EF-Editor is a very powerful tool, offering numerous features for content-creation. However, the handling of the EF-Editor is very difficult and only a few authors are able to exploit its offerings.

4.2 eXe

The eXe-Editor (eLearning XHTML editor) is an open source project of the University of Auckland[8] (New Zealand). eXe enables the publishing of eLearning-based learning units. The aim of this project has been to develop an intuitively, flexible und easy-updateable learning-content editor.
The whole editor is based on an interactive website. eXe may be controlled by a spe-

6 TU Dresden: http://tu-dresden.de/
7 Department of Pedagogical Psychology and Deployment-Psychology: http://psylux.psych.tu-dresden.de/i4/index.html (accessed Oct, 2006)
8 University of Auckland. http://www.auckland.ac.nz

cial version of Mozilla Firefox[9], provided by the eXe project. The navigation within the editor is quite simple. Different objects (e.g. Activity, Case study,…) may be added to the learning-content and build-up the final structure. Out of the combination of these objects the learning-content is established.

The functionality of the eXe-Editor is – compared to the numerous possibilities of the EF-Editor – restricted. Although the authors may structure the learning-content by the different elements, interactive objects are hardly supported. For additional need the integrated "iDevice-Editor" offers the possibility to create individual objects.[10]

All in all the eXe-Editor is a highly user-friendly, simple to use program, offering the opportunity to create simple HTML- and SCORM-learning units.

4.3 Implication

Both, the EF-Editor and the eXe-Editor are very mature systems. The EF-Editor especially supports the interactivity and activity of learning-units. The eXe-Editor has a much simpler interface and an easy-handling content-establishing tool.

However, both systems don't have impact on the learning-content. Authors have the duty to define the learning-target-group, the learning-habits of the learner and also have to look for a proper learning-content-structure for the learning-unit by themselves. Content-establishing-help hasn't been integrated yet, although numerous authors are overextended by the content-publishing.

Current authoring-systems concentrate mainly on either the interactivity of content (especially within mobile learning environments) or usability. The impact on the learning-content is up to now not integrated because of semantic lacks and ambiguity.

Authoring systems have to be developed which support both: technical facilities and content-support.

5. MobiLearn-Editor

5.1 Implementation

The "Didactic MobiLearn Editor" has been developed using the Microsoft Visual C# .Net framework[11] because of its' good support for graphical user interfaces (GUI). The

9 Mozilla Firefox: http://www.mozilla.com/firefox/
10 University of Auckland (New Zealand) (2005), "eXe – The e-learning XML Editor"
11 C# – Microsoft Website: http://msdn.microsoft.com/vcsharp

established learning-units are based on XML files connected to an XSD. The editor enables all for the publishing of MobiLearn-content necessary steps. Figure 1 shows the final learning-content editor.
It comprises three main parts: the main-window, the content-window, and several functional-windows.

- Main-window
  The main-window controls the program. Available learning units are opened, new learning units are created, selected learning units are saved, and various previews can be generated.
- Content-window
  Within the content-window learning-units are presented and can be edited in the window directly. All changes are directly adapted to the XML-file. Using hidden IDs the content-window is straightly connected to the functional-windows which have an enormous impact on the content of the learning-unit.
- Functional-windows
  The functional-windows represent the (didactic) features of the editor. The features comprise the selection of proper child nodes as well as a learning-theory analysis and other features described later in this paper. Additionally the functional-windows present the library of the learning-unit (available media-objects which may be added to the content) and allow authors to change the attributes of the structural-nodes.

5.2 Features

5.2.1 Simple Framework

Frequently software vaunts because of numerous features and opportunities, however, in some cases clear simple structures and navigations justified on the user's needs are much more efficient. For this reason a simple navigation, logical steps and no superfluous features are added to the "Didactic MobiLearn Editor". The editor's features are concentrated on the author and on the learning-units.

5.2.2 Separation of File Format/Content Structure

File format and content structure must be separated in order to guarantee content which is completely independent of the authors' technical knowledge. Learning environments – requiring specific code lines within the actual content – restrict the authors' creativity and inspiration. Therefore a straight interface becomes obligate.

With the help of the "Didactic MobiLearn Editor", authors edit and produce content directly in an editable and embedded Internet-Explorer-component, rendering the learning-unit in XML style. Content-configurations (q.v. chapter 5.2.5 Content Marks) are supported by visual aids and are completely separated from the final XML-output.

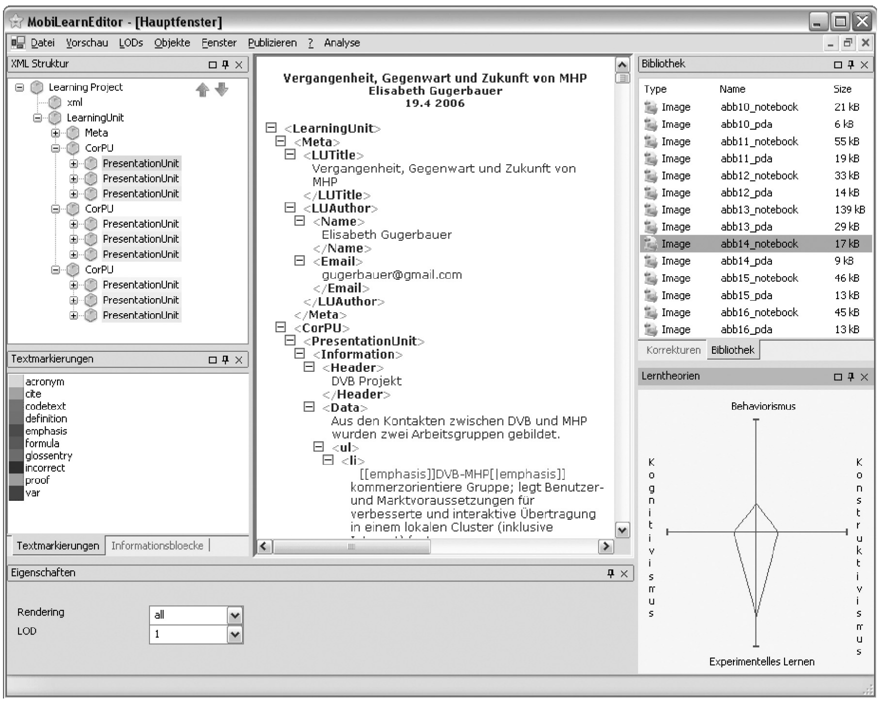

Figure 1: Didactic MobiLearn Editor

5.2.3 Predefined Structures and Templates

In order to simplify and optimize content authoring structures may be defined and offered to the authors. These structures mainly cover general information (e.g. references) and can be integrated within content easily. Templates have more impact on the content itself, aimed either on content issues or on target groups (e.g. by the use of learning theories). Such templates support authors creating content for the first time or may be established/adapted by experienced authors, wanting similar content structures for learning unit series.

During the development of the "Didactic MobiLearn Editor" and the analysis of m-/eLearning environments and learning theories, templates have been established which concentrate on the one hand on learning theories (behaviorism, constructivism, cognitivism and experimental learning) and on the other hand on target-groups (elementary school, lower grad, upper grade, scholastics, and adult education). These templates may be used for the establishment of learning-units, supporting new authors or providing similar structures of learning-units-modules. Changes, extensions and adaptations on the content and on target groups are facultative.

5.2.4 Child-Node Presentation

Depending on the rules of a DTD/XSD, content-nodes and content-child-nodes have a strict sequence. In order to obey these rules the capacities of the whole structure is frequently not used. Elements are unacquainted, structures are not well enough defined. By presenting all node possibilities (e.g. by selecting a node all proper child-nodes are presented), the whole complexity may be exploited easily.

The "Didactic MobiLearn Editor" presents proper child-nodes by a functional-window. If an author selects an XML-node of the learning-unit structure, all possible child-nodes are presented. Nodes which have to be included are highlighted. Because of this structure only nodes can be added to the learning-unit which obey the predefined DTD/XSD structure. The DTD/XSD restrictions are directly selected by the DTD/XSD-file and are for this reason exchangeable.

5.2.5 Content Marks

Content highlighting and adding specific marks avoid content ambiguity and provide the possibility to give hints to the most important parts of the content. A well defined list of unique marks (e.g. emphasis, cite, proof) enriches content enormously.

Within the "Didactic MobiLearn Editor" authors voluntarily mark parts of the learning-units. The marks are all highlighted by different colors in order to intensify the marks. Marks are again, directly added within the text-paragraphs. Additional comments or special text-mark-tags need not be added manually.

5.2.6 Learning-Unit Slider

Voluntarily authors derive learning units by predefined content structures or even templates (depending on learning theories or target groups). By providing authors a kind of visual monitoring (e.g. sliders showing template approximation by values between 0 and 100 or visual guides demonstrating correspondence by distance), content can automatically be compared with template necessary structure guides.

The "Didactic MobiLearn Editor" concentrates on the learning theories behaviorism, constructivism, cognitivism and experimental learning. For this reason a graph has been implemented which visualizes the tendency of the current learning-unit, by a dynamic four-sided figure (see figure 1, bottom right).

5.2.7 Proof Reading Features and Requirements

Testing finished content may either be done by proof readers, checking the content on spelling errors, ambiguity and even knowledge mistakes or by potential target group members, checking the understanding and learning results. In order to use these remarks globally, the possibility for proof reading marks - similar to content marks - should be guaranteed. These marks need not have emphasis on the final content, however, must be clearly demonstrated to the author in order to reengineer content passages.

In order to facilitate online corrections by various authors, the "Didactic MobiLearn Editor" offers the possibility to add marks to the learning-unit which haven't any impact on the final published learning-unit. Marks like *"Check the content again."*, *"Add additional media objects."*, *"Proof spelling."* or *"Illustrative material missing."* may be added to the learning-unit and reengineered by the author.

5.2.8 Content Comparison and Analysis

Especially at the beginning of content authoring uncertainness about the final content, context and structures occurs. Learning units are hardly ever compared with other content and therefore authors have to either trust their own experience or have to look for content comparison by themselves. If content is well enough structured (e.g. XML structure), content comparison and analysis become possible. Authors may check the established content automatically with other similar structured learning units (Statistics about similar learning units are necessary).

During the MobiLearn project 12 learning-modules, comprising several learning-units about the topic "media informatics" have been published. These learning-units have been analyzed and are used for content comparison and analysis (length of a learning unit, amount of media data, amount of elements, amount of different elements, amount of rendering attributes, amount of LOD attributes,…). The "Didactic MobiLearn

Editor" checks the current learning-unit and compares the values with the MobiLearn project statistics. The results are published within the editor. If authors generate a learning-unit-module, they can additionally compare the whole module with the MobiLearn project statistic. These generated statistics may also be used for content-reengineering. Published learning-units become more homogeneous and students need not habitude on different learning-unit-styles.

6. Conclusion and Future Work

Depending on the level of information about the content itself (e.g. like within the MobiLearn project by managing content by different information-unit-blocks), automated content support becomes possible. Even if restrictions by semantic lacks remain, opportunities will occur simplifying content authoring. Additional features like defining content structures by simple restrictions (target group, topic, extent, possible learning theory, and others), content derivation from existing learning units, content combinations, content linking and many others will arise.

The proposed authoring framework should demonstrate that the possibility for supporting authors in publishing learning-units may be guaranteed. In order to establish m- and eLearning content for learning-environments, simple, user-friendly, and author-supporting authoring frameworks must be established simplifying the production of learning-units. Content establishment has to become much more intuitive, self-explanatory and independent of underlying formats. Achieving this goal gaps between technical expertise and content domain expertise will be eliminated and content creation will depend solely on its topic.

7. Acknowledgement

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Mobile and motivating: How something very small can become big. (Mobile Microlearning)

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Abstract: Mobile learning today is technically possible, accepted by large numbers of people and is already happening, although not always recognised as such. However, its area of application is still limited and there is inadequate integration of mobile learning into larger learning systems. Yet when embedded in a meaningful way into existing and global learning scenarios, the advantages of mobile learning can be usefully exploited. Often there is a lack of appropriate design and presentation of content, and a lack of integration into a wider context. The aim of this paper therefore is to introduce an approach that illustrates how small units of learning can be designed to motivate and thus comprise more than might be apparent.

1. Main Idea and Vision

Recently I had a conversation with a taxi driver. He told me that a couple of days ago he had purchased a PlayStation Portable (PSP)[1] that helps him to pass the time when waiting for new customers. He used to read while waiting and often still does so. Then he told me very excitedly about the advantages of the small device. When waiting in his taxi it was not always possible to read, perhaps because the bustle of daily life was too distracting or he was too tired, or the light in the taxi was poor. Therefore he often sat in his car waiting, bored and with the feeling that life was passing him by while he had to sit around idly waiting for customers. Then, however, when books seemed tiresome, he was able to use his portable PlayStation. The games are fun, immersive and waiting periods can even be filled with social interaction because Multi User Games,

1 PSP is a registered trademark of the Sony Company.

which are played via LAN, mean that there are friends online most of the time. This gives him a sense of real life and community. For the taxi driver therefore this small thing is something very big. Yet reading has not been pushed into obscurity: for the right time, a good book remains popular.

Although it might sound somewhat futuristic, mobile learning any time and anywhere has already begun in a broad sense. While travelling by train – perhaps to a conference like this one – one can see, for example, that children are fascinated by their Game Boys[2], that people of all ages send SMS, that appointments are made using PDA's, that laptops make it possible to surf the Internet. Portable electronic devices have created something in western culture that is hard to plan and to control, and relatively difficult to achieve: acceptance among a wide range of social groups. When mobile phones were launched they were viewed as a temporary trend. At present, however, almost every person in Western countries has a mobile phone. In 2005, there was a mobile phone in 88 percent of households in Austria (Statistik Austria, 2005). In March 2006 there were 8 926 700 mobile phones registered across all mobile network operators in Austria (RTR, online). On 1st of April 2006, the population in Austria was about 8 274 700 (Statistik Austria, online), which means a penetration of mobile phones of 1,08 mobile phones per inhabitant. This is clear evidence for the popularity of mobile phones, which are fun to use. There is now also a recognised need for continuing education and lifelong learning. It might be argued therefore that if there is to be more learning within shorter time periods, learning should also be fun. This may be achieved by using mobile devices in life-long learning, which can deliver attractive, 'just in time' and 'on demand' learning.

2. Mobile

Let us compare the pastime of the taxi driver, described above, to a tourist strolling through the town, to a schoolgirl playing on her Game Boy on the train journey home, and finally we will focus on the work of a manufacturing company. First we shall take a closer look at the tourist's stroll through the town. He does not wish to make the

2 Game Boy is a registered trademark of Nintendo.

effort and pore over a travel guide in order to find his way. He would like to have a number of alternative routes, to walk leisurely through town but without getting lost. He wants to define what is important for him and he wants to be told how to get there. So if there is electronic information available at important sights, the tourist can use his mobile device to get information about relevant sights that can be found along his route. When he approaches a tourist sight, he can receive the appropriate information in 'light and digestible' but stimulating micro-bits in his mother tongue. If there is a word in a foreign language that he does not understand, he can get a translation via the mobile device.

And what about the commuting schoolgirl? She has to travel to and from school and thus spends a lot of time on trains or buses. In the mornings she tends to be tired and after a couple of lessons at school she is no longer interested in books. She prefers playing with her Game Boy and does so with a passion that any teacher can only dream of inspiring in lessons, despite encouraging active learning. However, computer games provide something beyond active learning – they offer vast opportunities for learning and children relish the challenge (Papert, 1994). An example is the learning capacity of five-year-olds who, as a result of playing the game on the Game Boy, can without difficulty name the 150 Pokemon-figures and describe their characteristics.

These examples outline some benefits of mobile learning, which can also be utilised in work-related fields. Therefore we next consider the manufacturing company, which is also affected by an increase in complexity. Production processes must take into account ever increasing variables and some of the factors involved are changing markets, low life-cycle products, and more specific as well as higher customer demands from products. A difficulty arises for the production worker because a machine operator has to have ever more work-related knowledge and consider ever more information, yet make decisions in an ever shorter period of time. For example, any machine malfunction needs rapid and appropriate action, which means that operators must have quick and ready access to the relevant information.
In addition to a knowledge base, however, there is a need for access to external sources of collective and shared information, and advice on how to use it effectively. Specialist machine operators need valuable knowledge on site right where the problem exists, but this is precisely where currently the knowledge is not available. Yet when problems occur there is no time to get information from desktop-eLearning platforms or colleagues. It also seems cumbersome to note potential engine problems during

inspections, which must be entered into a computer system at a later time. The solution might be a networked mobile device that a worker – like the tourist – can carry at all times. The device would provide ready access to data bases or knowledge management systems, whether for the purposes of data input or retrieval. With mobile, wearable devices, skilled workers can access information without having to leave their work station. Existing knowledge can be utilised at any time where it is needed, and new knowledge can be better retained when stored immediately and as it is discovered or emerges. This is just as in the Nintendo advert „Game Boy micro is with you at every step, wherever life takes you" (Game Boy, online).

As noted above, the majority of people in our society possesses mobile devices, and people use the devices "wherever life takes them", be they mobile phones, Smartphones, PDA's, wearable computers, mini-laptops or something similar. Those wireless mobile devices could help us to learn anywhere and whenever needed. For that reason an employee of the maintenance division of our project partner (see chapter 7) has expressed the wish that all employees should be equipped with PDA's. Service and maintenance tasks could then be entered into PDA's and retrieved as well as carried out on the shop floor. The advantage is that important information is available any time, and can be easily passed on and stored. Moreover, communication between workers in different divisions can take place more effectively, for example between maintenance and paper mill, as well as across the entire plant. The integration of workplace and learning thus moves into a new dimension, as does learning in real-time. The mobility is conducive to the ubiquity of learning; the persistence of learning processes increases, passive knowledge acquisition diminishes because knowledge is gained on demand and in context and therefore can be integrated into concrete experiences. This linking of knowledge and ad-hoc-problem solving is the essence of mobile Knowledge Management Systems, as Franz Lehner (2002) characterises them. The ability to search for something anywhere and any time provides a sense of security and thereby might increase the fun factor at work.

3. Motivating

There is much talk about the leisure society. If fun is so important to us, why should it not also be used actively and productively? Why should we not discover the fun in learning for our personal and collective development? Another point to note is that the retirement age increases steadily. Most people have to work longer, perhaps for 40 years or more, and they have to learn throughout their lives, for some 80 or 90 years or even longer, from the first to the very last day of our life. Horst Siebert stated rightly that "learning is living, living is learning" (Siebert, 2003, 18). What kind of life will we live then if there is no fun in learning? What potential for growth, sense of success, or possibilities for self-fulfilment will we miss if we are not keen to meet and master challenges? If, however, the power and pleasure of learning and work can be discovered and stimulated, this power and pleasure can be used for the good of both - the individual and the community.

Many authors have written about the fascination with (computer) games (e.g. Huizinga, 1997/1971; Fritz, 1995; Turkle, 1998). Here we should note that selected aspects make handheld devices attractive also for learning. The advantage of digital information lies in its potential for creating content that enhances learning: for example, hyperlinks can link to further knowledge and information can thus be presented at different levels and in varying detail according to need. The user can interact with the learning material and receive performance feedback, either system generated messages such as 'Correct, well done!', or even interactive feedback from peers. Searching for particular learning materials is much easier because it is no longer necessary to do a serial search through books or piles of paper. Instead, the electronic environment makes it possible to find the required content quickly and without much effort. It is furthermore possible to filter content according to keywords. Another important point is that the updating of learning materials can be done easily and quickly.

Textual content can also be enriched by meaningful use of Multimedia. Animation and simulations can be used to illustrate concepts that cannot be directly observed and are difficult to explain. Information transfer on the Internet, for example, was simulated in a clear manner via TCP/IP protocol. Electronic colours cost nothing and if used with principled care, they make text visually appealing and help to create a clear and coherent design. The user is then less aware of technical aspects, is less intimidated and therefore less likely to turn away from the new technologies. The traditional 'dry' learning content can be revitalised and made more vivid. This vividness attracts the learner's attention, and provides continuing fascination and motivation. In this way learning can be delivered in fun 'parcels', it is easy to understand and retain, it is diverse and appeals to different senses, is entertaining and hence a more rewarding experience.

4. Mobile and Motivating: Micro

Mobile learning has been possible for some time, though limited in scope by factors such as the number of books and documents that can be carried, and hence the need to carefully select the literature that can be taken on journeys. It shall not be denied that traditional learning materials can be motivating and can awaken a thirst for knowledge. Rather, the intention is to show that in small formats there is great potential for mobility and motivation.

Such small formats have a variety of applications (see Chapter 2 for a description). However, the advantage of (playful) learning via fun 'parcels' also lies in the close reference to the learner's real-life context, because learning is possible right were it is needed. When students and skilled workers are asked to list factors they find motivating or de-motivating in learning, they tend to attribute a lack of motivation to situations where the need for learning and its application are not clear. It is possible, however, to make learning happen "wherever life takes you" because the end products from information and communication processes, for example iPods or head-mounted displays, are getting smaller, they are turning micro[3]. The learning units are getting smaller. The learning content is getting smaller. Micro end products need Microcontent and give rise to Microlearning. Microlearning fits in perfectly with the 'playful' approach to learning and the 'playful' design of learning content. The micro pieces must fit easily into a larger whole and because they tend to be used in noisy and distracting environments, they must attract and hold the user's attention for the relatively short periods they are in use. The playful approach is ideally suited for this.

Microcontent has, furthermore, a motivating and attention-grabbing effect in that the small knowledge-bits are just the right size and contain only essential and relevant information. The information is therefore easily digested. There is no need to display 989 pages which indicate the vast amount still to be learned and hence may overwhelm the learner. Instead, learners are freed from the burden of knowledge – in both the physical and mental sense. The learning experience is thus given a new dimension of levity, and on different levels.

3 Even if the trend is 'getting micro', there is a limit for the size of mobile devices because of the necessity to handle them. This limit could be broken by operating with the mobile device via voice control, for example.

The mobile learning environment has limitations but is particularly suitable for areas where learning needs to occur 'on demand' and 'just in time'. In this context learning is highly effective because it is relevant and can be applied immediately. Mobile Microlearning is less appropriate in a situation where learning must cover entire topics (to the extent that such learning is feasible) but is most successful when structured in bite-sized bits of information that can be used to refresh or add to existing knowledge. Acquiring a wide knowledge base can be difficult because the mobile device is too small to display an overview or much detail. Knowledge bits, though attractive, appear as isolated items. Thus there is a lack of the context that is necessary for initial comprehension. The small display area also makes it difficult to navigate the content pages. Although the Internet is based on 'pull' technology (Steinberger & Mayr, 2002) where the user must request information, mobile devices will lead to a rise in the delivery of information 'push' style, which can be characterised as 'finding, not searching'. Any attempt to simply transfer desktop learning applications to mobile devices is bound to fail (Zobl, 2001) because in addition to the problems of navigation, it is not access to a complete learning programme but rather to single 'knowledge-bits' that should be flexible and mobile (Steinberger & Mayr, 2002). In order to help learners succeed it is necessary to link traditional learning approaches and mobile microlearning in an effective and meaningful manner. A successful outcome, in my view, can be achieved by creating well-structured and categorised learning materials from desktop-eLearning platforms. Materials are thus already divided up into smaller or micro units. Indeed, true microlearning can occur where such eLearning programmes comprise mobile and context-searchable smaller bits of information, which are interlinked in a way that makes transparent their connexions and embedding into the larger whole.

As an example, for our partner in the paper industry this would mean the ordering of learning content into categories that make orientation easier and that provide simple cognitive schema which facilitate the rapid and reliable entry of content. The process of developing best practice solutions for manufacturing processes in the paper industry produced the categories listed below.

- Aims/Why?
  Employees must be aware of the objectives and understand the rationale for working practices. In addition to increasing motivation, transparency about the necessity of implementing certain measures ensures that 'correct' decisions are taken.

- When/How often?
  Employees should be informed with regard to when and how often a specific procedure has to be carried out. For example, certain maintenance procedures must be followed at regular intervals, or specific measures must follow certain events.
- Procedures
  All procedures are to be explicitly stated in coherently structured and easy to follow steps.
- Tips
  Special advice should be listed in the form of tips, perhaps listing points to note while working through certain procedures or stating solutions to frequently encountered problems.
- Safety measures
  Safety rules and measures must be made explicit in order to protect employees' safety and prevent accidents and injuries.

The categories above can be made more salient through colour coding and the addition of memorable icons. Figure 1 shows a simple outline that is intended to present the main idea.

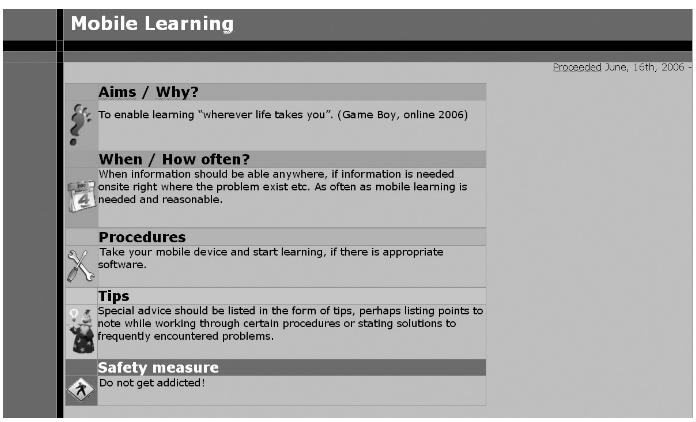

Figure 1: Design of learning units that facilitate orientation and enhance recognition[4]*.*

4 The learning unit was developed with Content Creator, version 2.9, from bitmedia. The icons were downloaded from http://www.sukria.net/images/icons-window.png, http://dotpups.de/files/iconsets/kde-icons-48x48.jpg and http://www.polymedial.de/digitales/websites/icondesign_04.html to show the idea.

There is colour coding and the addition of memorable icons in the design of the single categories too, as shown in figure 2.

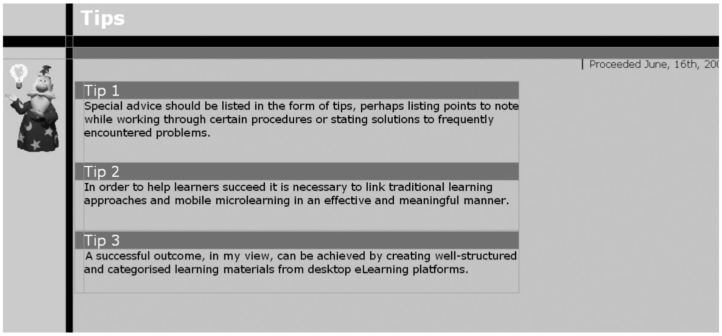

Figure 2: Example of the design of the category 'tips' in the desktop learning environment[5]

Keeping the colour coding and the memorable icons eases the classification of the knowledge-bits. The information from the mobile device is shown in the global context of the desktop-eLearning system. Microcontent is subject to the limited transfer rate for mobile devices and thus has to be simple and 'slim'. Colours and small icons are therefore suitable for mirroring the embedding of micro information bits into the larger context of the desktop-eLearning environment. Tips, for example, which can guide certain steps to be taken on the actual shop floor, can be delivered via mobile and instantly recognised as such by colour and icon (see figure 3).

5 The icon shows Merlin, the avatar from the Content Creator.

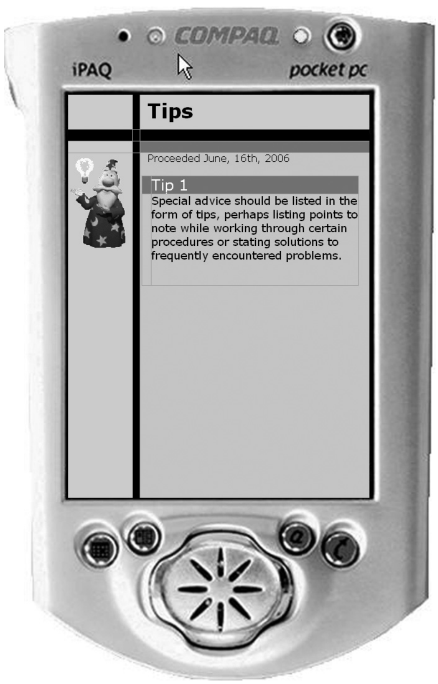

Figure 3: Application and recognition of an information bit from the 'desktop-eLearning' platform on the mobile device[6]

The design of the microcontent is very vivid, motivating, suitable for mobile applications and in an appropriate situation helps to develop something very big from something very small.

6 To outline the idea a picture from the Pocket PC from Compaq was used, which can be found at http://web.mit.edu/vivoni/www/esri/p010203.jpg. Navigation elements are missing in the illustration because of the reduced representation.

5. Mess, Confusion and Chaos?

The question then is what the effect might be on our daily lives when we constantly carry small and often private information units, when we have access to learning and information anytime and anywhere, and when there is access to us anytime and anywhere. According to David Nott, addiction treatment manager at the Priory Hospital Marchwood in Southampton, „People are beginning to treat their mobiles as human beings because they symbolise contact, friendship and attention" (Nott, 2006). However, Nott also found that the use of mobiles can lead to addiction. Another question is whether carrying a mobile device at all times will lead to anxiety, or perhaps a sense of being constantly subject to control. Will our identity become ever more fragmented? Can mobile information transfer maintain a certain degree of data safety and protection? What are the implications for safety at work when manufacturing workers' attention is focused on handhelds? Will we lose our overview in the face of incoherent and seemingly incoherent bits of information? Or is it an outmoded idea that one needs an overview? Do we thereby cause our lives to descend into chaos?

Even in the television it was suggested that viewers are overwhelmed by floods of pictures and comments that are often removed from context. Hertha Sturm (2000) refers to the missing 'half-second' which individuals would need in order to understand the information with which they are bombarded. In the case of a book, for example, turning pages causes breaks during which the brain can find the time needed for assimilation. However, in the absence of such important breaks, assimilation processes cannot also be cut short, at least not to the same extent. The overload of information, news and lifelong learning can lead to a fear of 'spoiled time'. In the same way as the mobile telephone has almost forced us to be available at all times and has, therefore, become a nuisance, the pressure of lifelong learning might become unpleasant and have grave consequences if every bit of time can be filled with further learning. If there are no opportunities for relaxation and 'quiet time', then there is also no opportunity for strengthening existing knowledge, for letting thoughts wander or for creativity.

As noted in the introduction above, the taxi driver's PSP has not pushed out reading, nor must we allow the technology to take over. There must be an even-handed approach, taking a step back, looking at the world away from the ubiquitous computer use.

If this can be achieved, we might, where appropriate, fill many idle moments in our lives with meaningful activity. For example, we spend time travelling by plane, train or bus, in doctors' waiting rooms or at the hairdressers, all of which takes up valuable time that might be used more effectively. And for this, mobile devices provide an ideal solution.

6. Method and Team

The theoretical and visionary explanations derive from practical experiences with projects in the paper manufacturing industry and my experiences as a university teacher using eLearning-platforms.

For our partner in the paper industry a first module of a Knowledge Management System– an electronic shift protocol – was developed and put into operation in 2002. In 2003 the system was expanded by two further modules – a shift support based on Best Practice and an extended search function including expert lexicon and technical dictionary. The project was coordinated by DI (FH) Wolfgang Meyer, the eBusiness Institute of the Alpen-Adria-University of Klagenfurt (Univ.-Prof. DDr. Heinrich C. Mayr, DI Harald Semmelrock, DI Marko Anzelak, Mag. Gabriele Frankl) and addIT as partner for implementation. At the end of 2004 the conceptualisation of an eLearning module was started, which is currently being developed with the following partners: eBusiness Industriestiftungsinstitut of the Alpen-Adria-University of Klagenfurt (Univ.-Prof. DDr. Heinrich C. Mayr, Dr. Claudia Steinberger, DI Marko Anzelak, Mag. Gabriele Frankl), Institute for Media and Communication Studies (Univ.-Prof. Dr. Christina Schachtner, Mag. Gabriele Frankl and Mag. Angelika Höber) and addIT.

7. Conclusion

The aim of the paper was to show how micro-content, delivered via mobile devices, can be designed to enhance the drive for learning and to improve the quality of materials in order to discourage passive attitudes, to enrich work and life in general, to fill idle times with useful activity, and to integrate fun learning into daily life. The goal here is to further personal as well as collective development.

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Microlearning in Virtual Communities of Practice?

An explorative analysis of changing information behaviour

(Changing Patterns of Learning: Schools, Universities, Vocational Training)

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Abstract: During the last years there was an increasing demand for a new paradigm to better model computer-supported learning and knowledge-processes. With concepts like eLearning 2.0, Connectivism and Microlearning, first approaches are made to adequately describe the development of new information behaviour.

Virtual communities of Practice as places of informal social activities of knowledge-building and learning are the obvious place for an analysis under the above mentioned point of view.

The paper will first bring out the essential aspects of new approaches to educational research and give an introduction to the concept of social learning in virtual communities.

The introduction will be followed by a re-interpretation of the results of selected studies concerning learning in virtual communities of practice. With this analysis it can be shown, in how far interests of community-members as well as their usage comply with concepts like shallow thinking, connection-making or microlearning. The paper thus contributes to the urgently needed empirical description and awareness of changing individual information behaviour, which is a first step towards developing supportive educational scenarios.

1. New Concepts of networked learning

In his paper „eLearning 2.0“ Stephen Downes claims that during the last years, eLearning at large developed further together with the world wide web to an extend that requires new terms and models for analytical description. A closer look to discussions and publications of the last years reveals a number of approaches and concepts that aim at modelling actual media use, three of them will be summarized in the following chapter.

1.1 eLearning 2.0

The term "eLearning 2.0" was chosen by Downes in analogy to the buzzword "Web 2.0" that summarizes platforms, applications and services that enable users to easily create, share and connect content on the web (e.g. social networking sites, blogs, wikis,…) which is thus continually transformed from the so-called *Read-Web* to a *Read-Write-Web.* Although "Web 2.0" is about technological development, the most fundamental changes occur at the level of internet users, who as "digital natives" (Prensky 2001) developed new approaches to learning, working and gaming online:

> *„They absorb information quickly, (…) from multiple sources, (…) expecting instant responses and feedback. They prefer random „on-demand" access to media and expect to be in constant communication (…). "*
> *– Prensky (2001)*

In its core, „Web 2.0" is based on participation, content-creation and personalization. Against this background the term "eLearning 2.0" is chosen by Downes, to adequately describe a range of analogous approaches and developments in the field of eLearning. In contrast to the currently prevailing learning platforms with prestructured, linear learning paths, Downes anticipates the eLearning-application of the future to be a learning environment with several interoperating applications. This environment acts as a node in a web of content and supports learner by contextual collaboration with people and systems. This vision of future eLearning is among other things based on the learn-theoretical approach of connectivism which is getting more and more influential since its first publication in 2004 by George Siemens.

1.2 Connectivism

In the article „Connectivism: A Learning Theory for the Digital Age" Siemens claims, that the three main learning theories behaviorism, cognitivism and constructivism can no longer be used to adequately describe and analyse learning processes or develop learning environments considering the radical changes during the last 20 years. He emphasizes the necessity of a fundamentally new perspective on learning

> *"Many important questions are raised when established learning theories are seen through technology. The natural attempt of theorists is to continue to revise and evolve theories as conditions change. At some point, however, the*

underlying conditions have altered so significantly, that further modification is no longer sensible. An entirely new approach is needed.“
- Siemens (2004)

Technological development, that brings with it a reorganization of living, communicating and learning as well as the shrinking half-life of knowledge leads to a change of learning processes. Some significant trends are:

- Informal learning is gaining more importance, as learning occurs through communities of practice, personal networks or completion of work-related tasks
- Technological tools are altering and shaping the way we are thinking
- (cognitive) processes can be supported or taken over by technology
- Know-where is getting more important than know-how or know-what

Starting point of connectivism is the individual but learning is no longer considered to be an internal individualistic activity. Rather it is becoming a core competency, to connect to specialized nodes or information sources, when individual knowledge at the point of application is not sufficient. In this way, access to what is needed is getting more important than the knowledge currently possessed. As we can no longer personally experience and acquire all learning that is needed to act, competence has to be derived from forming connections. To facilitate continual learning, it is necessary to create and maintain multiple connections. From a connectivist point of view, learning is a process of connecting specialised nodes or information sources and may also reside in non-human appliances.

1.3 Microlearning

The term microlearning is not so much a clearly structured concept, but "a metaphor referring to a set of models of learning" (Hug 2006, p.3). Microlearning is understood as learning of microcontent or acquisition of microknowledge (Langreiter/Bolka 2005, p. 1). In contrast to connectivism microlearning is rather an integrative perspective that concentrates on structuring and syndication of information. Focus is the learning individual and although microlearning includes informal learning it has been mainly applied to model formal contexts.

The concept of microlearning is trying to provide forms of teaching and learning, that comply with the demands of information society like highly specialized knowledge work, information-overload and lifelong learning (Bruck 2005, p.1) by focusing on dealing with large amounts of information and continuing integrated learning processes. Although there doesn't exist a precise definition of microlearning, its different forms can be analysed through the interaction of several dimensions (Hug 2006, p.3).

In the context of virtual communities, microlearning denotes spontaneous, informal and rather short learning- or information-activities, that connect to other social knowledge-sources via the internet. The shift to microlearning is characterised by the following three aspects (Bruck 2006, p.15):

- Creation of new architectures of information through reduction of information abundance and complexity as well as structuring in small units.
- Reduction of information from the perspective of the individual that has to cope with large amounts of new information and wants to learn. This requires new didactic models.
- Development and use of technologies to support learners in their individual habits and needs and offer personalised services to allow individuals to chose time, place and pace of learning

Especially for the development of better support for individual information-habits it is necessary to analyse in a first step individual needs and behaviour. As virtual communities are recognized as

Virtual communities of Practice as social learning and information spaces to which people quickly connect on demand are the obvious place for an analysis under the perspectives described in this chapter. In the focus of the following chapters is the theoretical foundation of an analysis of individual information-strategies and information-networks in social learning spaces.

2. Social Learning in Virtual Communities

Since the early days of the internet, even before the invention of graphical browsers, its different services have been used for communication between locally separated people. Soon, the first virtual communities developed, like "The Well" (Whole Earth

'Lectronic Link), that Howard Rheingold analyses in his book "The Virtual Community" (Rheingold 1993) giving a first description of the phenomenon of online communities. In the following years it was intensively discussed among experts if community can develop and exist on the internet at all, a question that has been answered in the affirmative today (Matzat 2004). At the same time, virtual communities were identified and examined as places of collaborative learning and implemented in formal and informal contexts.

Theoretical background for this research was provided by the moderately constructivist approach of situated learning, which Wenger connected to the concept of communities of practice in in 1998 (Wenger 1998).

2.1 Situated Learning

In the end of the 80s the assumptions of cognitivism in learning-theory were fundamentally questioned. This criticism aimed mainly at the reduction of human behaviour to cognitive information processing (Kerres 2001, p. 74) without considering the context of action. Brown, Collins and Duguid criticised for example the common assumption of a

> *„separation between knowing and doing, treating knowledge as an integral, self-sufficient substance, theoretically independent of the situations in which it is learned and used."*
> *– Brown/Collins/Duguid (1989, p. 32)*

Although different approaches of situated learning are connected through this fundamental criticism of the cognitive point of view, there is no comprehensive theory of situated learning, but different approaches using the same concept (Clases/Wehner 2005, p. 563).

One of the main constructivist thoughts of situated learning is that concepts are neither right nor wrong but merely more or less functional for certain situations. Like this, knowledge is closely connected to experienced situations, it kind of indicates the situation in which it was acquired and used. The term *situated* which was already used by Mead (1934), was taken up again in the 80s in the context of artificial intelligence-research (Winograd/Flores 1986) and then referred to situated human action (Suchman 1987).

2.2 Communities of Practice

From a situated perspective, learning can only take place in connection to authentic action, which in this context designates that action is embedded in a culture („ordinary practices of the culture" Brown/Collins/Duguid, S. 34) contrary to scholarly action with symbols (Lave 1988). Because functional knowledge can only be acquired in interaction with the social and physical context, processes of social participation have a key function for the learning process. Thus it is no surprise that already in the context of early situated approaches learning has been understood as enculturation into a community of practitioners (Geertz 1983), a concept that has been developed further by Wenger and Lave under the term Communities of Practice (Lave, Wenger 1991).

In an interview Wenger summarizes three central elements that constitute a CoP (see De Cagna, p.7):

1. Domain: The members must have expertise in a common area („domain"). In contrast to teams CoPs are defined not by a common task but by the shared interest in a topic.
2. Community: There must be a group of people, who interact with each other, develop ideas together and exchange experiences.
3. Practice: A further important element is a shared practice of the members, that is developed over time within the Community e.g. by together finding solutions for current problems.

The process of jointly defining meaning within a CoP is described by Wenger as a combination of participation and reification (Wenger 98, p. 55f). While participation designates the comprehensive sharing of common practice, reification represents the process of the shared formalization of experience and/or abstract knowledge into artifacts of the Community. Over time a commonly negotiated repertoire at abstractions, stories, tools, concepts, routines and procedures develops. Although CoPs in enterprises are increasingly created from the outside, they always are self-organized systems without a teacher role. The activities and topics of a CoP reflect the understanding of the individual members of relevant topics in their daily practice. CoPs represent a place of common learning: participants exchange ideas and best practices and together generate new knowledge, which in turn improves the individual practice of the participants.

2.3 Legitimate peripheral Participation

The Community of Practice approach is based on the concept of situated learning. In their book „Situated Learning. Legitimate peripheral participation" Lave & Wenger (1991) describe learning based on anthropological research as legitimate peripheral participation (lpP) in a CoP.

At the beginning of the learning process and in the state of lpP the novice takes up a position at the fringe of the community. Free of the responsibility that full membership would bring, he participates only partly in common practice (described as peripherality) but at the same time hat full access to the common practice of community members (legitimacy). The process of situated learning leads to the expert status and a full membership within the CoP and represents thereby also a process of cultivation. LpP thus describes the relationship between experts and novices and the process of growing into the community. Lave and Wenger indirectly take on Wygotskys concept of support in a zone of next development: learning is being facilitated through participation in the practice of experts, who already are in an advanced zone of development.

The learning motivation of the participants arises from the desire for intensified sharing of common practice as well as for its improvement. Only through this shared practice learning objects can become important for the individual (see Arnold, p. 80). It has to be taken into account that frequently it is not, as generally presumed, the exchange with the experts that is most efficient but rather the exchange with other novices (Lave & Wenger 1991, p. 93).

Naturally the learning process is not finished after developing expertise. The introduction of novices is, as Wenger points out, only a variation of the learning process that also defines the later advancement of the shared practice by the community members (Wenger 98, p.102).

3. Community-Research revisited

Wenger (2000) distinguishes five different levels of participation in communities of practice (see figure 1).

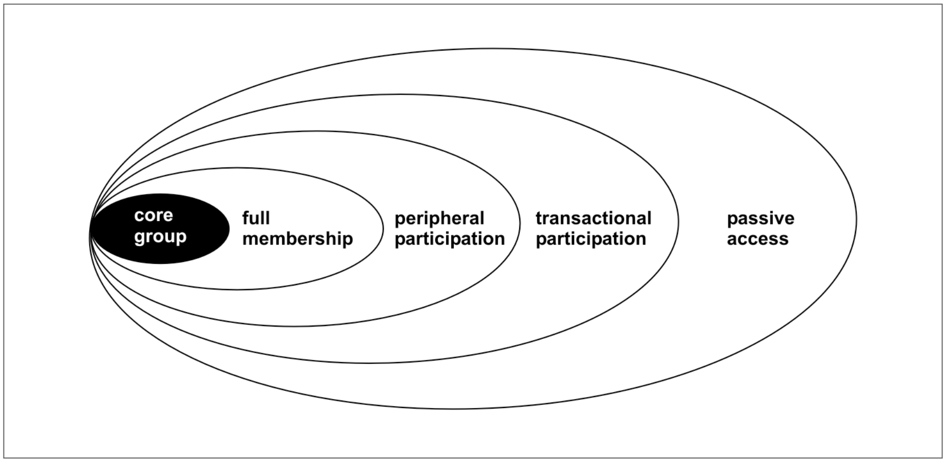

Figure 1: Participation levels (Wenger 2000, p.219)

Discussion of situated learning processes of enculturation described above only includes the three participation levels shown on the left side. The levels of passive access (access to artefacts produced by the community e.g. archives) and transactional participation (outsiders who interact occasionally to receive or provide a service) are hardly ever considered especially not in terms of learning. Even peripheral participation is not researched very often as community-studies mostly focus on learning processes of active participants and full members.

This is why, as Stegbauer (1999) observes, community-research often provides a distorted picture of actual community use, because access by these peripheral groups constitutes a large part of community usage, but is rarely considered nor supported on this note.

3.1 Lurkers – the neglected majority

Those users of virtual web-based communities who read messages of other users but do not or rarely post messages themselves are commonly referred to as lurkers. Lurking-behaviour is a mass phenomenon as lurkers are in most cases the majority of users in mailing lists and message boards. Estimations run up to a lurker-poster-relationship of 100:1 (Carroll/Rosson, 1996). A survey of a large business consultancy in Chicago indicated, that 98 % of the visitors of large online message boards (e.g. AOL and MSN) never posted any own ideas or messages (Katz, 1999). Other researchers found an average lurking-rate of 46 % in health-related boards and 82 % in mailinglists about software-support (Nonnecke et. al, 2000) respectively a rate of 52 % lurkers that read postings and 6.2 % that never read postings of active members (Soroka, 2003).

Given the prevalence of Lurking in virtual communities, behaviour, strategies and motivation of this user group are rather sparsely investigated. In publications about virtual communities, there are mostly only posters viewed as community-members, lurkers are hardly ever explicitly examined, although according to the concept of legitimate peripheral participation, they are supposed to represent an especially active group when learning is concerned. This reluctance can probably at least partly be explained with methodological problems that occur when researching "invisible" lurkers. For this reason it is mostly research about lurking in mailinglists as in these cases it is at least possible to gain information about numbers of subscribers which is much harder in the case of message-boards. But without analysing logfiles it is also in mailinglists hard to tell, if subscribers ever read postings of others at all (Soroka, 2003).

Another problem when researching the phenomenon of lurking is that its not easy to find a clear definition. Some authors for instance also define transactional (Wenger 2000) community-members who are posting seldom or only sporadically as lurkers (Nonnecke, 2000; Rafaeli, 2004). This example shows, that it is impossible to establish fixed classifications of lurkers and posters, as they can neither cover changes in time nor in individual behaviour in different lists. In addition, it is in most cases not possible to confirm if members are sending side-posts i.e. messages directly send to other listmembers. The phenomenon of lurkers sending side-posts is described by Katz, who analyses differences between public and private reactions to his postings and articles (Katz, 1998).

3.1.1. Perspectives on Lurking

In many cases, lurkers are viewed rather depreciatory. In a discussion about the subject in the virtual community "The Well" which was described by Rheingold (1993) one poster claimed that lurkers should pay more for their internet-connection than active members. The appraisal expressed here, that lurkers are supplying themselves at the expenses of the community with information is expressed not only by active community members, but also regarded as reason for lurking by numerous researchers.

Schönberger (1998) for instance holds the opinion, that lurkers are merely wasting bandwidth. Furthermore not only Kollock and Smith (1996), but also Wellman and Gulia (1999) as well as Morris and Ogan (1996) defame lurkers as free-riders. Beside this basically rather negative view, lurking is often advised to newcomers in virtual communities, to get to know rules, conventions and topics of the community before actively participating themselves (see Stegbauer/Rausch 2001, p. 49). This strategy corresponds to the concept of legitimate peripheral participation in communities of practice according to Lave and Wenger (1991). Empirically validated was the approval of so-called educational lurking through a study, according to which 64 % of the members of educational and 71.5 % of health support communities are considering it important to allow and accept lurking (Abras, 2003). In addition, posters feelings of resentments against lurkers seem to be less distinct than the above mentioned negative connotations let assume (Nonnecke, 2004).

Views on the phenomenon of lurking are ambivalent – an observation that also proves to be true for scientific discussion. Rafaeli summarizes the conflicting approaches to lurking from perspective of the community as follows:

> *„On one hand lurking is a way of getting to know the community and becoming an integral part of it […]. On the other hand lurking is seen as a negative behaviour that can jeopardize communities' existence. Free-riding can cause a "tragedy of the commons" […]."*
> *- Rafaeli (2004, p. 3)*

Noticeable is, as already mentioned, that even in the scientific community a negative view on lurking prevails. In this context, lurking is primarily viewed from an E-business-perspective i.e. the perspective of community-operators. Nevertheless in recent years there was a continual change to the perception of lurking as legitimate strategy to be taken seriously (see also Nonnecke/Preece 2004):

„We used to think that we should encourage all community members to participate equally. But because people have different levels of interest in the community, this expectation is unrealistic."
– Wenger/McDermott/Snyder (2002, p. 55)

Despite this trend, aim and focus of most research remains at least implicitly the process of so-called delurking, which means the development from lurker to active participant, i.e. poster (see Nonnecke, 2004). In many cases the results are merged to recommended measures to better support the development from lurker to poster (e.g. Soroka, 2003).

The described conflicting perspectives towards lurking will in the following be examined closer from a pedagogical perspective. This examination is led by the assumption, that through a change of perspective the reproach of free-riding can offer an alternative view on individual strategies of informal learning of lurkers. We assume that learning activities identified in this context can be matched and explained with the concepts of networked learning introduced above.

3.1.1.1 Lurking as Legitimate peripheral Participation

The notion, that lurking is an important developmental stage while integrating into a virtual community, will be designated in the following as *developing perspective.*

Theoretically, it is based on the concept of situated learning through legitimate peripheral participation by Lave and Wenger. Also in the context of community-building different development stages of the community are conceptualized according to the shift from lurker to core member on the individual level. Reichelt for example identifies three steps of community-development: entry, participation and emancipation. While in the first phase input is mainly given by the operators, community-members continually learn to operate the platform themselves at begin to form a social network, that leads to a self-organised community of emancipated members (Reichelt 2004, p.72). The assumption, that active participation in a virtual community of practice is preceded by a phase of passive observation, is self-evident and in applies in many cases. But there are also findings, that contradict the general applicability of this model, like a recent survey showing that a core of active community-members participates from the beginning and does not necessarily need to go through a process of activation (Zinke et.al., 2004).

Soroka found that the time span of lurking prior to the first posting had no influence on users' future participation behaviour (Soroka 2003, p.10). Also the analysis of Stegbauer shows, that the first posting was in most cases sent after a relatively short period of passive membership. The likelihood for inactive participants to become active was already minimized after four months. Of the new subscribers during the period of data collection only 30 % became active posters (Stegbauer 2000, p.123).

It can be summarized, that the concept of legitimate peripheral participation is applicable to learning processes of lurkers in virtual communities. But it can not be used to exhaustively describe and explain the mass phenomenon of lurking, as lurking appears to be less a phenomenon of transition but rather a durable pattern of behaviour.

3.1.1.2 Lurking as Microlearning

As an alternative to the *developing perspective* one might re-evaluate the accusation of free-riding raised by the community to facilitate a different perspective on the lurkers' individual informational strategies. This perspective will in the following be called *informational perspective.* With this perspective lurking can be seen as a legitimate and – probably – very efficient informational behaviour. As has been said earlier this perspective is being supported in research to an increasing degree (e.g. Nonnecke/Preece, 2004). For the examination of this perspective it is not sufficient anymore to use the earlier described paradigm of enculturation, which has been transferred from offline- to online-cultures as the strategies of information enabled by digital networking seem to possess new qualities.

Concerning the reproach of free-riding, there are numerous approaches and arguments that emphasize the social function of lurking for the community. E.g. bridging to other communities in the sense of weak ties (Stegbauer, 2000; Nonnecke et.al, 2000), management of resources, which means the use of archives and faqs to hold expert inquiries low (Madanmohan, 2004) and the avoidance of information-overload which would be the result of intense contribution by all members (Stegbauer, 1999; Rafaeli, 2004). But besides that there exist also findings on the reasons of lurking which indicate that lurking supports individual strategies of information and learning.

Asked for the reasons for lurking, 54 % responding lurkers in mailinglists stated that reading/browsing was enough, 13,2 % had no intention to post from the beginning and the majority was looking for answers to questions they had (62 %). Although not posting, 50 % of the lurkers did profit from list-membership as expected compared to the posters (Nonnecke/Preece, 2004). In a survey about reasons for using online-communities the reason mentioned most often was to find solutions and answers for urgent problems and questions and to receive general suggestions and tips while discussion and debate with others was no reason for community-use (Zinke/Fogolin, 2004). Aviv (2003) conducted a content-analysis in an informal message-board to study processes of knowledge construction and found that only simple questions were answered and that discussions never constituted processes of negotiation of meaning.

This summary of recent results regarding reasons for lurking shows that in many cases learning is not necessarily connected to enculturation into the community but that users are accessing archives or even posting some messages in order to quickly find needed information. The high percentage to which lurking occurs also depends on the special conditions of virtual communities. In many cases for instance it is much less costly to passively access archives of a virtual community or post a single question than to find experts for a face-to-face-meeting. Furthermore, virtual communities can according to Wellman (1999) characterized by their network-structure: people are no longer embedded in traditional, closely knitted and binding face-to-face communities but are moving through loosely connected less binding and often changing networks that are nevertheless still supportive and sociable.

4. Conclusions and further research

Drawing on existing studies about user- and especially lurking-behaviour it could be shown that established concepts of informal learning in virtual communities are not suitable to grasp user behaviour in all forms.

It can be assumed from the above presented research and considerations that by visiting, using and participating in different virtual social spaces, users create and maintain their individual informational environments to which they can connect on demand if acute problems or questions arise. Thus it appears adequate to view informational- and learning-strategies in virtual communities as microlearning from a connectivist perspective.

To further analyse individual strategies and behaviour explorative qualitative studies will be conducted by the authors. By using interviews for data-collection it will furthermore be possible to draw a more complete picture of lurking behaviour in different web-based environments than existing studies that do mostly focus on mailing-lists. As informal learning in virtual social spaces is becoming more important it is necessary to gain a deeper understanding about personal strategies of learning virtual social spaces. Based on the empirical description and awareness of changing individual information behaviour, it will become easier to develop adequate supportive educational scenarios.

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Microlearning in Trade Union Education

Designing and Implementing Innovative Educational Services Using Microcontent

(Changing Patterns of Learning: Schools, Universities, Vocational Training)

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This paper presents a case from the often neglected yet very instructive field of trade union education and examines how microcontent was used in designing new educational services that extend and enhance the traditional, classroom based learning environment provided in this field.
The aim is to point the attention to relevant success factors and research issues which can be discovered in that particular case and may help develop the use of microlearning and microcontent in educational contexts further. On a second level I would like to contribute to the ongoing discussion[1] on the role of informal education and the question if and how it can be supported by educational institutes or even be integrated in their portfolios. My thesis is that this can be possible without touching or destroying the genuine culture and value of informal learning – if done with care and a viable concept. The learning from this case may in this perspective lead to a general model applicable by different kinds of educational institutes.

1. Challenges in Trade Union Education

Trade union education can be seen as a collective name describing a mixture of organized activities in different educational spheres. To a large extend it is dealing with forms of civic education which are openly offered to adults and youth. These activities are usu-

1 Cf. positions of G. Siemens, J. Cross and others.

ally based on trade union values and aim to promote these values towards society. To a lesser extend the term also refers to those educational activities which are organized to serve the development of human resources within trade union organizations themselves. However, the largest share in all of which is perceived as trade union education – and the most interesting one – is that of the training provided for shop stewards (Vertrauensleute), members of works councils (Betriebsratsmitglieder) and trade union representatives in the board of (large) companies (Aufsichtsräte) or in other words: organized educational services for institutionalized and to a growing extend also professionalized functions in industrial relations.

1.1 Training Members of Works Councils

In German industry, the service and the public sector roundabout 300.000 elected members of works councils (Betriebsräte) hold the mandate to represent the workforce. Most of them work on a volunteer basis and thus engage in an extra activity next to their learned profession and their "official" job at the company. Only about 20 % are working on a full time basis. All are elected for a four year term and have to be reelected or continue with their actual job afterwards. On this basis education and training become crucial for the functioning of a works councils. German labour law consequently stresses the important role of education by guaranteeing any member of a works council access to education, or to put it precisely, it guarantees them the right to visit seminars ("Schulungen" lt. BetrVG, §37, Abs. 6) and forces their company to pay for the costs – as long as the subject of the particular course is crucial for the fulfillment of the tasks of the works council of the company. As a matter of fact, German labour not only guarantees access to education it demands from any member of a works council to actively engage in it[2].

The tasks of a member of a works council, which education should enable them to fulfill, are not limited to organizing and representing the collective will and the interests of the workforce but in many fields also include the responsibility to co-manage the com-

2 Despite this, studies show that only about 35 % of all members of works councils do attend seminars and courses to qualify themselves for their mandate. One of the basic reasons not to do so is lack of time – basically a problem for works councils with members working on part time basis and for SMEs.

pany on behalf of them. Beyond basic competencies in managing boards and meetings this requires up-to-date expertise in highly specialized domains of knowledge from the world of labour and industrial relations. The broad range of complex subjects they have to cope with in their daily work, often mixed and intertwined, starts with legal matters, – labour law in particular –, as the most obvious and irredeemable ones, and are followed by economics and management as well as health and safety issues or ICT. In all of these subjects they are asked to argue, decide and act appropriately and in accordance with the state of the science. And as crisis becomes a steady state in most industries and companies they are asked to do so under enormous stress and with large ethical burdens.

1.2 Understanding the Learning Ecology of Members of Works Councils

To work as a member of a works council, it is often said, means working in one of the most learning rich environments that can be found in a company. It is defined by multitasking, constantly changing situations and a broad range of subjects matters.

A close examination of the learning ecology of works councils shows clearly that – despite the almost unique focus of trade unions and German labour law on formal education and traditional classroom learning – the vast majority of the knowledge, expertise and competencies used in their daily work derives from informal, self organized or unorganized forms of learning. A recent study[3] provided strong evidences for this assumption. Whereas 51 % of the interviewees (mostly members of works councils and the board of companies) said they would consult the internet in case they need help to solve a problem connected to their tasks as workers representative, only 42 % mentioned seminars and conferences. In total – it turns out to be the most unlikely path to follow for them. In contrast to that 65–75 % would rather consult a colleague, an expert or – most likely – printed material (books, papers etc.). In other words: the basic thing to understand is that the existing and well established learning ecology of a works council is much broader and deeply rooted in the daily practices of all members of a works council than had been taken into account from the limited point of view of institutionalized trade union education.

3 Hovestadt (2005)

Thus, taking this kind of unlimited view on the whole **learning ecology** of works councils leads to a revised insight into the motives of its members for attending seminars and courses as they do within the established institutions of trade union education. Rather than education it is solutions for current problems that they are looking for – once their daily routines of finding crucial pieces of knowledge fail. Routinely and on a daily basis they are in need of quick access to such very specific pieces of information in support of either collective decision making and consulting processes or the closing of individual skill gaps. The ranking found in the answers of the study cited gives clear evidence that they are looking for it within their personal environment, in a social as well as in a spatial sense. In other words the learning ecology of members of works councils should be described as a personal learning environment, were institutionalized learning spaces and organized education are only one (minor!) element. And one of the additional interpretations one may draw from the data cited above may be that they, following their preferences, rate these personal resources possibly as more reliable or efficient ones than seminars.

Likewise, attention needs to be turned towards the learning styles of this particular target group. They are working and acting in an environment which leaves hardly any place for reflection and learning on stock. They have to act and acquire knowledge often simultaneously and under enormous pressure (limited time budgets , heavy workload, „sandwich-position" between management and companies workforce, etc.). The tasks they are involved in change constantly, they have to inform, consult, discuss, negotiate and decide on issues which are highly complex and are evolving permanently. To manage that, occasional learning and learning in action has become a habitualized behavior and must be seen as their standard mode of operating. Hence usability, relevance, action orientation and up-to-datedness come first! Knowledge is essential and needs to be at hands quickly, thus for them effectiveness in acquiring knowledge is a top priority. Consequently their learning style should be regarded as a form of personal knowledge management. Supporting effectiveness should become one of the main goals for educators.

Following this line of thought it is interesting to take a second look at the finding, that almost half of them would consult the internet and prefer this to attending a seminar. As with most other target groups, the internet, especially the google search engine, obviously plays a significant and growing role in the individual knowledge management of almost any trade or profession. As the study shows, this is true for members of works councils in the same way as for others. Two different studies that were conducted to examine the daily work of a member of a works council prove that they make use of the internet as an alternative or even preferred medium to acquire knowledge and expertise when needed. Two quotes demonstrate how the established routine of asking ones trade union (representative) whenever a problem occurs that cannot be solved with existing resources and knowledge is now more and more being substituted by looking for help on the internet (or "asking" google):

> *„You don't have to take the long way to your local trade union or to ‚Düsseldorf' [formerly location of the DGB headquarter and until today, of the DGB Bildungswerk] to get an answer. You go into the Internet [...] and within an hour you know, what you wanted to know."*
> – member of a workers council quoted in a research study for IG Metall NRW (2001)

> *„You only get an information from IG Metall [German metal workers union, largest union in the world] if you can show your membership card and number. Even if you are in trouble they don't help you otherwise. With the New Media getting the information you need online is as quick as trying to get help from them on the phone. I prefer the Internet..."*
> – member of a workers council quoted in a research study for Hans-Böckler-Stiftung (2005)

These quotes do point the attention to the fact that trade union organizations do not deliver adequate support for informal ways of learning and acquiring knowledge online. As a starting point for that we, like anyone designing educational services and innovations in education have to understand that learning is (already) highly integrated into the daily (work-) life of professionals like members of works councils or similar target groups. It is also undeniably true that the rise of technology at most workplaces has changed or at least influenced individual learning styles. Designing innovations in education has to respect and connect to these pre-existing learning ecologies rather than to flatten and destroy them.

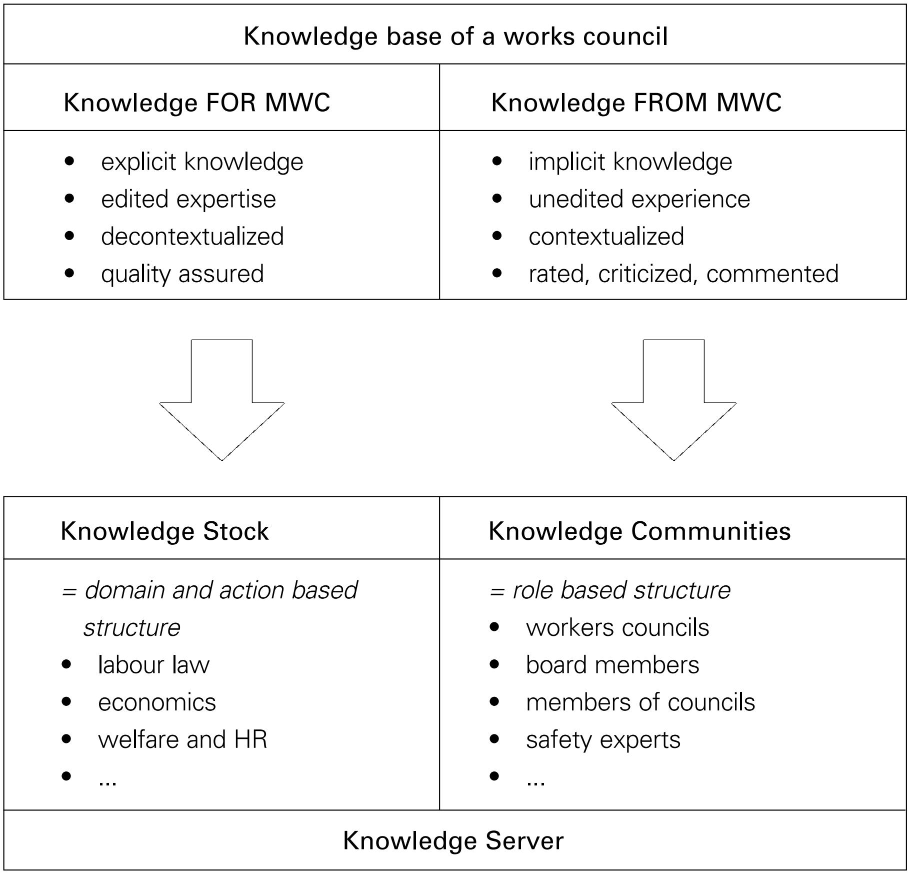
The success of the educational service described in this paper is a perfect proof for this thesis. It gives an example of how an educational service using technology and microcontent was designed "organically out of the media practices" (Lindner, 2006) of the target group. It works almost like piggy backing on the "routine activities of everyday digital life"(Lindner, 2006). With an example like this it also becomes clear that the "Googlization" of learning styles is not restricted to tech kids or an imaginary "homo zappiens". We will see what the consequences of this view can look like if seen as an opportunity for the design of intelligent educational services.

2. Designing Educational Services for Members of Works Councils Using Microcontent

2.1 Analyzing the Knowledge Base of a Works Council

By clustering the items found in the research quoted above and as a first approximation to describe the knowledge base of a works council we used the distinction of knowledge *for* and knowledge *from* members of works councils as the two most basic categories.

Although these categories should be regarded as "ideal types" they turned out to be of extreme practical value. Both could be and were used as a foundation stone in the construction of the architecture of the knowledge server to be built. Knowledge for members of works councils was collected in a "knowledge stock" which was then organized along domain- and action based hierarchies. Likewise Knowledge Communities were built in order to catalyze and support the knowledge production and sharing within the boundaries of the institutionalized roles in industrial relations such as members of works councils, chairmen of works councils, members of the board of a company, health and safety experts, representatives of handicapped staff, data protection representatives etc.



Because these categories also perfectly match the basic strategies chosen by members of works councils when in need for help, i.e. knowledge and expertise, this basic architecture guarantees a close relation with the existing learning ecology of works councils and their individual members by mirroring the underlying pattern of knowledge acquisition.

2.2 A Knowledge Server for Members of Works Councils

Designing a premium or value added service for participants of seminars that is able to blend into the existing learning ecologies and enhance the quality of learning taking place within the traditional settings was the initial task which led to the development of a “Knowledge Server”.

For this, and that was the second basic idea, it should be possible to make use of the vast amount of contents that are produced anyway in the daily practices of an educational institute and which are often co-produced by the learners themselves. So far, valuable knowledge that had been created during consulting processes, for studies or publications or even during e-mail conversations with colleagues, experts or participants disappeared without further notice or let alone usage in pedagogical contexts. Securing and formatting these contents in a way that allowed them to be reused was the first, making them easily available to the participants the second aim of the construction of a Knowledge Server. In other words: microcontent rather than any kind of technology (hype) was at the heart of it.

Basically the design of the Knowledge Server was meant to mirror the full knowledge base of an individual member of a works council and support the personal knowledge management. Whereas this happens to take place in role based knowledge communities and domain based knowledge stocks, I will from here on only refer to the concept and the realization of the knowledge stocks and the use of microcontent within that particular context.

2.2.1 Microcontents

The first list of possible formats for microcontents was generated on the basis both, the collection of preexisting stocks of knowledge that already existed as well as the known demand for relevant contents that was uttered by participants of seminars. In both categories we have user generated and edited content. The production of this content is either driven by experts and tutors or motivated by the participants of the regular courses.

a. Examples for expert driven content:

- basic texts / brief introductions
- relevant law textes + comments
- recent court rulings
- web based trainings (wbt)
- internal company agreements

- sample texts / letters etc.
- online resources (links, WBTs, etc)

b. Examples for user driven content:
- FAQs from a mailing list for course participants
- Comments from a mailing list for course participants
- commented statements by experts for a mailing list
- internal company agreements
- sample texts / letters etc.
- online resources (links, WBTs, etc)

It should be pointed out that this list mirrors precisely the requests for additional material that were constantly brought to the attention of the trainers and staff during as well as in the follow up of seminars and courses by the participating members of works councils. This demand was now translated into a repository of well defined and narrow formats for different kinds of knowledge assets regarded as help- and useful in the support of the daily efforts in problem solving by works councils.

2.2.2 Technology

The formatted contents are implemented as learning objects editable and accessible via a personalized, login-protected web portal. A flexible rights management allows individualized packages of content and services to be defined and later to be assigned to each user or group of users individually. New types of learning objects can be defined and added to the repository at anytime, if necessary.

The internet based software platform specially built for this purpose, consists of a web server, an application server and a combination of customized applications. It provides various services that support and facilitate the use and search of contents as well as community activities. A personalized homepage which shows up once a user has logged in, displays latest items added to the subscribed packages and activities (posts, requests, polls, new members) within ones community. Optionally offering RSS feeds for this functionality, rather than e-mail alerts as it is being offered now, is listed among the desiderata that came up only recently and is planed to be realized in the near future. One mechanism to access the contents is a classical navigation, which allows the content a user has chosen to subscribe to be browsed according to a hierarchy in a particular domain of knowledge which is structured by containers (chapters) and contents (learning objects) assembled within a particular container. Each container is headed by a brief introduction to the relevance of the subject described by a container and followed by a list of contents assigned to it.

More importantly, there are various search mechanisms at the users' disposal which can be freely combined in accordance with the individual users research habits or the logical necessities of a particular domain. There is a google-style search at the center of the user interface which aims to adapt to the everyday use that is made of devices like (primarily) google. It offers an optional search request to be made in google if the results displayed do not satisfy the users search tasks – a feature that is meant to support the argument that the use of the Knowledge Server can become as ubiquitous as the use of google which comes along with it still. The global search of the Knowledge Server covers all contents available on the server (– including the community activities and resources!). Next to this there are complex search mechanisms like filters (allowing categories, indexes and free text to be freely combined in a search) which can be applied to defined domains and supports quick access to the most relevant contents of a particular query.

Beyond the technological solution described here, the relevant point to make is that this architecture and service design allows a flexible use, supporting search patterns and habits that have become routine for the users. Lowering the (technological) threshold and blending into preexisting routines turns out to be essential for a scenario like this to work properly and to be accepted by the users.

2.2.3 Information Architecture and Taxonomies

The design of an information architecture that allowed each object to be placed in a logical structure and to be related to taxonomy was of high importance within the concept. The solution that was finally implemented is based on two basic elements:

- *a hierarchical navigation* – this navigation follows the logical structure of the action oriented approach used in the trainings and seminars rather than the established ones used and known in jurisprudence. (Using tasks as structuring principle rather than subject related logic)

- *a thesaurus* based on expressions known to practitioners rather than lawyers and legal experts – used for indexing and retrieving microcontent. The same thesaurus is also used in seminars and textbooks of the residential courses. It stems from seminar work and is constantly pursued by new input

The fact that these two elements are unique and proprietary products of the institute is fundamental for the marketing of the service and its business model. More importantly it was opted for this solution because it gave the unique chance to link the seminar work with the learning activities taking place at the workplace (or elsewhere). The presumption was taken that this kind of action oriented, user centered design of information architecture and taxonomies would lead to better results compared to an orientation towards mere expert cultures.

2.2.4 Pedagogy

One of the principles which was paid great attention to is that no product or service should be made availed by the institute which does not meet the regular quality standards which are offered and expected by customers in the core business of seminars and trainings. Unfortunately many educational institutes have failed to put up and execute a similar policy when experimenting with technology based services and eLearning in particular – hence failure here should not have come as a surprise. As much as the Knowledge Server benefits from and capitalizes on the brand value of the trainings offered by DGB it can also ruin this very same value by offering minor quality. Hence all contents are edited and controlled by trainers and experts on the subjects. In case of contents from the domain of labour law a freelance lawyer is editing the content on a regular basis. All this contributes to the principle that the service is meant to be and to be perceived in no way as a substitute or second class service but as an integral part of the services offered to the target group. Consequently the same pedagogical principles are applied here as in the regular trainings and seminars.

The Knowledge Server is committed to the action oriented pedagogy that is used in trainings and seminars. Quality assurance is only one reason for that effectiveness and usability are equally important ones. It was assumed that knowledge is as much acquired and relearned as it is constructed "in situ". By using a shared frame of reference in seminars visited in the training centers as in the support of learning at the workplace, users are enabled (and forced) to connect what they are working on with the basic and often decontextualized knowledge and competencies they have learned in the seminars. As a result this does not only enhance the quality of the actual learning with and using of the Knowledge Server and its microcontents in their daily work but at the same time raises the quality and effectiveness of the visited seminars and trainings (an effect which was reported several times during first evaluation meetings).

So far the users are encouraged to make use of the Knowledge Server in two different scenarios:

1. using small time-spaces for knowledge acquisition and continuous learning efforts (just-when-time / learning on opportunity)
2. acquiring knowledge in action and for solving current problems (just-in-time / learning on demand)

Both scenarios seem to be equally accepted and appreciated by the subscribers and used without exclusive preferences for one or the other.

2.2.5 Implementation

Individual access to the service called "Knowledge Server" is offered as a premium or value added service. Basically this gives the opportunity to offer it as a free extra for clients of seminars or as a service that is charged with a subscription fee. At the moment a mixtures of both is the preferred model where participants are offered a voucher for a 6 month subscription free of charge which can then be turned into a regular subscription with a semi-annual fee of 90 EUR or a renewed period of free of charge in case another seminar is visited within these 6 month. In any case each subscription allows an individual choice between a number of predefined, electable packages of contents and services to be made by the subscriber.

The business model defined for the service is based on the fact that quick and easy access to critical knowledge when and where needed is rated a prime demand by members of works councils. Hence the benefit of a subscription is convincing and most obvious to them. Given that other web based services offering access to relevant contents for members of works councils or experts in the different domains of knowledge the service described here can benefit from USPs such as its unique and proprietary pedagogical format, the strong brand value that comes along with it, a network of contributing experts and practioners.

The marketing of this service is relying on the existing marketing channels for seminars in so far as it is offered as a piggyback service but even more on the actual seminars themselves where the service is being promoted as an integral part of the seminar work that is done. The pricing model marketed in analogy to the subscription of a professional journal and as such it is acceptable to the subscribers and also rediscountable via the regular procedure of the running cost of a works council being paid for by the company according to §40 BetrVG (ger. labour law).

3. Evaluating the Use of Microcontent in Trade Union Education

The Knowledge Server with its various stocks of microcontents from different domains of knowledge is now implemented and offered as a regular service within the portfolio of DGB Bildungswerk. Beyond simple usability tests and evaluation of particular services we are now interested to learn more about the best possible design of a learning environment and the most effective scenarios for the service to be used in. Although the evaluation process is far from being finished, in the current state some interesting findings can already be highlighted and will help to focus our attention on particular research issues.

3.1 Key Findings of a First Internal Evaluation

At present the knowledge server assembles about 1500 learning objects of 12 different types. The stock is growing at a rate of 5 to 20 objects per week. In this starting phase, with limited promotion, it has to deal with some 500 subscribers since the beginning of the year (= 15 % of the annual figure of participants in this field), growing at a rate of 10–30 per week at the moment. Within less than two years time we expect to break even with regard to the costs of running and maintaining the service.
Based on feedback, collected from participants as well as trainers, the conclusion may be justified that earlier assumptions, who made us believe that eLearning was needed and appreciated by the participants of courses by DGB Bildungswerk, were in fact true[4]. Only that it must be taken into consideration that they were clearly attracted by the use of technology based services for learning at the workplace or in action rather than whatever forms of electronically aided distance education.

4 In 2001 a representative survey executed by the PSEPHOS institute showed that 84 % of the participants of courses held at the DGB Bildungwerk either definitely or possibly wanted to use e-learning if it would be offered to them. Only 16 % rejected it then. Unfortunately, as it turned out, in reality all did – in terms of "e-learning 1.0".

With some of the findings one is now able to partially complete the picture that emerges from this sudden shift in acceptance of technology enhanced learning services. The key learnings for trainers and management at DGB Bildungswerk are:

1. Acceptance as well as demand is high. The subscribers are not only IT experts or tech heads. Meanwhile, access to IT and networks (internet) can be regarded as *ubiquitous* within the target group. Compared to other trades and professions, IT skills are *not* significantly underdeveloped among members of works councils. On the contrary, the use of technology has fundamentally shaped and changed their learning behavior and expectations towards education.
2. Sustainability is not an issue anymore. The continuous use of the service has developed far better than expected. The rates of usage per user show a regular revisit by most and are far from showing the typical one-off pattern. Beyond that the use of the web based service seems to add to the sustainability of the residential course by engaging the participants in further learning activities.
3. Quality in content and pedagogy is a strong competitive advantage and knock-out criteria for users. The fact that the microcontents are checked and edited by a legal expert (lawyer) as much as the trust in the institution and its pedagogical concept motivates users to subscribe to the service rather than free of cost services that are also available.
4. Effectiveness and efficiency count high among the evaluation criteria of the users. Most complaints about other services focus on that issue.

3.2 Comparing First Evaluation Results with External Research

Several indicators and studies show that the numbers for visits of seminars and courses are decreasing continuously over the last years. For trade union education this adds to an even more dramatic decline in membership and trade union oriented workers. Another negative trend is that members of works councils have become more restrictive with their time budgets affecting notably their willingness to take several days off to visit seminars.

So far the reaction from the world of trade union education has been to shut down services and close training centers – all over Europe. In that perspective technology based services are often perceived and sometimes utterly meant to be a substitute for resources that are not affordable anymore. The service described in this paper and the results of our evaluation so far indicate that this perspective is neither compelling nor without an alternative. First of all, technology based services can and should be offered as a complementary offer rather than a replacement of existing services. Secondly we are able to show by our example that it can successfully contribute to *widen* the scope of trade union education rather than to minimize or substitute it. Trade union education has to be organized *differently* as an answer to the changes in the world of labour – not to be downsized continuously. In that, technology based services do and can play a leading role as a benchmark study of the British TUC[5] concludes from our and other examples.

So does a study which was commissioned by the Federal Institute for Vocational Training (BIBB) examining the use of knowledge communities for learning at the workplace. It presented the thesis that technological support of informal and self organized learning, to be most effective, needs to be *coupled* with formal learning, courses in particular[6]. The nature of that connection, however, has to be one of a *loose coupling* in order to achieve this. In successful examples of communities that were meant to support informal learning at the workplace and which were build as well as offered by educational departments or institutes (DGB Bildungswerk, IBM Germany and VW Coaching) they found that these services were as much the creation of a new kind of learning space to support informal, self-organized learning as they were a valuable supplement to the existing structures (courses and trainings) , contributing to the enhancement of their quality and effectiveness. One of the reasons they name is that this mode of technologically supported informal learning can do and add something to the development of expertise and competencies which traditional classroom learning does not: it motivates further learning, leads to deeper understanding of learned subjects and can immediately be used in action.

Both results contribute to my thesis that a. informal learning can (and should be) supported by educational institutes and b. that this endeavor does not necessarily lead into irresolvable problems or logical contradictions but can be managed successfully *by structural links* between formal and informal learning processes. For this, our case and its design can serve as a convincing proof.

5 Creanor / Walker (2005)

6 Core Business Development, Studie zur Einführung und Nutzung von Online Communities zum Lernen in der Aus- und Weiterbildung von Organisationen, Bonn 2005, p. 93.

3.3 Open Research Questions

So far it can only be said that the solution of widening the learning space and linking formal with informal learning processes leads to a rise in the *perceived* quality of our services. For this case, there is no data available showing in any way an objective and detailed measurement of precisely which qualities had been raised and how.

We now would like to know better how learning with microcontents and the "pipe" they are delivered through are integrated in the daily practices and routines at the workplace of the subscribers, especially how they make use of the knowledge acquired or constructed from microcontents. Last but not least we would like to understand better which role the use of technology or different media play in the way they learn in such an extended learning environment.

In preparation for that we found that whereas there is plenty of valid information on *what* members of works councils learn, hardly any research or literature exists that is focusing on *how* and *when* they learn. An exploratory study that we jointly commissioned together with the Hans-Böckler-Stiftung came to the same result.

Consequently some of the aspects that must be examined in an evaluation study are:

- when does learning occur in their daily practices, what initiates learning activities
- how is the knowledge server integrated in their learning behavior
- how do they make use of the two basic scenarios (just-when-time and just-in-time learning) and why
- are there other scenarios invented or preferred by users

Finding new insights here may bring some light into the discussion on how learning takes place within the work of works councils.

3.4 Methodological Challenges

A structural description of the learning ecology of works councils, based on a secondary analysis of existing data was the founding stone of the concept presented in this paper. Starting like that contributed to the process of challenging or correcting the stable constructions and biased judgments of the pedagogical staff with regard to the needs and demands of their participants. All in all it has turned out be a wise and fruitful step to do. Nevertheless it is a limited and rather shallow first approach.

To find evidence whether and to what extend the Knowledge Server succeeded in connecting to and blending into the preexisting learning ecologies or in other words merge pedagogical concepts with individual learning habits and strategies of our participants we need to take a much closer and detailed look into the processes and perceptions that develop when learning occurs in the "natural habitat" of the individual learner.

Hence research should be done examining learning in its authentic settings and contexts. We are convinced that a case study based on an qualitative approach will be able not only to answer our immediate questions on how learning with microcontents looks like but will also contribute to the further refinement of the pedagogical design of this and other services. Ethno- and biographical research is needed that takes into account the learning histories and a specific background of members of works councils.

In that we are not seeking for an illustration of learning theories of any kind but a theoretically sound understanding of how our service meets the learning habits of our subscribers / participants as well as an unbiased view of their actual needs and demands when preparing themselves for the tasks they have to fulfill as members of works councils.

4. Conclusion

We started with the observation that there is a growing gap between management training and trade union education and the notion that, to be most effective, the training of members of works council should be regarded as much the training of knowledge workers as it is the case with management staff. Based on this thesis, the basic idea was to widen the classroom setting and extend the learning space created by us as an educational institute. This led to the design of a service which was designed based on the structures of the existing learning ecology of works councils and meant to support the personal knowledge management of members of works councils. It is meant to connect to the networks of their learning ecology as much as support the learning processes taking place within these networks. The way in which the service had been implemented might be seen as a model describing a viable path of linking informal, occasional learning with formal settings like trainings, courses and seminars. Structural links between the curricula of these classroom based services and the architecture and taxonomies of technology based services help enhancing the quality of both modes of learning without destroying their original and irreplaceable qualities. First evaluation results show that this fundamental thesis might be valid and the service built contributes with positive effects to the aim of organizing the knowledge work of workers representatives in companies more effectively.

Developing these coherences further leads us to the point were we in fact might think of trade unions as learning organizations[7] in the sense that the methods and tools described in the discourse / theory of organizational learning might be applicable to them with great benefits. The same is true for working structures like works councils. Its members can be regarded as knowledge workers and should consequently be treated and supported as such. Finally we may conclude that 'knowledge work' is not something which is only done by a managerial elite and business consultants as common sense and some researchers[8] wrongly suggest but a perspective which can (and should) be applied to any form of professional work. Further research is meant to lead to a valid proof of that theoretical thesis.

If this is true, technologically supported "business intelligence" as it is common in management of many companies might one day be confronted by an equivalent like "labour intelligence". The use of microcontent provided online to support and enhance the training of members of works councils is one milestone of creating exactly that.

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Micro-learning Elements in the Intel® Advanced Training Course

(Changing Patterns of Learning: Schools, Universities, Vocational Training)

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1. Micro-learning Elements in the Intel® Advanced Training Course

Micro-learning – at least in the German-speaking world, the concept is clearly still largely unknown. There are no matches in the German version of Wikipedia or in the German EducationalDatabase. Similarly low is the hit rate for related terms like micro-teaching. Methods of study which fall under the banner of 'micro-learning', can encompass a time period of anywhere from a few seconds (e.g. with mobile learning) up to 15 minutes (study objects which are sent by e-mail). There is some contiguity with older concepts such as 'micro-teaching'. Naturally with the concept of micro-learning, questions also arise with regard to an adequate 'micro-pedagogy' and 'micro-didactics' as well as the problem of studying in general.

By 'micro-content', one understands a small, self-contained chunk of digital information, which can be approached individually and used in different, loosely structured 'macro-contexts', or 'macro-containers'. Micro-content comprises a very limited amount of information compared to other forms of cultural 'content'. This is due to physical constraints (screen size, complexity of the interface, see also 'micromedia') and cognitive boundaries (limited attention span of PC and internet users, but also media users in general).

Moreover, micro-content can be individually called up and addressed: it is defined, or at least can be defined, through a formally determined meta-data record (like its own URL, a time marker (e.g. construction/change time), the name of the author, an IP-address, connection data, a title, an HTML-tag or keyword, etc.). Micro-content is the (smallest) element, from which a 'metaweb' can be formed. Furthermore, micro-content is self-contained: it is – not only formally (through meta-data), but also in content – an independent information unit. It can be clearly differentiated from a macro context. It is not implicit in either a macro context or – importantly for Web 2.0 – in an individual application. It focuses on a single idea, or a few connected ideas. It is accompanied and defined by explicit or implicit meta-data.

New approaches should now be demonstrated, as details of the Intel Education initiative refer to the concept of micro-learning. 'Intel® Teach to the Future' is a worldwide program, developed by educators, for educators. The goal is the effective application of technology in teaching practices, in order to improve the learning environment for students; teaching forces experience here, how they can integrate technological aids into their teaching units.
The teacher training program Intel® Teach to the Future reached more than 300,000 teachers within four years in Germany, covering all types of school – from primary school to grammar school, to vocational school – as well as all subjects and year group levels.
The program was integrated into existing training infrastructure by state initiatives, partnering with the Academy for Teacher Training and Staffing in Dillingen, with ministries of education, pedagogical institutes and media centers. A core component of the training course are the approximately 10,000 Master Teachers and Senior Master Teachers nationwide (teachers from every school-type), who carry out the training inside or across schools. Because of the overwhelming demand, as well as suggestions and requests on the part of participants, the measure was taken to create 'Intel® Teach to the Future: Online Training and Collaborative Learning', an extension course with new emphases. The Advanced Training Course for educators and trainee teachers began in 2004; the training is subject-oriented and communicates multifaceted suggestions for teaching practice.

Thus, the widening of methodological competence through the application of digital media and the enhancement of schoolchildren's learning capabilities take on a special meaning. In terms of helping collegial practice, examples of proven teaching methods are placed at educators' disposal in the form of 'learning paths' which have been specially prepared for the training, so that participants can be instructed step-by-step, try out the content and methods themselves and adapt them to suit their own specific needs.

With Intel® Teach to the Future: Online Training and Collaborative Learning, subject-specific and curriculum-wide themes are tackled, with individual exercises designed to aid the expansion of media competence also integrated into the 'learning paths'. The materials are available through a training platform which is constantly updated and expanded. This forms the basis for internal school training, supports subject-specific or cross-curricular teamwork, and enables school-wide collaboration with teachers from other schools. The official recognition of all teachers follows in the form of a certificate of participation from the state and Intel.

The Intel® Education initiative prepares teachers and students for the demands of tomorrow. Intel Education reflects Intel's commitment to education and the effective introduction of technology in classrooms all over the world.

The goals of the initiative are:

- The improvement of teaching in mathematics and natural sciences in primary and secondary schools
- The upgrading of the effective usage of technology in education
- To increase access to technology
- To encourage the general public, particularly women and minority groups, to take up technical positions

The Intel® Advanced Training Course is primarily apportioned to 'macro-learning'. In particular, the learning paths are complex and require some time to adapt. Nevertheless, the Intel® Advanced Training Course is a good example of the application of micro-learning principles. This can be demonstrated with some examples:

The basic principal of the Intel® Advanced Training Course is the self-facilitated development (in teams of 4-6 people) of new studying concepts from existing 'learning paths' for personal education. There is no fixed 'course'. Participants determine themselves the times, types of organisation and materials with which they work. The relation to micro-learning becomes apparent in that the learners choose for themselves from the small details of the materials, those which they need for their current practices. Learning is established communicatively in small groups, and learning materials can be extracted and regrouped from their original context or used in a different context at any time. The study group and every individual member of it can decide themselves the time to adapt the individual steps further, and learning is based in the usual working environment.

With regard to the materials for teaching practice, the platform for the Intel® Advanced Training Course contains several hundred examples of teaching methods. As well as the description of the teaching process, the materials also contain short texts, graphics, and sometimes photos and other media aids which have been used before, but can also be used in a different context. Through these small study units, with a processing time of at most 15 minutes and multifaceted combinability for different purposes, there exist interesting links to micro-learning. For examples of these, please have a look at

http://aufbaukurs.intel-lehren.de/preparation/m9691_7002_AB.pdf
or http://aufbaukurs.intel-lehren.de/preparation/,4139_01047-04.jpg.

1.1 Boundaries of the Compatibility of the Intel® Advanced Training Course with Micro-Learning Principles

The Intel® Advanced Training Course platform uses the 'traditional' internet and is formulated for use on standard (Windows-based) PCs and laptops. Use on smaller hardware platforms (e.g. PDAs) is not intended, as there are few signs today of a larger adoption in schools.

Table1. References of the Intel® Advanced Training Course's Learning Paths to Micro-Learning

Example	Micro-Learning Reference
Concrete Examples of Teaching Materials as Micro-Learning Units:	Features:
• Learning Idea 'The Great Tuber" http://aufbaukurs.intel-lehren.de/index?s=3260 Extra materials: http://aufbaukurs.intel-lehren.de/index?s=3263	Interactive cards on the exercise and learning control (mediator, time consumption a few minutes per exercise).
• Learning path 'GPS in Teaching': examples of teaching methods and materials: http://www.gps.medienecken.de/index.html	Perfectly structured, illustrated theme-sites, individually accessible.
• Learning path 'Learning in Stages Using the Example of 'The Bolero" http://home.arcor.de/german.bausch/fb-musik/music/bolero.mid	Midi-data, also adaptable for other teaching concepts.
• Learning path 'Application of Tools Using the Example of Statistics and Diagrams – in a Green Nutshell' http://aufbaukurs.intel-lehren.de/index?s=2023	Clearly structured teaching documentation (very quick to receive); good, clear teaching materials
• Learning path for German: Application of Tools Using the Example	Here e.g. in the teaching documentation, an extremely concise but expressive half-page summary

'The Mystery of Treasure Island' http://aufbaukurs.intel-lehren.de/index?s=1335 http://www.lo-net.de/class/GNeumann-5a/personen.htm	The 'Index of Persons' contains extremely short, graphically well-prepared characteristics
• Learning path for geography, chemistry, biology: Self-Organised Studying Using the Example of the Theme of Water Teaching documentation -> Advance Organizer Map (Mindmap with complex preparation of the whole project http://aufbaukurs.intel-lehren.de/index?s=1200	Very compact overview with links to other concise information
The 'Library': This contains – mostly text-based – pieces of information, which are mostly very compact. • Alphabet stories (primary school, German) http://aufbaukurs.intel-lehren.de/library/1063_Buchstabengeschichten.pdf • Craft materials with Mediator 6 (primary school, case study) http://www.krebs-bammental.de/tutorials.html • The Content Path: study circle for teaching beginners' chemistry http://www.seilnacht.tuttlingen.com/Lernzirk.htm	Small, individually selectable units. Rudimentary meta-data (title, contents, media format) PDF-data (2.5 pages) with immediately adaptable graphics and texts. Web tutorial with small, independent units. Short clues; numerous work materials (1–2 pages) to download, immediately adaptable for teaching
Learning paths and learning ideas generally	Modular construction, meta-data, individual choice of constituent elements (own URLs)

Creating "Micro" Exercises Utilizing TTS (Text-To-Speech) Technology: New Horizons in Foreign Language Teaching

(Changing Patterns of Learning: Schools, Universities, Vocational Training)

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Abstract: This study describes how the synthesized English speech sound generated by a commercial TTS engine (Pentax "VOICETEXT") is utilized within a CALL (Computer-Assisted Language Learning) room environment as well as within the Moodle-based eLearning environment for a class of English as a foreign language in an average-level Japanese private university. It also argues that a TTS synthesized speech file as "microcontent" will open a completely new horizon in foreign language teaching, implementing ubiquitous multimedia learning environment at a significantly low cost.

1. Introduction

We have seen an amazingly rapid development in TTS (Text-To-Speech) synthesis technology past several years. Here in Japan, in our everyday life, we encounter TTS synthesized speech when we use the public transportation system, vending machines, interactive voice response system or automobile navigation system without recognizing the existence of the TTS technology. A popularly held idea underlying the use of the TTS technology is that this technology is meant for auxiliary measures. As a matter of fact, TTS generated speech is generally considered to be a "possible" alternative to human speech only within a special and limited environment, and very few people regard it to be a model to be learned by human beings. However, the situation has changed dramatically past two or three years as the quality of the TTS speech sound is beginning to approximate that of the actual human speech sound. There are very few reasons to reject the idea of using the TTS synthesized speech sound as model voices to be presented to students in a foreign language class if there is a serious difficulty in obtaining an instructor who is a native speaker of the target language or if the authentic speech materials recorded by a native speaker of the target language are not available.

In our everyday life, we cannot actually work properly without the support of the information technology. Our naive view about the information technology is that we human beings "control" it and "just make use of it." The fact is, however, our own way of thinking and acting is unknowingly and deeply influenced by information technology. Think of the recommendation pages of Amazon.com, RSS or the Asian character input method of the Microsoft Windows system. We of course physically "make use of the information technology," but it is as if the information technology itself were "coming to help us."

Though we may still have some kind of mental resistance, the time may have come when we can use the TTS synthesized speech as a model in educational settings focused on the teaching of foreign languages. At the very least, we will surely be "communicating" with a robot fluently speaking TTS synthesized speech within 10 years.
Accepting that TTS technology can be applied to foreign language education, then what are the actual benefits of using TTS synthesized speech in foreign language education? Below is a list of several concrete benefits of using TTS synthesized speech compared with the problems of the traditional method of creating the recorded speech materials through the analog/digital conversion process.

1.1 Cost Effectiveness

Since we do not have to hire a native speaker of the target language or at least we can reduce the number of the teachers who are the native speaker of the target language, the cost for the human resources can be reduced. The problem is not only the salary. Hiring a foreign instructor often entails extra workload for the institute or the municipal government and this will also cost a lot. Searching for an appropriate foreign instructor, sending staff to the country where the applicants live for the job interview, assistance in writing documents for the application for residence permission, etc., are latent costs. Using the TTS synthesized speech can dramatically reduce these costs.

If we ask a native speaker of the target language to record conversations and other materials, there will be another cost problem. Suppose that we have finished the recording sessions but have found a very small mistake a few days later which requires another recording session. This will of course create another and unexpected cost and we cannot assume that the same native speaker will again be available for the recording sessions at a desired time.

1.2 Technological Problems Concerning Recording

There are also some technological problems we encounter when we record the human voice. The quality of the recording equipment really matters and, in addition, input level adjustment is really a very difficult but very important factor that will determine the overall quality of the recording. We must avoid the saturation caused by the overly high levels of input, but if the input level is too low, relative noise level will increase. Some recording equipment such as the minidisk recorder is equipped with the Auto Gain Control system. This seems to be a very convenient system, but if the input level should abruptly change, the resultant recording will inevitably be accompanied by unnatural fluctuation of the noise level. Especially if there is a long period of silence, the noise level will dramatically increase, since the system always tries to keep the recording level constant.

Even if the equipment problems are resolved and the input level is well controlled, we can never expect a high quality recording if the environment of the recording room is not good. Unless we have a recording session in a professionally soundproofed recording room, an optimal recording through a microphone is practically impossible. And of course the truly desirable professional recording room will cost a fortune. Compromises over the physical environment of a recording room may be reached, but whenever annoying noises come from outside, we will need to stop the recording and we will be mentally exhausted by the whole recording session.

1.3 Native Speakers Are Not Always Good Readers

We tend to think that native speakers of the target language, especially if they are teachers, are desirable persons to ask for assistance with the recording. However, very often the actual speech of the native speakers betrays our expectations. We must realize that this is quite a natural phenomenon, since native speakers working for an educational institute are not at all professional announcers or professional actors/actresses. Sometimes we feel the actual speech is far from what we have expected and are tempted to stop the recording sessions to ask the native speaker to speak as we wish. But if we really stop the recording session and give instructions to the native speaker to utter the script in a more proper manner, we will be inevitably confronted with the furious look of the speaker, or at the very least, a very puzzled look. The speaker simply does not understand why he/she should be given instructions on proper manner of reading by a non-native speaker of the target language while he/she was asked to come for the recording sessions. This is really a miserable situation, but we will encounter such problems as long as we ask native speakers to record the speech for creating educational materials.

1.4 Complicated Editing Process

Even if the recording sessions were successful, we must still anticipate a complicated editing process. First, we must input the recorded material into a computer. If we can handle all this digitally it would not be so difficult, but if we need to convert analog sound material we must control the process and the input level very carefully. Needless to say, the quality of the converted sound depends on the quality of the sound card of a computer. If it is not of a good quality, the resultant recording may be contaminated with a lot of unnecessary noise caused by the computer, which itself is a digital noise generator in a sense.

2. Creating TTS Synthesized Speech Material for Language Teaching

2.1 General View of TTS System Used for the Study

If we use TTS synthesized speech, most of the difficulties mentioned above will be resolved. All processes of the speech material production are done with a computer and everything will be quite simple. An educator merely types the script and then just one click will generate a WAV format sound file. For example, the author currently use the TTS system called VOICETEXT offered by Pentax. As you can see in figure 1, just clicking the Read Aloud key (with ">" icon) after typing the script will generate a TTS synthesized utterance. By clicking Synthesize and Save key (with the "bag and speaker" icon), then the synthesized speech will be saved as a WAV file. The sound quality of VOICETEXT is really superb and the author's students did not recognize that they had heard synthesized speech until they were told so.

VOICETEXT accepts some special tags that will locally control some prosodic features of an utterance. Some of the useful tags are as follows:

a. <vt_pitch>: tag to change the relative height of the fundamental frequency of the selected area

b. <vt_speed>: tag to change the relative speed of the selected area

c. <vt_volume>: tag to change the relative loudness of the selected area

d. <vt_pause>: tag to insert the desired duration of a pause at a desired place

If we want to modify some prosodic features of the total utterance to be synthesized, these can be easily implemented through a GUI menu. Due to these features, flexible speech synthesis is possible using this software.

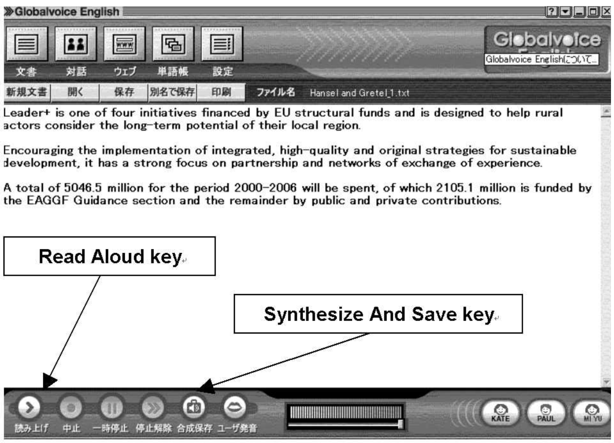

Figure 1: Text Input Field of Globalvoice English

2.2 Actual User Interface of TTS Software

The TTS engine used for this study is called "VOICETEXT" released by PENTAX Co. in Japan. The actual name of the software used is "Globalvoice English" with one male voice of American English and one female American English voice. The software not only reads the text aloud typed in the relevant input field but also can save the sound output as a WAV file. Figure 1 shows that the actual text input field and the prosodic features, such as overall pitch level or overall speed of the utterance, can be modified using the preference menu as shown in figure 2. If we judge the speed of the speech is too fast for our class, we can adjust the overall speed of the utterance and make the speech much slower using the preference menu.

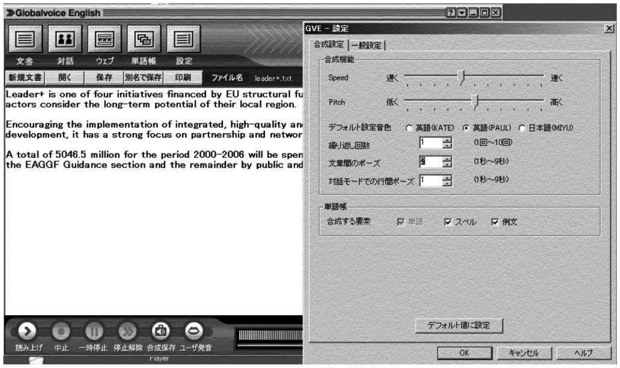

Figure 2: Setting the Preference Menu of Globalvoice English

There are two options for the further editing tasks. One method is to edit the generated WAV file using appropriate sound editing software such as Audacity (URL: http://audacity.sourceforge.net/) or WaveSurfer. The other way is to continue the editing task using the Globalvoice English software, without leaving its text input field. For example, if we would like to have the spoken text repeated three times, we can just paste the necessary script three times on the text input field. When we want to set a pause at a certain phrase boundary, we can just insert "," (a comma) there and then the software will automatically set a short pause at that point. The speech material can be saved as a WAV file after these rough editing tasks are finished and if necessary, we can further continue more detailed editing work using some sound editing software.

We may be very often tempted to add more prosodic variety to the speech generated by Globalvoice English. In such cases, the local modification of certain prosodic features is possible by using the tags. As shown in figure 3, we can add necessary tags to the place where we would like to have certain prosodic effects and then the software will modify the prosodic features at that point only. Prosody is not only important in total recognition process of the human speech (Ozeki, 2005) but it also reflects and disambiguates the syntactic structure (Azuma & Tsukuma, 1991, Lehiste, 1977) of a phrase and sentence. Because of this, local control of prosodic features is one of the indispensable features of the TTS speech synthesis software.

1 URL:http://www.speech.kth.se/ wavesurfer/ (accessed Oct, 2006)

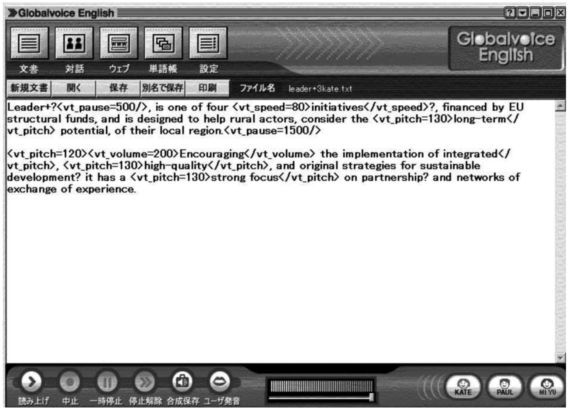

Figure 3: Tags for Local Prosodic Control

3. Multimedia Environment of Language Teaching

TTS synthesized speech materials can be used in various kinds of language teaching environments. Teachers can take a laptop computer with them to their classroom and present the sound materials through an appropriate PA system. Or the synthesized speech materials can be recorded onto a minidisk or a cassette audiotape so that the speech materials can be easily used through a traditional audio system. However, a much more effective way of using the TTS synthesized speech materials for language teaching is to use them in a so-called "CALL" environment, or in an eLearning environment.

3.1 Brief History of LL and CALL

In the discipline of teaching English as a foreign language (TEFL) in Japan and other developed countries, quite a few teachers have been interested in using advanced media as teaching tools. During the 1960s, when behavioral psychology and structural linguistics prevailed in the TEFL domain, many educational institutions introduced Language Laboratory (LL) for language teaching. In a sense, this was a revolution in the discipline of TEFL, since it suggested the possibility of creating an environment for autonomous language learning by students. LL is in principle a special classroom equipped with special kinds of tape recorders with which students can practice grammar-oriented exercises by listening to a model voice and then recording their own speech according to the instructions. The teacher lets students record using model speech stimuli with a prompting cue to trigger students' speech. The students' tape recorders were specially manufactured so that they could record their utterances without erasing the channel where the model voice is recorded.

Model Voice	I live in Kyoto. (1)	(pause)	Mike (3)	(pause)
Students' Channel		I live in Kyoto (2)		Mike lives in Kyoto. (4)

Mike lives in Kyoto. (5)	(pause)
	Mike lives in Kyoto. (6)

Figure 4: Example of LL Audiotape Recording

Figure 5: Typical LL room

For example, as figure 4 shows, the students first listen to the recorded model voice (1), after which they record their speech imitating the model voice (2). Then the model voice gives a prompting cue (3) so that students can produce the sentence with "Mike" as a subject of the sentence. The students try to say the sentence with "Mike" as a subject (4), though some students may drop "s" after the verb "live." The model voice presents the correct answer (5) and the students are encouraged to repeat the correct sentence (6) for reinforcement. Thus, the LL system was a dream tool with which teachers of English as a foreign language (EFL) partially were able to implement "automation of the teaching process."

The learning material is normally transferred to students' audiotapes through the high quality analog copy system. Very often the transfer is implemented four or eight times as fast as the normal tape speed. As the practice materials are copied onto students' audiotape, students are allowed to study at their own pace and preference to a certain degree. The Full-scale LL systems also allowed for student(s)-student(s) as well as student(s)-teacher communication over a headphone and often offered a response analyzer for multiple-choice quizzes. This preference of teachers of EFL for advanced media later led to the development of Computer Assisted Language Learning (CALL).

By following up on the features of the traditional LL, CALL boosted the learning opportunities of students through its capability of multimedia computing and easy access to the Internet, especially WWW. Instructors can also digitalize the traditional audio/video materials and edit the processed digital resources so that they may adapt their CALL system by using the easy-to-handle software supporting the instructor's teaching material creation. The dedicated software is installed on students' client computers for students' self-study. Multimedia files can be transferred to students' computer digitally through the intranet system.

The preference of teachers of EFL for computer-mediated teaching tools might seem rather incomprehensible to educators in other disciplines. However, if you remember the philosophy underlying the LL system was "automation of the teaching process," the popularity and support of the CALL system among teachers of EFL will be more easily understood. Needless to say, if the teachers offer their students a Web-based learning space, they will be able to let the students make the most of the total blended learning environment.

3.2 Actual Environment where TTS Synthesized Speech is Used

A newly renovated CALL room ("WeLL" system developed by JVC) was allotted for the author's 2006 spring semester class of "English Business Communication" at University of Marketing and Distribution Sciences, Kobe, Japan. The teaching material adopted is BIG CITY (Oxford University Press) Level 1.

During the class, students are told to attempt several small-scale speaking-oriented activities, such as conversation practice, oral presentation, shadowing (i.e., trying to imitate the utterance orally while listening to the model speech), *etc*. For these speaking-oriented "micro-exercises," TTS synthesized materials generated by Globalvoice English are mainly used, since it is possible to create native-like speech sound quite easily without the help of native speakers of English. A videotape accompanies the textbook, but the speed of recorded materials is normally too fast for the students to follow. The video was recorded in an authentic situation and because of the sound effects (i.e., noise of the street or the restaurant), it is a little difficult for the students to concentrate on the English utterance only, though these effects really give them authentic atmosphere in the situation where the conversation is supposed to be taking place.

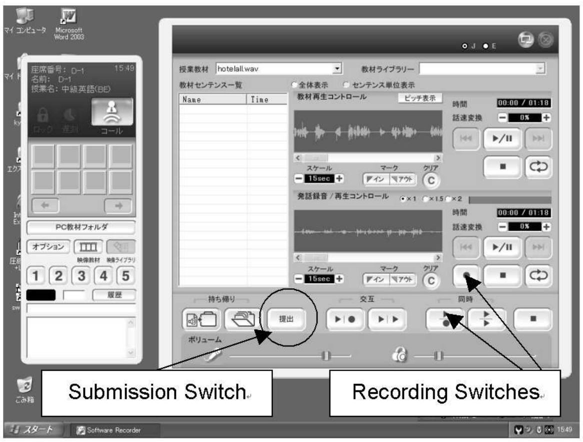

Figure 6: Recording through Software Recorder

The synthesized materials are stored as WAV files on the server of the CALL room and they are distributed to students in the form of "streaming" through the software called "Software Recorder" that comes with the CALL system. For example, students can enjoy the shadowing practice following the TTS model voice and they can record their voice by themselves to compare the features of the model voice and their own utterance (See figure 6). Students can record their speech as many times as they like and if they judge their recorded speech is good enough, they can submit the recorded WAV file to the teacher by clicking the "Submission" switch of the Software Recorder (See figure 6). This action will transfer the students' sound files to the instructor's server in the CALL room.

In order to support students' learning activities after the class, a Moodle eLearning site is also offered. The same oral exercise materials as used during the class are encoded into MP3 format and stored on the Moodle server so that the students can retry the micro-exercises even at home. Figure 7 shows the author's actual Moodle page for the conversation exercise.

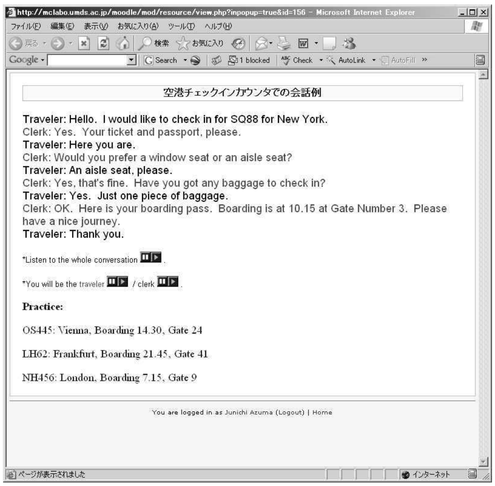

Figure 7: Conversation Practice Page of Moodle

Teachers may normally upload an MP3 file within a certain material storage folder of the Moodle site and set a hyperlink to the MP3 file when publishing a page for listening practice or shadowing exercise. Just setting a hyperlink to the relevant MP3 file will automatically create the PLAY/STOP switches and enable the Flash streaming. No programming or coding is required.

During the next class period, students can be requested to record their utterances in the WAV format using the Software Recorder of the client computer of the CALL system. Students' WAV files can be sent to the instructor's server and the instructors can take the files away to their office and evaluate each student's utterance. The evaluation of the utterance is uploaded onto each student's space of the Moodle site.

4. Conclusion

During the analog age, sound materials or video materials were quite difficult to produce and compile. Naturally, reuse of these materials was nearly impossible unless one was really prepared for an enormously laborious task. However, owing to the rapid development of the information technology, handling of these multimedia materials is becoming easier and easier every year. Once the sound or video materials are digitalized, they will become just a simple microcontent and can be handled as easily as a simple text file. These materials can be easily manipulated as learning objects to be part of the multimedia "micro-exercise" and can be dynamically applied to various types of educational environment and various communication styles.

The impact of the TTS technology lies in the ease with which people can generate the speech sound directly from the script on the spot. Reuse and sharing of the text information through the Internet was truly a revolution. However, as we type in a letter using a keyboard of a computer, our idea is instantly digitalized in a sense. Because of this, the digitalization process of the text materials is not actually a difficult one when compared with the digitalization of analog sound material. What is superb about the TTS technology is that it can skip the complicated process of the analog/digital conversion and create the sound file seemingly direct from the text input.

In the age of Web 2.0, where the openness, content aggregation and efficient microcontent retrieval are supposed to create a completely novel network society (see Alexander, 2006), the proper handling of multimedia files as microcontent will dramatically increase the value of the network. TTS technology is believed to contribute to the establishment of the new era of the multimedia content aggregation through its capability of easy and quick production of the speech sound. You can start the podcasting or the Internet radio service even without expensive recording facilities if you use an appropriate TTS system! Without doubt, it will greatly contribute to the discipline of foreign language teaching in the multimedia-based ubiquitous communication age.

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Mind Shifting or Shape Shifting?

Re-thinking Learning Paradigms for the Online Environment

(Changing Patterns of Learning: Schools, Universities, Vocational Training)

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Adult learners present challenges to curriculum developers and instructional designers in the online learning environment that aren't readily apparent in the face-to-face realm of physical classrooms. Learning, rather than teaching, becomes the primary focal point for content creation and the construction of infrastructure through and around which learning occurs. Teaching shifts from the model of sharing accumulated knowledge to one where the teacher constructs learning experiences aimed at diverse interests which stem from the lived experiences of the learner.

Against this backdrop sits the enabling, but not-so-transparent, technological environment. It's here that the shift begins to occur. It's quite evident in hindsight that we've attempted to step into this technological world with the assumption that what we historically knew and believed about teaching and learning would handily apply. Our initial uses of information and communications technologies led us to accommodate the delivery vehicle at the expense of innovation. In order to move beyond this, to achieve some level of transparency, we need to see them as learning technologies. Through that lens we shift the focus to learning. Advocates of effective face-to-face teaching would also suggest that learners and learning should be the focus, e.g. constructivism, resource-based learning, etc. Didactic teaching is never the ideal, but eLearning environments have a minimal chance of success unless the focus shifts.

Once we make that shift, efforts then revolve around how to enable the capacities of the technology to support learning experiences. At a high level, questions of synchronous, asynchronous or blended learning must be addressed. However, it is at a more fundamental level that those people who contribute to the realization of a learning opportunity, such as instructional designers, learning facilitators, teachers, and content developers, must engage themselves. The question is simply how the capacities of the technology can be merged with the content to satisfy the learning needs of the client group. Knowing the client group is essential at this point. At a simple "how-to" level it may very well be acceptable to generate a one-size-fits-all activity to engage learners from diverse interests and backgrounds. Their commonality may be a desire to acquire functional knowledge of a procedural nature such as how to effectively browse the web. This does work; however, if the functional knowledge is derived from the practices of a particular occupation, then the learning experience must reflect the occupation as well as the needs and interests of those working within it. The learning experience must be discretionary, context-driven, competency-motivated and flexible to accommodate a range of interests across the client group.

Are we thinking "big ideas"? Yes, we are; however, the learning architecture that's assembled to enable the learner to progress from a state of not knowing to a state of knowing must be designed from the inside out. The smallest procedural details warrant significant attention. That is not to say that each minute aspect is pre-designed to direct a potential learner through a linear path towards achieving a narrow outcome. Though sometimes necessary, this isn't always desirable. What is desirable though is a learning activity that appeals to the personal and professional interests of the adult learner at a time when the desire to learn is at a peak. In addition to this, the activity must have imminence - it must relate to the learner in such a way that the learner perceives obvious and sometimes immediate application.
Formal learning institutions have long-standing practices of presenting learners with relatively fixed curricula structured for delivery within fixed time frames where content is primarily driven by the developer and/or the deliverer of the curriculum. Learners travel through this curriculum at a pace set by the instructor. Alternative learning options such as the Virtual Teacher Centre, which is the focus of this paper, fill a critical gap on the contemporary learning landscape. The Virtual Teacher Centre has no formal status as a learning institution in the sense that it can award professional credentials or degrees. Nor is it simply a web site designed for browsing content which would place it strongly in the realm of informal learning. It would be tempting to argue that it resides within what is often described as non-formal learning. However, to do so would over simplify

its mandate and core activities. Entering into the debate around formal learning, informal learning, non-formal learning, self-directed and directed learning can be insightful; however, it can draw attention away from the practices of the learner as we attempt to understand those practices. Adult learners, in the case being described here – classroom teachers in a primary/secondary school system – approach online learning opportunities with an identified need and an intention to learn. The structure of any individual's learning experience or cluster of experiences is shaped by the nature of accessible content, levels of interaction and the needs of the learner.

1. Virtual Teacher Centre

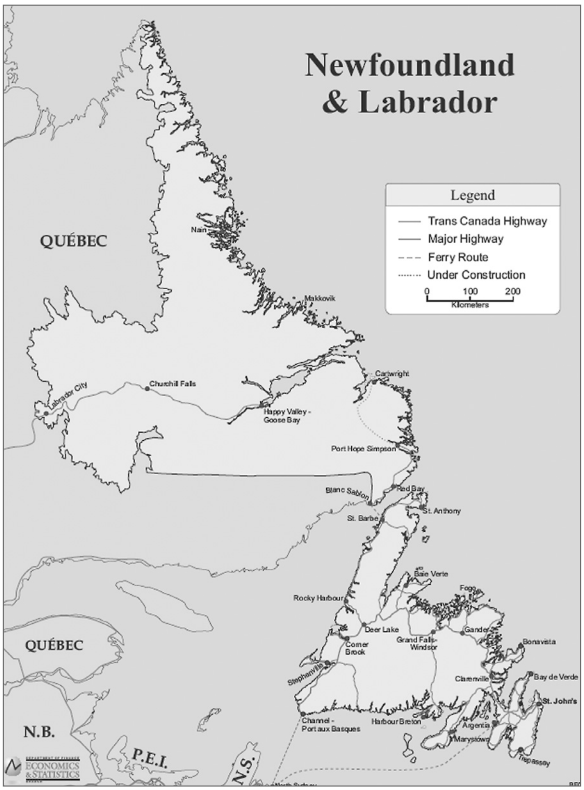

Figure 1: Newfoundland and Labrador

The Virtual Teacher Centre (VTC) serves the professional development needs of K-12 classroom teachers throughout the province of Newfoundland and Labrador, Canada. It was launched in November 2001 as a vehicle to provide teachers throughout the province with access to professional development opportunities, timely information, and resources related to their teaching responsibilities. Sixty percent of the population of Newfoundland and Labrador is clustered in a small number of urban areas, with forty percent residing in small, isolated communities', some of which are not accessible by road. This has the potential to create enormous inequities in service delivery. For teachers in these isolated communities there are limited opportunities for professional interaction with colleagues and the ability to avail of face-to-face professional development is practically nonexistent. The VTC was created primarily to establish an online community of learners that would provide all teachers in the province with access to professional growth opportunities, no matter where they teach and live. Its intent is to break down geographic barriers, to help eradicate the inequities imposed by location.

2. Mandate

The VTC client group engages in learning voluntarily. There is no certification-driven mandate or remuneration as incentive to engage in online learning experiences. Without external rewards the menu of learning opportunities must be broad and varied enough to attract attention by themselves and appeal to diverse needs across the group. Consequently, the initiative is mandated to address three aspects of teaching and learning:

2.1 Professional Development
Learning activities, developed in-house and/or through partnerships, aimed at matters of pedagogical interest.

2.2 Learning Support
Provision of access to technical training, educational research, curriculum resources, online interaction opportunities and communications

2.3 Knowledge Sharing
Capturing, organizing and storing professional knowledge and experiences of users and making it available to others in the client group.

These umbrellas enable an assortment of activities and resources that range from discussion forums to structured short courses as vehicles to enable the teacher to improve practice. They also function as vehicles to blend the contributions of all education partners – government, the teachers' association, school boards and a teacher training institution.

3. Partnerships

A professional development initiative like the VTC cannot exist without substantive partnerships which it has been successful in achieving. A formal partnership exists between the VTC and the Centre for Distance Learning and Innovation (CDLI). This falls under an agreement between the Newfoundland and Labrador Teachers' Association (NLTA) and the Department of Education. Under this agreement the VTC functions as the sole vehicle for online professional development for the NLTA and CDLI with the understanding that this includes the online professional development of the Department of Education. A partnership with Memorial University see the VTC maintaining an office on campus, thus enabling significant opportunities for collaboration in both the creation and delivery of professional development. Through individual initiatives the VTC partners with school districts and various community-based groups.

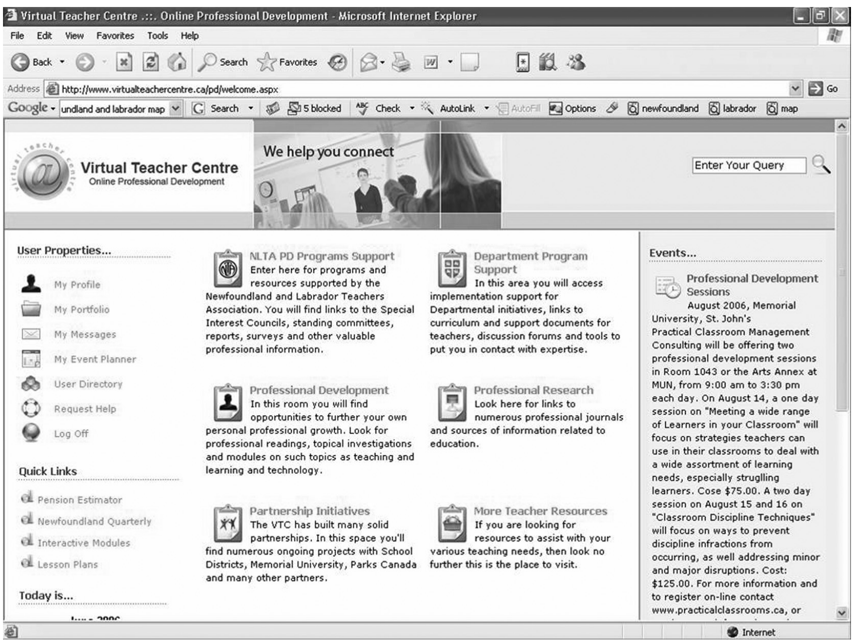

Figure 2: VTC Gateways

All of these partnerships are aimed at enabling more, high-quality professional development opportunities for teachers. A broad partnership base provides the VTC with the means to tap into the extensive resources of each partner that would otherwise not be accessible. It also enables collaborations to create PD content and to bridge the K-12 world of teachers to such partners as Memorial University.

The VTC, as a not-for-profit entity, has also been able to partner with external funding agencies to develop professional content for teachers. As a result of a funding relationship between the VTC, the Atlantic Canada Opportunities Agency (ACOA) and the Government of Newfoundland and Labrador, teachers now have access to 20 pedagogically sound learning modules on matters related to Information and Communications Technology. Another funding partnership between the VTC and the SchoolNet initiative Industry Canada, in collaboration with the New Brunswick Teachers' Association, has resulted in ten new online modules in areas of Teaching and Learning. These ten modules are available in both of Canada's official languages.

4. Professional Development

One writer defines professional development as "continued learning by educators to improve their knowledge and skills." (K. Michael Hibbard, et al, 1996).

A short definition perhaps, but one loaded with meaning. The first two words, "continued learning" describe a process of choice; one where the learner chooses to learn and chooses to pursue learning. It is not something foisted on the person, it is intrinsic. Then we have "by educators", which defines the professional nature of learning through the naming of the constituent group that this "continued learning" resides within. The question then is, why engage in "continued learning"? The answer lies in the next two words, "to improve". Where does this motivation "to improve" come from? What precipitates a decision "to improve"? Again, awareness of the need "to improve" must occur within the individual, regardless of the external influences. And what is it that educators want "to improve"? The definition uses the word "their" to place ownership, and then goes on to identify "knowledge and skills". This identifies the nature of the "continued learning" and specifies what the learner wants "to improve." So then, what can one conclude from this definition? Quite simply, it is this.

Professional development is an internally driven process where the learners willingly seek to become better at what they do.

When anyone sets out to provide a professional development service such as we have here, you cannot and should not limit it to a single audience. It must attempt to address the broadest audience possible, including the pre-service teacher in training, the new teacher, the seasoned teacher, the administrator and management level educators. It must also attempt to address a wide range of needs that can be satisfied in varying time commitments. Stack on top of that the need to work with various education partners throughout the province, and you soon get a picture of the complex environment which constitutes the VTC.

5. Learning Opportunities

The VTC provides access to a broad range of learning opportunities in a variety of formats. These are stand-alone or a combination of online and face-to-face learning experiences which attempt to engage learners according to their own perceived needs and meeting the needs of a client group characterized by varying investments of time.

5.1 Self-directed

Teachers may chose to read an article from current and past issues of online education journals and complete a 100 word summary of the article for submission to the VTC, after which they may view the submissions from other teachers on that particular article. A teacher interested in delving more deeply into a particular topic may choose from prepared Investigations or request that one be created. Investigations are a series of related articles linked by several reflective, practice–oriented questions which the learner must complete prior to moving to the next level. These self-directed learning experiences are quite popular.

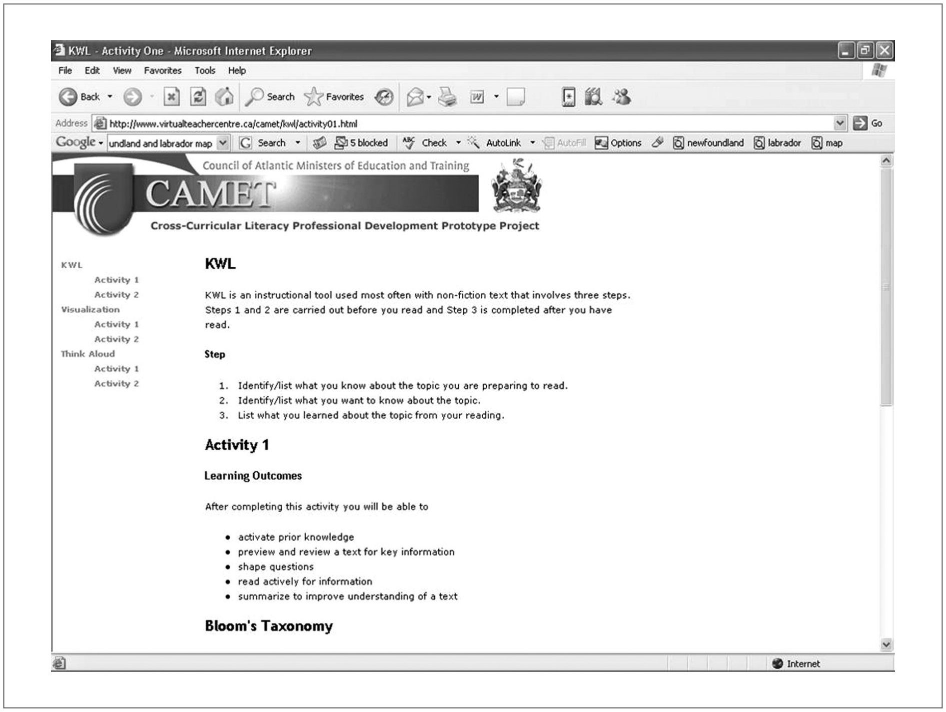

Figure 3: Self-Directed Learning Activity – Literacy Strategies

5.2 Directed

Learning Modules that range from four to seven lessons are available on topics related to teaching and learning such as Brain Research and Learning, Multiple Intelligences, Constructivism and the relationship between Teaching Style and Learning Style. Other modules focus on the applications of information and communication technologies including Information Literacy, Mentoring and Facilitation.

Through partnerships the VTC has assisted with the development of learning activities targeted towards particular teachers in the system. In one instance, implementation support for a new high school course in Career Development has been provided to those particular teachers. In another, learning experiences were developed for Intermediate teachers to acquire skills in the utilization of literacy strategies across the curriculum.

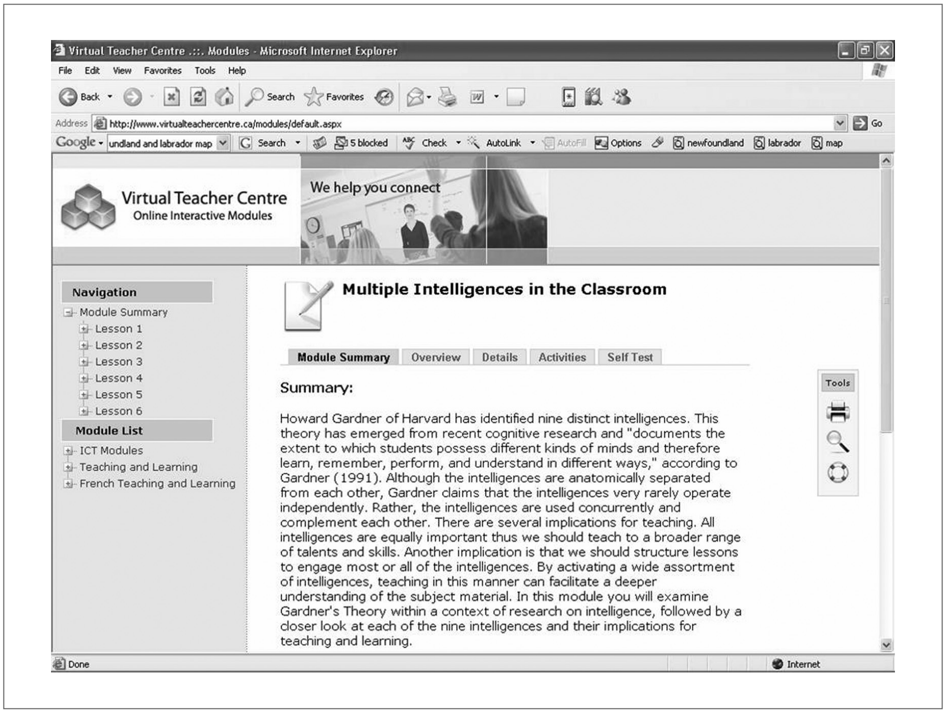

Figure 4: Directed Learning Activity – Multiple Intelligences

5.3 Collaborations

Teacher groups interested in participating in an online venue as a support to their face-to-face interactions usually avail of the VTC where they employ discussion forums, web conferencing, document storage and sharing as well as avail of other learning opportunities related to their particular interests. On occasion, learning activities are developed at the request of individual groups.

Research collaboration with education partners complements the mandate. Currently, the VTC is partnering with a consortium of fifteen organizations to study various aspects of distance learning in the province, including the types of learning experiences offered through the VTC. This initiative is funded as a community-university research (CURA) initiative of the federal government. The VTC also functions as the research dissemination vehicle for the project.

Teachers of all career stages are supported in their professional needs. New teacher recruits to remote, northern, isolated communities are provided an inter-agency institute focused on critical matters as they prepare themselves for their new teaching assignments each year. This North Coast Learning Institute, planned and led by the VTC, brings together the university, Department of Education, the teachers' association, school districts and the communities to provide these new recruits with practical and professional knowledge on the eve of their taking up new positions.

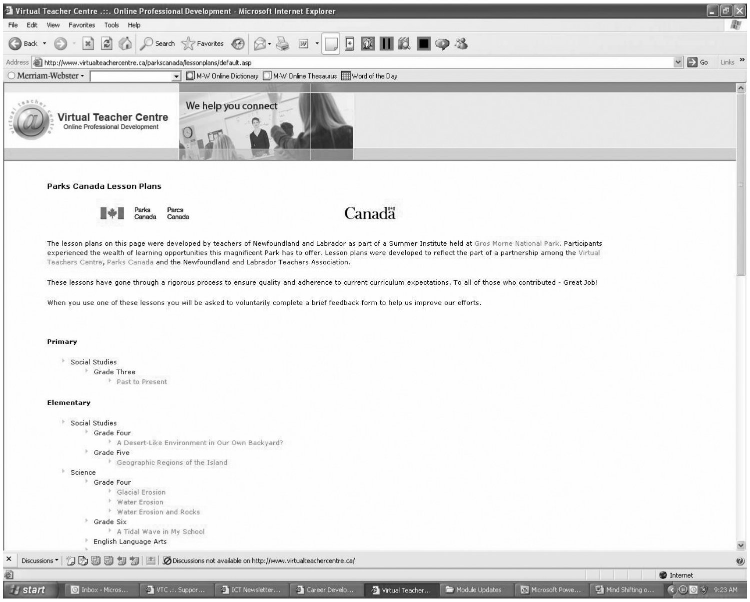

Figure 5: Collaborations – North Coast Learning Community

5.4 Content Creation and Sharing

Through partnerships and individual contacts, teacher-developed, curriculum-based resources are acquired and posted for use by other teachers. Sometimes this occurs among groups of teachers who participate in summer institutes based on school programs such as an annual initiative with Parks Canada where teachers prepare teaching materials utilizing resources of Gros Morne National Park. On other occasions teachers voluntarily submit lesson plans for sharing.

University resources applicable to the K-12 classroom such as those in the Geography Department of Memorial University are sought out and made available for teacher download. Graduate students engaged in educational research may publish their work through the VTC as a means of dissemination.

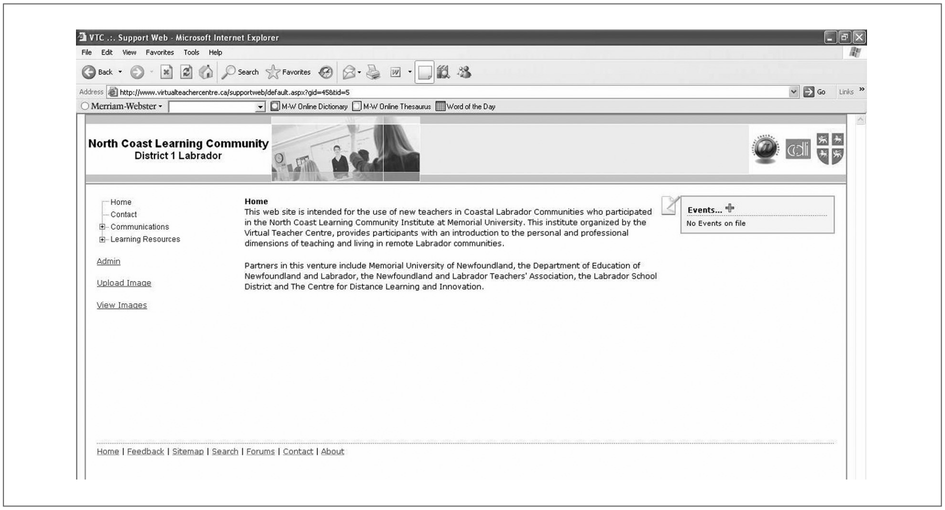

Figure 6: Content Creation and Sharing – Lesson Plans

5.5 Research

In addition to providing professional development opportunities to teachers on an individual basis, the VTC enables schools and school districts to extend single-day learning events into distributed, time-shifted occurrences that carry on throughout the school year using internet-based technologies. It engages in research and development with education partners in determining the most effective methods and tools to enable online learning. Some of the key questions currently being pursued through a multi-year Community University Research Alliance include:

- Are the instructional designs employed by the VTC in delivering professional development opportunities to teachers appropriate and effective? Which learning models have emerged as being most effective in the online environment?
- How much of a role does informal learning have in a teacher's efforts to remain professionally current in this province? Is the VTC addressing and fulfilling this need? If

yes, how can it do it better? If no, then why isn't this so? What can be done to improve its capacity?
- How do administrators and teachers view online learning for professional development purposes? Does it hold status and value sufficient to provide teachers leave time to participate in this method of learning during the school day? If not, why?
- What types of content do educators feel are most appropriate to the online environment?
- What are the true impediments to online learning for adults?
- What relationship exists, if any, between a teacher's use of inquiry-based learning through technology with students and the teacher's use of an inquiry-based approach using technology to address their own personal and professional learning needs?

6. Personal Professional Services

When teachers register with the VTC, a number of automatic services are provided. These include the capacity to edit their profile. If one changes school district or improves credentials and wishes to note that, then this feature is quite useful. Users also get access to an Event Planner or Scheduler. This is completely private because the site is password protected and users choose their own password. In addition each registered user is provided a Digital Portfolio which can be used to track and store information about all types of professional learning experiences. Internal Messaging is also available where registered users may send and receive e-mail messages internally.
Registration at the VTC is free to all teachers in the province of Newfoundland and Labrador. Teachers in other provinces are extended registration upon request. Students and faculty in the Faculty of Education at Memorial University as well as staff at the Department of Education are welcome to register.

7. Conclusion

All of this brings us back to the question of how the professional development needs of this client group influences how the experience is designed, structured and delivered and whether or not the experiences meet the needs of the client group. Earlier we examined the question of what constituted professional development. A second question inevitably follows - "How do you measure the relative success of online learning opportunities such as those offered through the VTC?" There is no clear quantitative measure we can apply. That exists for several reasons. Professional development is best defined by the individual teacher; thus, a five minute learning experience may be completely satisfying to one teacher while the needs of another may require two hours. This demands a range of learning opportunities that take varying times to complete and be available on demand. Second, the type of learning experience that is most effective for one teacher may be different for another. This means that one teacher may visit the VTC every month for information or content whereas another may visit only twice a year. In each instance, if a professional development need is being met, then the experience has been successful. Third, the individual skills and competencies of teachers in the use of information and communication technologies is a factor in the degree of confidence with which teachers approach online learning. There is still a fair degree of technophobia within the teaching profession. This may inhibit the willingness of a teacher to spend very much time online at the VTC or inhibit their ability to navigate and search out learning opportunities. Online learning is a new concept for teachers. It will take time to build respect and support for this approach to professional development. In short, it will take some degree of mind shifting.

Innovations in thinking such as using the technological tools as learning tools requires a re-examination of how we design and construct learning experiences in this environment. We must consider the immediacy of learner interaction with content, circumstances around how that content is accessed and how the new knowledge is applied. This requires a re-thinking of how we assemble content for online delivery. Learning objects, RSS feeds, Blogs and the many components which are purported to be part of Web 2.0 are only a small part of this re-think. Where learning objects are discrete reusable pieces and Blogs dynamic, real-time content generation, the real challenge is not in how we manage these in a learning environment, but how we structure learning experiences around, through, above and below them. This is where shape shifting of traditional notions of learning must occur.

In 2003, Stephen Downes posted a distinction between traditional education models and those presented in the online world. He observed that in traditional education, most learning is obtained in the context of a structured curriculum and learning objectives.

The unstructured environment is used to fill the gaps, to round out the rough spots and apply the in-class learning. In the online environment, most of the learning takes place in an unstructured environment, while learning using a structured curriculum and learning objectives is used to fill gaps, round out rough spots or to support practical learning. He may have been describing what the Virtual Teacher is attempting to achieve had he known about what we were doing in a remote province in Canada.

www.theatertheorie.net: A Web-tool for eLearning and e-archiving linking theory and practice.

(Changing Patterns of Learning: Schools, Universities, Vocational Training)

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Abstract: This paper presents a project of the University of Applied Scienes and Arts Zürich, from the area of applied research and development, in which a Web-tool for archiving knowledge and gaining competences in the field of theatre theory is developed. www.theatertheorie allows an interactive and critical dialogue between diverse arts-theoretical approaches and aesthetic practice. In recent years, in the discourse of cultural and art studies, under the term of the 'performative', concepts have emerged, that have led to changes in understanding of theory and its relationship to practice. Such changes have, in the conceptualisation of www.theatertheorieled us to innovative solutions in relation to media forms and structuring of content. These are solutions corresponding in many ways with the idea of microlearning. In front of this background we would like to briefly document the development process of our tool to date. Based on short video sequences, it offers a multipart and complex networked hypertext structure. For a specifically navigation system, ideas were won by a student project and developed to a interface-concept with its accompanying database.

We will first examine briefly with a change in the understanding of the intersection of theory and practice happened in recent years. These first observations provide the context for the subsequent discussion of the project www.theatertheorie, on which we wish to elaborate.

1. On the relationship between theory and practice

1.1 The Performative

In recent years, there has been a change in cultural and art studies, which under the description of 'performative turn' has been given an often paradigmatic significance. It proposes that cultural acts are no longer to be understood 'as text' functioning through representation. Therefore they cannot be described on the basis of their meaning, through interpretation, that is as semiotic or hermeneutic. Rather, cultural acts should be understood as performances. And consequently, their special 'performative' qualities as live and fleeting occurrences, come into view.[1]

Under the thematic area of the performative, in arts theory deficits are discussed in the traditional approach to art. New forms of aesthetic practice can only insufficiently be described as semiotic or hermeneutic approachable 'works of art'. One can only appreciate these new art forms when one goes beyond their textual meaning, and considers them as 'acts of art', which direct attention to their materiality and interactive process ability, and inasmuch, aim at affecting, to produce a presence, to create an experience, to irritate perception.[2]

1.2 The understanding of theory

The term 'performative' therefore encompasses critical tendencies of art-theoretical concepts, which allow to understand the approach of art theory to its object in a new light. Alongside this, the question of the status and understanding of theoretical knowledge and work must be revisited.

In short: theory was, under the banner of a modern and global rationality, seen as the business of a neutral, external observer, which searches the object of research, beyond the surface of material realisation for a deeper, ruling, pattern of significance, and organises this in a meaningful and logically consistent, lasting totality of explanation.

The scepticism, even aversion, of many artists, art lovers and art students with regard to theory, often finds its roots in this understanding of theory - that theory claims being able to explain art and therefore have the final word on it.

1 See Fischer-Lichte (2001) p.9ff, see in general also Gumbrecht (2004), Wirth (2002), Köpping/Rao (2000), Carlson (1996).

2 See Mersch (2002), Fischer-Lichte (2004), Lehmann (1999).

If the critical concepts provoked by new art forms and brought into discussion under the 'performative' are taken seriously, then the premises mentioned above, in understanding of theory cannot be maintained. A theory, which seeks to adequately grasp aesthetic experiences, must rather admit that the perception and interpretation of the observer is dependent on the manner of perceiving and of the perceiver's subjective state of being, that is to say, that the observer in his/her time bound and physical presence is always part of the observed (as part of the setting of the act of art). The status of theory thus cannot be supersede or remain unrelated to that of practice. Theoretical knowledge and work, taking seriously the intentions of the performative, claims to be part of a critical regionally conceptualised rationality, operates in a close and ongoing exchange with the observed practice and seeks to clearly acknowledge its borders. In this sense, theory can suggest terms and concepts to allow reflection upon practice – these terms and concepts must however, demonstrate their relevance towards practice, i.e., they are validated in dialogue with practice.

We would like in what follows to present our project www.theatertheorie and to illustrate how the influence of this new understanding of theory leads to conceptual decisions that in key points touch closely on microlearning ideas.

2. www.theatertheorie – Goals

The goal of the project is the development of a web tool for eLearning and e-archiving, that critically and interactively examines diverse art theory concepts and themes, for their relevance in practice and makes them fruitful.

In www.theatertheorie recognised theatre researchers elaborate their positions, and enter into dialogue with famous Swiss theatre producers, based on examples from their aesthetic practice. This new (type of) tool is based on video clips, and offers a multipart and an interwoven, networked hypertext structure, with an innovative navigation system.

The advantage of www.theatertheorie over conventional archiving and teaching tools is found in its specific linkage of content, – that is, of access to art-theoretical positions to examples of aesthetic practice, and to their relationship to each other, – and to its form: that is, the Web, with its presentation and structural possibilities. Short video sequences of extracts of explanations, in which theorists proffer aspects of their perspectives, can in the Web (through direct streaming) be presented directly alongside video sequences of theatre productions, and podium discussions between theorists and artists, in which the practical application of theoretical ideas are considered and demonstrated.

This hypertext relationship is complemented and deepened through additional linkages and contextual information. To this end, independent, extensive descriptive lists are brought together – on the one hand a keyword list on cross-disciplinary themes, and on the other a person and works list with information on and references for all people and works mentioned in the lectures and discussions.

www.theatertheorie thus creates a complex knowledge net, which has multiple cross-linkages and cross-references, which is at the same time is (or should be) easy to navigate. The user is allowed to decide in which art and manner s/he wishes, to approach the theoretical concepts and terms, whether this concerns practice, comparative research, or documented extracts of artistic practice, which s/he comes across at any given moment.

3. Media forms and structuring of content – influenced by the way of unterstanding theory

3.1 Media forms of content

For the content of www.theatertheorie we use, among other documents, such of the event series 'Denken hilft'.[3] This contains the expositions of three leading theatre researchers on their positions (Hans-Thies Lehmann: 'Postdramatisches Theater'[4], Erika Fischer-Lichte: 'Ästhetik des Performativen'[5], Stefan Hulfeld: 'Theater als Theorie'[6], theatre performances from internationally renowned Swiss producers Barbara Weber, Christoph Frick – Theater Klara, Lukas Bangerter – Theater Plasma), and

3 ‚Denken hilft' was presented by the 'Vereinigte Theaterschaffended Schweiz – Sektion Zürich' (see www.theaterschaffende.ch) and in collaboration with the 'Theaterhaus Gessnerallee' in Zürich (www.gessnerallee.ch) and took place in the first half of 2005.

4 See Lehmann (1999).

5 See Fischer-Lichte (2004).

6 See Hulfeld (2000).

podium (or panel) discussions between the researchers and artists. In each part of the series, one theoretical position and one production were linked and visited by theorists and artists, and this formed the basis for each podium discussion. There are transcriptions and video-documentations of all the events in the series.

The understanding of theory and the theory-practice relationship gets relevant in relation to the question of the media form of content.
The decision to present contributions to art theory and to practice in the form of video recordings of lecturers, podium discussions and performances, implied changes in the reception of the contributions (in relation to conventional modes), which also has relevance for the theory-practice relationship. It is less significant that the contributions use the same media form, rather, it has to do with the consequences that changes in the form of media used brings with it[7].

1. The form of the contributions to theatre theory results in a change from a written text – the conventional form – to, for its author, an orally presented text, that furthermore, is documented as a video recording. This change in the medium signifies an increase of the performative qualities of the contribution to theory. Through the linkage to a (filmed) physically perceived author, with his gestures, his oral usage of speech, theoretical knowledge and work are set in a context which also comprehends the transitory and the momentary. Theory can be recognized in this media form in the role of dialogue partner at the intersection with practice, setting aside the assumption of the exalted and eternal.

2. With regard to the contribution to aesthetic practice, the change from a transitory, presence live-act to a repayable video recording of a performance can conversely be described as reducing the performative qualities. This reduction is a consequence one must accept if a performance is to be made memorable through recording technology, and therefore accessible to theoretical reflection.

Reduction of the performative qualities by the documentation of highly performative acts of art, increase in performative qualities in the presentation of, by traditional stan-

7 See for the following Brandstetter (2004), Seitz (1999).

dards, poorly performative theory – this concordance, generated by choosing the media forms of content, corresponds with our intention facilitating an ongoing dialogue between theory and practice.

3.2 Structuring of Content

Individual sequences, dealing thematically with single aspects, are extracted from the video clips of the theoretical lectures, performances and podium discussions. These sequences of between approximately 30 seconds and six minutes, – in the following clips named and sorted according to the categories ‚Theory', ‚Practice' and ‚Dialogue', – form the basis of an information network *(figure 1)*.

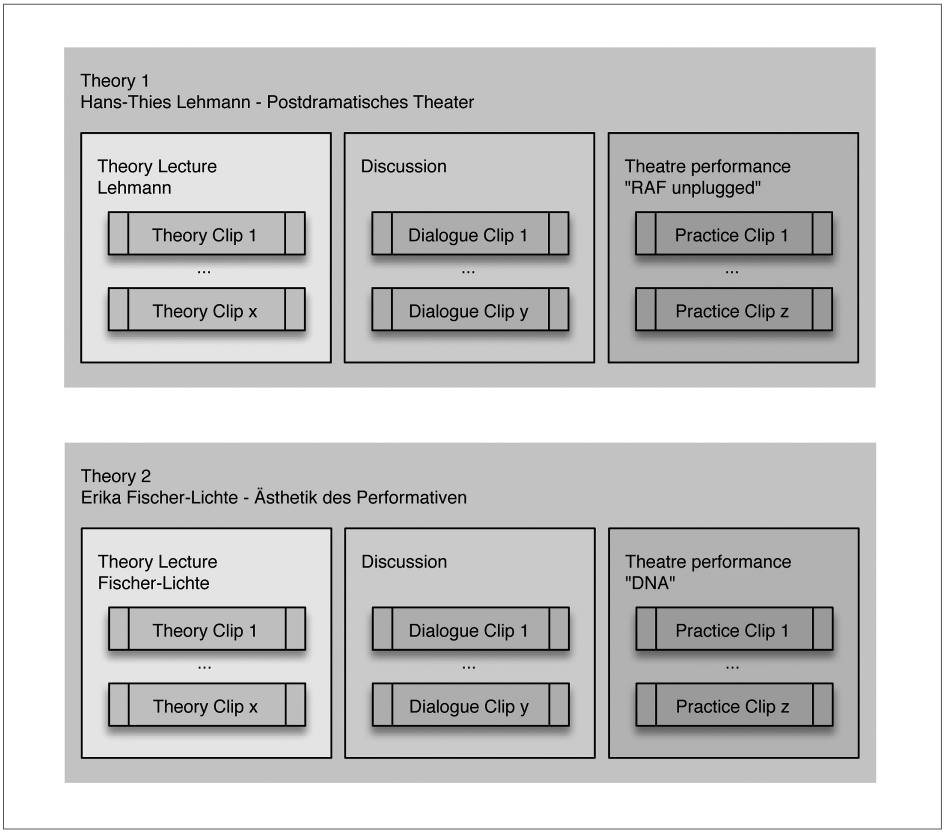

Figure 1 >>

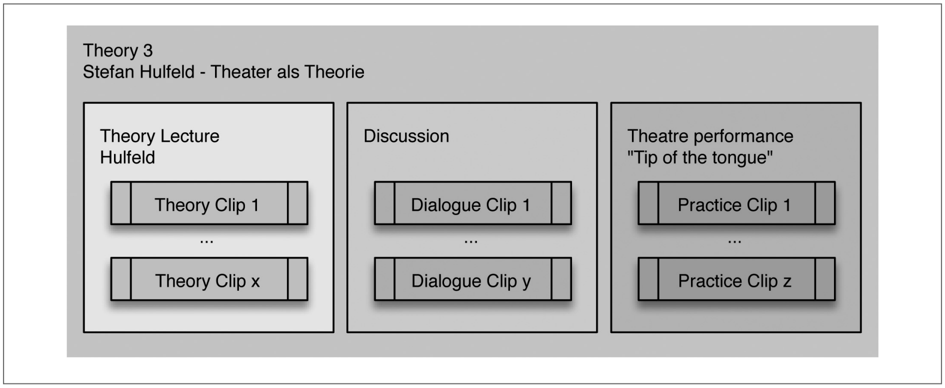

Figure 1

Our tool structures and presents the diverse categorised clips such that the user is offered different opportunities to explore how theory and practice converge and exchange with each other. In addition, clips with semantic descriptions such as keywords, speaker, referenced people and works, are identified and correlated to each other. A theory clip can be related to one or more dialogue clips, and these to other dialogue clips, or to performance clips – it allows comprehension and argumentation paths from theory to practice and vice-versa. These more or less extensive path-nets of linked clips, each originating from a singular theory clip, we call 'Module' *(figure 2)*.

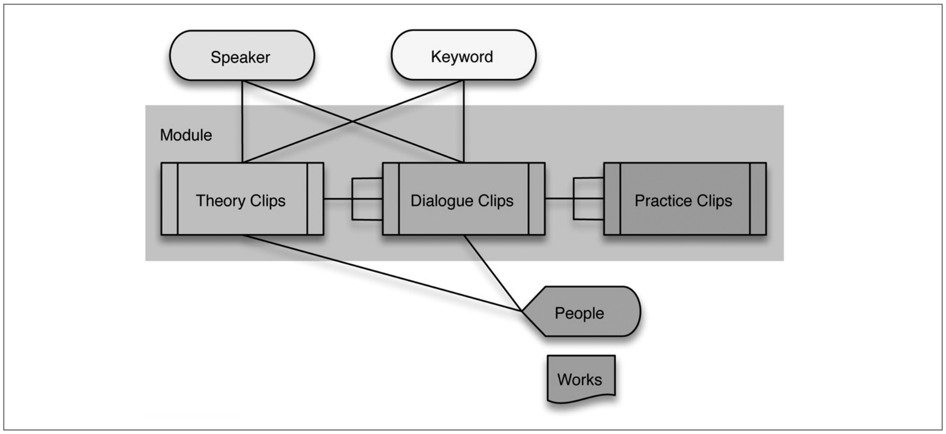

Figure 2

Multiple 'Module' of the same lecture/performance/podium – unit build together a so-called 'Ansatz'. In this is found the art-theoretical position of each lecturer dissected in smallest meaningful units, accompanied by the performance and podium discussion sequences, so the position can illustrate its relevance for practice *(figure 3).* In this way the understanding of theory gives reasons for the structure of content.

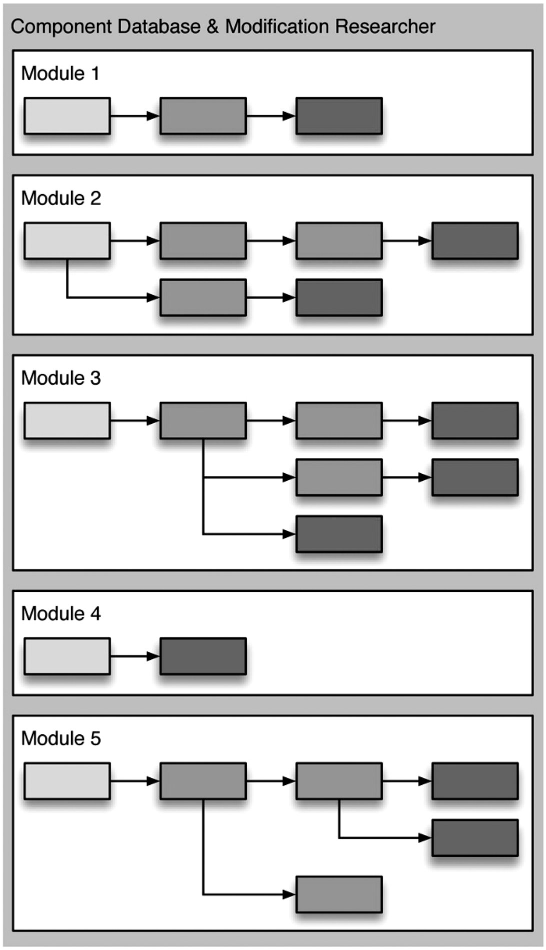

Figure 3

In summary, the above-mentioned changes in understanding of theory in our eLearning and e-archiving tool come conceptually into force corresponding with the ideas of microlearning

1. In the fragmentation into different, smallest meaningful components (microcontent) in different specific media forms (micromedia) – such as video clips of the categories Theory, Dialogue, Performance; text concerning the referenced topics, text concerning the referenced persons and works, and categorised text information.
2. In the linkage of these microcontent units to each other and into the Web creating a network-like, open structure, which can be navigated with the use of our tool (microlearning).

Below, we explain how the user can orient him/herself in this tightly interwoven knowledge net. One of the most important goals, in the development of such a tool for saving knowledge and increasing competency, must be the development of an interface that assures a learning- and user-friendly navigation system for this knowledge net.

4. Development of the Interface

4.1 Requirements

The following are required for the interface, including the database on which it is based: The interface must at all times accord with above-described conceptual decisions on the media forms, and must explain the structuring of content and facilitate navigation for both.

Further, attention must be paid in its development that the tool:

- can be internally expandable – it should be possible to integrate additional art-research theoretical approaches, each with an example from aesthetic practice.
- structurally, be so constructed that different parts, although closely related to each other, can stand as independently of each other as possible, and each be individually regulated and easily accessible.

The interface must, as an e-Archive and eLearning tool, be suitable and sufficient for tasks related to user-friendliness and didactics respectively. This requirement creates the following tension:

1. The tool should make it possible for each user to design his/her own research or learning process in the field created between art theory and aesthetic practice. This requires that the tool offers complex possibilities for presentation and use that satisfy in particular the experienced regular user.
2. At the same time, the tool must allow all interested users easy access and remain user-friendly even for the inexperienced first-time user.
   The primary challenge therefore, lies in the conceptualisation of an interface that, building on the newest technological possibilities – takes both aspects equally into consideration.

In the following we will first explore the development of an interface-concept complete with a differentially constructed navigation tool: the discussion will include documentation of various stages of the development process. Thereafter will follow some remarks on the technological realisation of the interface and the underlying database.[8]

4.2 Four design proposals from a student project

www.theatertheorie is a research project of a Theatre Department. For various parts of the project which go beyond the competencies at our department, – in particular those where technological aspect play a decisive role – , cooperation was sought with institutions with expertise in the relevant disciplines, as, for example, with the evaluation of ideas for the interface design.
Students in the Departments of Interaction Design and Visual Communication at our University were given the task of developing proposals for the interface design. The student project would however also serve as a test. After research into the content had resulted in an unconventionally complex structure, the interface would be tested and completed by the as-yet not fully informed standpoint of the students. The perspective of students proves interesting, above all with regard to the utility of the tool for learners as users. Below, we briefly document the results of this student project.

The students, working in project groups developed four prototypical graphically formulated design proposals. These can be divided into two categories:

8 The development of an new tool was necessary because primary usage – and as extensive as possible linkages – of moving images is not possible with conventional eLearning platforms.

- Design proposals that adopted a grid-like matrix structure, and attempted to make this manageable using a hierarchical navigation metaphor (Theory —> Method —> Module —> Clips). This quite direct approach to realisation of a tool was put forward twice; a third proposal extended this simple hierarchical metaphor a little further, to achieve a graphic-emotional effect.
- Design proposals which present the linkage as general graph and which do not show the orthogonal matrix in order to simplify the overview of the whole. Only one such design proposal was realised.

Following is an illustration of each design proposal, including a commentary and critique of each

Figure 4a

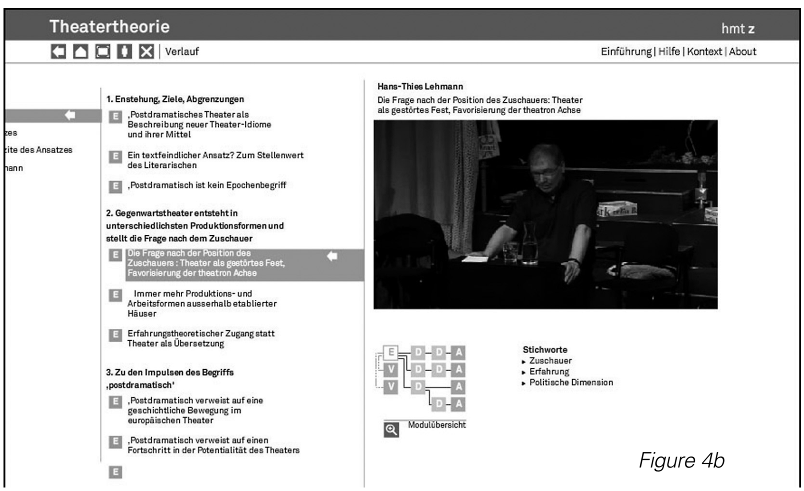

Figure 4b

Figure 4a/b: Proposal 'Typobaum'

This proposal[9] is marked by its clarity. The hierarchical structure is the central navigations instrument, which becomes ever more detailed stepwise from left to right. The choice within each level, similar to many computer windows in modern operating systems, blends in the choices of subsequent levels.

Critique

The simple and consistent navigation through a structure that remains hierarchical makes the system simple to understand and lends itself to clarity. In the organisation presented it is possible to show quite a lot of text based information on one page.
On the level of clips the linkages of the information is only schematic and less memorably presented. The change between this access and the exploration of the semantic descriptions (for example, of persons referenced by a speaker) is too abrupt and disruptive for the user (not illustrated)

Figure 5a/b: Proposal Karteikärtchen

9 Authors: Johannes Hoffmann. Andreas Lang, Tim Roth and Christoph Senn

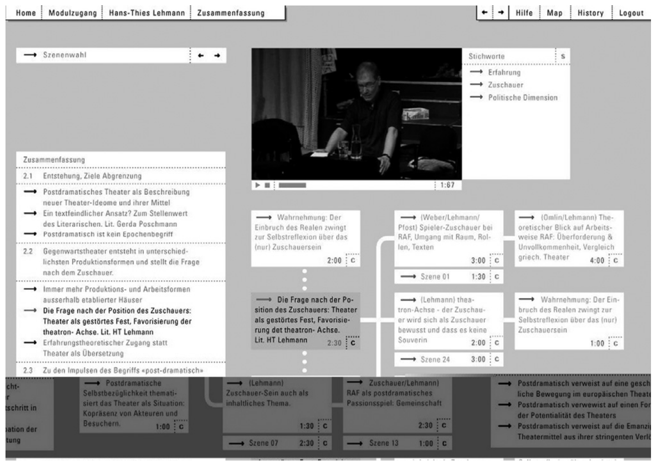

Figure 5b

This proposal[10] is noteworthy for its clear page organisation and descriptive text for usage. The hierarchical structure is in divided into clearly separated screens, and the navigation is similar to hyper linking.

Critique

The separation into singular screens makes the picture on the one hand clearer, but on the other complicates the overview within the system. After two to three page changes, the learner loses track of where s/he has come from and what his/her goal is. The surface, dissected through more rectangular fields, makes the presentation of text heavy information on one page more difficult and less flexible because a layout grid has to be maintained. On the level of clips the linkage of information is schematic, and filled with descriptions and illustrations, and this facilitates a good overview within each module. There are no significant irritations in the further exploration of the semantic descriptions, the information is shown in the page context.
A site map and a chronology open up additional possibilities. Their interactive presentation is succint and accessible.

10 Authors: Gregor Fraser, Simone Lacher, Barbara Schuler and Sandro Wettstein

Figure 6a: Proposal Planetensystem

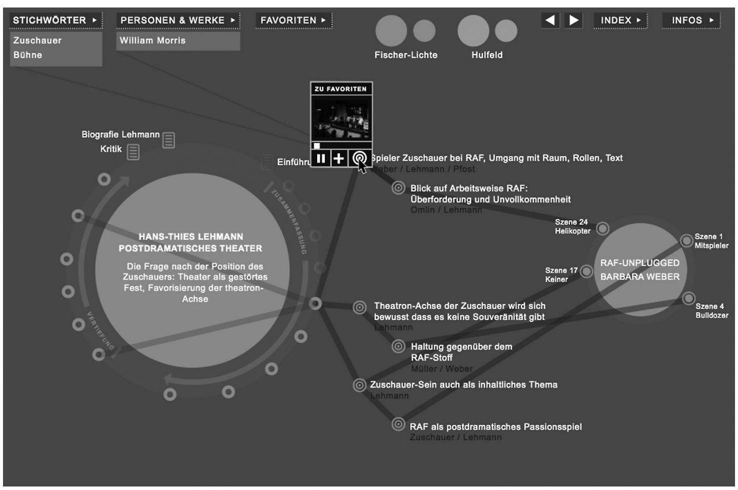

Figure 6b: Proposal Planetensystem

This design[11] distinguishes itself in the high dynamism in the usage by learners. The hierarchical structure is replaced by a quasi-free organisation of theories, methods, and modules in a form of planetary system. This means that there is almost never a need for changing pages, but that a situation dependent expansion or contraction, or a change of focus is accomplished through interaction with the planets.

Critique

The almost complete absence of a division into individual screen pages and the implicit dynamic is a huge computing task. For the learner this method facilitates understanding and overview at any given time. The freely positioned texts allow on the one hand the presentation of a lot of text-based information, but on the other, a not to be underestimated requirement for algorithmic exactitude in the positioning of the text. In addition, with increased frequency, the relationship between symbol and text is not always given. On the level of clips, the linkage of information is schematic, with descriptions and illustrations and allows a good overview within a module. Sometimes though, parts of the screen are 'wasted'. There are no significant irritations in the further exploration of semantic descriptions, although the information blended in can sometimes obscure module information. A chronology allows additional work possibilities. The presentation is succinct and interactive. The presentation system makes a separate site map unnecessary.

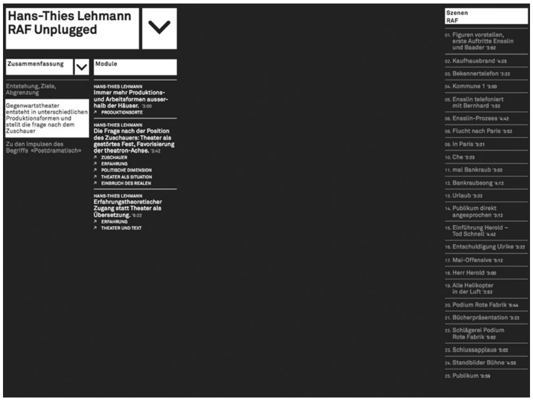

Figure 7a

Figure 7a: Proposal Textfahnen

11 Authors: Martin Brunner, Adrian Glatthorn, Michael Häne, Julian Kempmann

This proposal[12] distinguishes itself through an interesting division of space, strong contrasts and comprehensibility without high dynamics. The hierarchical structure is maintained and presented compactly. The learner has at all times access to all elements of his search path and can immediately choose a new direction. A page change is never necessary, although this means very smallfonts and poor legibility.

Critique

The organisation of the elements on one screen page facilitates the selection and navigation: The ease of overview is also a given, even if one must get used to the compact presentation. Extensive text based information is made possible through an interesting division of the page. On the level of clips, the linkage of information is schematically presented, although the chosen presentation form is not optimal and complicates the understanding of the structure of a module. Further exploration of semantic descriptions is replaced by the modular presentation, a significant compromise between irritation of the user and presentation in context. The poor legibility of the text, on account of the small fonts chosen, is, in comparison to the other proposals, critical.

4.3 Further development of the proposals

The student project should deliver very different design ideas for the interface. The design proposal of the group 'Planetensystem' was chosen for further development. It convinced the project leadership for the following reasons

- The structure of material and relationship to each other gave an ideal and surprisingly original impression. Theoretical methods and productions which related to each other were presented as two identically coloured planets, several such planetary systems in different colours form an entire 'cosmos' of our tool.
- The presentation of section titles (= clip title, icons) on the circumference illustrates the relationship to the time dimension of the video clips (or the oral presentations in the lectures). The circle intuitively adopts the graphic of a clock face. A tracking, which travels around the circumference, supports this relationship. The length of the clips can be proportionally presented (the distance to the next icon/title). For the documentation of productions, it can easily be illustrated that, first, not the entire production is integrally documented, but rather only specific extracts, and second, where these extracts belong in the complete production.

12 Authors: Marco Bucher, Benjamin Roffler, Daniel Senn and Arndt Watzlawick

- The circular organisation of the section titles (=clip titles, icons) is easier to overview than organisation into lists. This facilitates in particular a clear and simple visualisation of the intersection between diverse clips and clips belonging to different categories. The intersections can be presented as connecting lines from one icon/clip title on the (theory or productions-) circle to another or as a link to the icon/title of a dialogue clip. Using lists, it is much harder to present the entire collection of (theory or production) clips and at the same time to make known the points of intersection of a single clip with others.

For the further development of the design idea to a complete interface design concept, it was important to remain attentive to retaining the above mentioned qualities, and not to compromise the originality of the design, but to make it clearer and consequently to further optimise the design with regard to maximal individual freedom of choice in the modes of use and at the same time maximal clarity and ease of oversight in navigation.

The reworking, undertaken by the project leadership, working closely with the students from the chosen design proposal, led to the following design concept.

Figure 8a

Figure 08b

This concept will now be realized by an external contractor.

A test phase with theatre students from the HMT Zürich in September 2006 will show how far the interface, including its navigation tools, meets expectations, and how far www.theatertheorie as a complex structured knowledge net, has developed a method to offer new possibilities for practice-related saving (or archiving) of knowledge, and practice-relevant development of competence.
After final corrections, www.theatertheorie will be made widely available in Fall 2006.

5. Technological realisation

The technological realisation depended heavily on how the project came into existence and its requirements. That meant that in the formulation of a research contract, there was no detailed technological concept. In the first stage of the preparation of content and the structural organisation and annotation, no technological support was necessary –only through the assignment of the project to students was concept for technological realisation discussed in the foreground.

The orientation to the MCV[13] concept of (object oriented) software development led to a division between the data storage, the entry and the modification of this data and of the software for use through the user. The data store of www.theatertheorie includes the individual video clips with descriptions and the structural organisation in modules and method in the information network. In addition, semantic descriptions and linkages with further clips were saved. These data were physically stored in an SQL database on a web server.

5.1 Component data-saving and modification

After the definition of the data structure and the internal structure of the database, it should be possible to call up a user-interface using a web-browser for the entry of structural data, which would allow multiple project participants the possibility to add and change data at the same time. In addition, it should be possible to allow a first presentation in the projected module structure to offer those adding data direct visual control over their entries.

For the dynamic generation of this surface, and the presentation in the context of methods and modules, the web application framework RubyOnRails (hereafter RoR) was used. The application runs on the same server as the SQL database and allows on the one hand addition, presentation and modification of data, and on the other hand, serves as a model saver (display and use by the user). The choice of RoR allowed a flexible and simple adap-

13 The MVC concept is a conceptual separation within software systems which allows separate encapsulation of data, the presentation of this data and the functions the user can apply. Model objects include the data of the application and elementary functions for the modification of this data with possible immanent limitations. View-Objects summarize functions for the presentation of special parts of the model and the data necessary for them. Controller objects translate between the-model- and the view- objects when the user interactively operates. They are suitably integrated into the view and thus in a controlled fashion trigger diverse elementary editing functions in the model. For example, in a program for filing personal appointments, a model object would contain data of the appointment, e.g, day, time, title, description, participants, etc. Erasing or moving appointments, while controlling for scheduling conflicts, or setting up new appointments would be elementary functions of this model object on a data basis. The display of a specific choice of appointments, for example a calendar overview of all meetings, would be contained in a view object. Likewise settings for display, e.g, size of the calendar or number of days shown. In a controller object, would, linked to the view presentation, editing buttons, e.g, for deletion, moving of, or setting up of standard appointments be displayed. The user can trigger diverse functions of the model, as for example, creation of new appointments and filling with default data.

tation to the needs during the development of the data scheme and the entry of information by researchers that arose only during the work process. For example, the data scheme had to be changed or expanded several times. The premises 'Convention instead of Configuration' of RoR allowed in that way the adaptation of database tables, without necessitating an adaptation of the source code. An expansion of the functionality, for example to comfortable linkage of single entities with each other (Module –> Clip, Clip –> Clip, etc.), is possible absolutely object oriented in RoR. In the same way, the researcher is allowed the possibility of flexibly editing the on the web surface – AJAX[14] functionality, without creating specific JavaScript code within RoR. The complexity of the application on the server side is decreased because no various programming languages are integrated, and attention must be paid to browser compatibility.

5.2 Component: Interface for Learners

The component for navigation, display and interaction within a knowledge net – an information network – is developed as a more or less free standing application fort he user. It is not completely free-standing, as it is based on Adobe's Flash-player and is shown in a window of a web-browser. If one does not consider these limitations, this is a free standing application which for each user offers independent access to the information network,

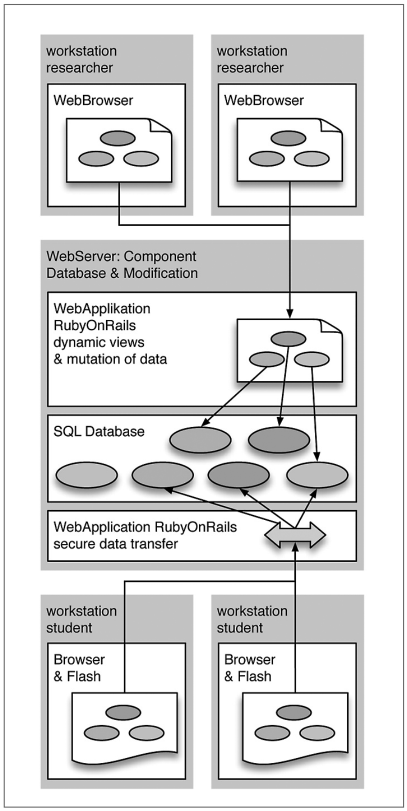

Figure 9

14 AJAX: Asynchronous JavaScript and XML
A combination of the possibilities of JavaScript and XMLHttpRequest. With JavaScript, one can, within a web browser, insert changes to the display of single web-sites dynamically, and therefore to generate a rudimentary interactivity, without delay caused by server access. With XMLHttpRequest one can, during the display of a website, access a server, without blocking the displayed site. The server is more responsive as a consequence of less transfer administrative information and is therefore able to add data to the already.

makes available the data from the web-server according to need and saves visited content or personal entries locally for each user *(Figure 9)*.

The application is in addition constructed fully object oriented, and uses ActionScript 2.0 (and in part AS 3.0) to convert the entities form the database into free-standing MVC objects. The use of Flash/ActionScript offers on the one hand full graphical flexibility, to optimise design and interactivity of the user interface in relation to the content of learning material. On the other hand it offers independence from different platforms and the possibility of distributing the application through the web browser.

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Experiences in Setting up a Virtual Learning Game Project

Two Cases: Adventure in the Castle of Oulu (1651) and Virtual Snellman (1822)

(Changing Patterns of Learning: Schools, Universities, Vocational Training)

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Abstract: The traditional notion of a learning environment has expanded to cover virtual spaces. Today, these virtual learning environments are often network-based and readily accessible to a certain group of students. Virtual meeting places are extremely popular among young people. Their very popularity can occasionally even present problems in everyday schoolwork. Thus, attempts to harness these new tools and environments for learning purposes are worth undertaking. These considerations have inspired the present project that has produced a 3D virtual learning environment with the aim of providing a space for microlearning activities. The space itself and its virtual inhabitants are based on historical data. The players who enter this environment learn by interacting with the characters and each other.

The game offers challenges the players try to solve as a team. It emphasizes group work skills, group interaction, and cooperation in various conflict situations that have to be negotiated inside the virtual world. Historical information plays a key role in gameplay and thus the learning experience is integrated to the events of the game, making learning fun. The environment utilizes both verbal and non-verbal communication and it does not contain violent or destructive elements and therefore it is suitable for children of all ages and both sexes.

The game concepts were produced in cooperation with the Department of Education of the City of Oulu and Ludocraft – the Game Design and Research Unit of the University of Oulu led by professor Tony Manninen.

Case I: An Adventure in the Castle of Oulu

- historical environment based on the ancient castle of Oulu in the year 1651
- virtual environment with a maximum of 30 participants
- 3D game engine, allows verbal communication between participants via headsets

Case II: Virtual Snellman

- J. V. Snellman, a historical statesman, father of the Finnish currency
- an open virtual network environment
- includes tools for mobile technology applications

2. Gaming Technology for Educational Purposes

2.1 Youth Culture and Social Change

Young media consumers wish to be active participants rather than passive observers of information. This is particularly apparent in their use of the Internet – they are at home in networks and virtual environments. Previously, the Net was conceived merely a source of information, but today the social and communal nature of virtual network environments is recognized. Information is actively constructed online through the exchange of opinions and images. Furthermore, users want to be able to influence their virtual environment and not only act as consumers but as producers of information as well. In the learning environments of the future, users will be able to manipulate content to suit their present needs. These developments, in turn, will present challenges to individual schools as well as pedagogy in general.

Young students are constantly applying new technologies creatively to suit their own purposes. According to the Scandinavian eLearning Nordic (2006) study, the use of information technology does improve learning results. The problem with new technologies is that teachers often feel unqualified to apply them to teaching. Teachers and students inhabit different digital worlds and this mismatch is reflected on the learning experience. The effective use of information technology requires a departure from traditional teaching methods and available pedagogical frameworks.

2.2 Games as Viable Learning Environments

Games and play are natural activities and part of everyday life. Before the advent of mobile and wireless technologies games were tied to specific occasions and locations.

Today, games are capable of producing a forum where people can establish and uphold relationships with others. The societal role of games is transforming gaming from a mere pleasure-seeking activity into an incremental part of modern society, especially in youth culture.
People use games as a means of expression. Gaming is a phenomenon that touches nearly everyone. Games and game environments provide a space wherein one can solve problems, interact with others, and build social networks. They also present opportunities for exploring and developing one's emotional life. Games are often multi-layered and can contain a vast variety of activities, address any number of interests, and provide countless possibilities for human interaction. In the future, it is crucial to develop genuinely innovative educational games for large audiences in order to counterbalance the mass of violent games on the market. As such, games will have an important part to play as learning environments and methods of teaching.

2.3 Using Games to Construct Meaningful and Motivating Learning Situations

The purpose of play is to practice everyday skills. In order to motivate the player, a game must have a goal. This goal produces a challenge for the player and motivates him or her to develop the skills that are required to reach it. Digital games fulfill the central requirements of purposeful play (Ermi et al, 2004). Learning need not be the explicit objective of play, but any given game requires some learning to take place. The charm of play and the popularity of digital games inevitably lead to the question: Can gaming be used in teaching? Through games, children are often prepared to go to great lengths in order to achieve their goals.

Playing games develops one's style of thinking towards an experimental, game-like approach to problem solving. The activities that take place within a game are circumscribed by a set of rules that have been agreed upon beforehand.
Online games and various virtual game environments are steadily gaining in popularity. Gaming is as much a hobby as reading books, but often this is not recognized by parents. Children are especially attracted to action and adventure games. Furthermore, children more often than not resort to their circle of friends in their choice of games and thus gaming is at the outset a social affair. Young students view games as meaningful and motivating environments that enable them to exercise their faculties, actively explore various subjects, meet with friends, and create and uphold relationships with others. In contrast, most parents and educators view games as entertainment.

This framework is the basis on which the present research on virtual learning environments in Oulu has been built. The Department of Education of the City of Oulu and the university's game research unit have produced two projects in which it has been possible to observe the benefits of educational gaming in practice. The following two cases provide information and discussion about the value of gaming in education. The cases consist of two games that bring history to life.

3. Case I: Adventure in the Castle of Oulu (1641)

Educational Gaming Technology: an Experiment in Design and Application

3.1 Background

In 2005, the City of Oulu celebrated its 400th birthday. The very same year, the city hosted an event known as the Festival of Schools and welcomed 12,000 school children and teachers from all over the country to participate in activities associated with the event. One the largest workshops at the Festival were dedicated to communication and media skills and the workshop needed something new and exciting to attract students. This need was met by designing an educational 3D gaming environment.

Research on the application of gaming technology to education has been pioneered in the University of Oulu by the Research Unit for Educational Technology at the Department of Educational Sciences and Teacher Education with the leadership of Professor Sanna Järvelä. In this work, the technology platform and coding have been the responsibility of the university's Department of Information Processing Science's game research unit, Ludocraft, led by Professor Tony Manninen. These efforts have focused mainly on higher education and they have been documented in various publications (see, for instance, Hämäläinen, Bluemink, Häkkinen & Järvelä, 2004). Drawing from this research, the present project aimed at developing students' communal skills in a virtual environment as well as exploring further advancements in the field.

3.2 Financing

After professor Manninen's research team had committed themselves to the project, it was possible to begin negotiations over financing and assigning various tasks to the participants. The total budget amounted to € 30,000 and it consisted mainly of personnel and administrative costs and the expenses of the technology platform used to realize the game environment. The sponsors acquired for the project included the development services of the City of Oulu and the European Social Fund overlooked by the provincial government.

3.3 Realization and Pedagogical Objectives

3.3.1 Production and Design Team

The team in charge of the realization of the project consisted of the following tasks:

- Producer & Lead Designer
- Lead Programmer
- Art & Level Design
- 3D Models & Animation
- Audio Design & Graphics & Text
- Concept Art & Graphics
- Graphics
- Animation & Graphics

This team was supported by a pedagogical group who planned the functional and educational features of the game and made sure it met the needs of players aged 9 to 16 years.

3.3.2 Platform

The platform chosen for the project was the Unreal Tournament game engine by Epic. A license agreement of € 50 per workstation secured the use of the platform for non-profit, research, and educational purposes. A client version of the Unreal environment was installed to a number of workstations which were then connected to a workstation that functioned as a server. Most modern PCs with adequate memory and a competent 3D graphics card can perform these tasks.

3.3.3 Game and Gameplay

The virtual game environment emphasizes group interaction and cooperative skills, testing these skills in various challenging conflict situations that have to be resolved through teamwork. The game itself is a multiplayer game designed for 5–30 players. It should be noted that the objective of the designers was to avoid the inclusion of any violent or destructive elements in order to ensure the applicability of the game for educational aims and younger players.

The environment is a faithful representation of the area surrounding Oulu Castle in 1716. The model is based on historical documents and drawings from the period. Some fictional elements were added to enhance gameplay.

The moderator (the teacher) sets up the game on the server according to the age and number of participants, assigns a preferred duration for the game, and adjusts the difficulty level. Each player is assigned a name, a character, and a specific mission. The assigned characters are based on typical professions of the period such as peasant, clergyman, merchant, or soldier. A typical mission statement reads: „You are a shopkeeper and your job is to buy and trade as much merchandise as you can. In addition, you have to contribute to the mayoral campaign of the merchant Anders Mattson by acquiring votes." The other players receive similar tasks associated with various professions. Some of the players act as henchmen, creating discord and thus adding suspense to the game. The players score points according to their performance on a given mission. The teacher, acting as moderator, can assume the likeness of a bird or a dog in order to move freely in the environment as an observer.

Movement in the game environment is controlled by the arrow keys on the keyboard and the computer mouse. Exchanging items takes place using the function keys.

Communication within the game occurs with the aid of headsets. Contact is established by approaching a character at which time a speech bubble appears and signifies the possibility for communication. Communication via speech instead of the usual written chat-form was found to be a major strength of the game. However, this required some special arrangements in the game room as it produced the need to create sound proof areas for the players. The practical solution to this problem was to erect cubicles for individual workstations.

A typical session consisted of the following activities:

- demonstrating the basic idea and principles behind the game 15 min
- gameplay 60 min
- feedback and discussion 15 min

3.4. Observations

The objective of the project was to investigate the educational use of a 3D gaming environment targeted for students 9 to 16 years old. Given the relatively short amount of

time that was available for design and production, the game itself can be considered a success. Despite the fact that the game had not been tested on large groups involving more than 20 players, the game environment was found to be stable and reliable.
Over 300 students took part in the sessions during the week of the Festival. In addition to oral and written feedback, gameplay was videotaped and recorded on the computers' hard drives. This material is currently awaiting further analysis.
Preliminary findings based on the oral and written feedback suggest that a game-like approach to historical materials is motivating for the students. As with the use of print or following learning material in multimedia form, assuming a character in a virtual world can act as a valuable supplement for the learning process.

New teaching programs often emphasize community, the importance of communication, and media skills. The game showed potential for the realization of precisely such objectives.
This pilot project did not contain the elements required for an in-depth study (such as the use of a control group) and therefore its conclusions must remain tentative. However, the project did produce a wealth of data that can be used to benefit future research.

At present, the environment is freely available for student groups through the Department of Education of the City of Oulu.

4. CASE II: VIRTUAL SNELLMAN (1822)

The positive feedback from Adventure in the Castle of Oulu inspired the team to conceive of a second educational game. Unlike in Adventure in the Castle of Oulu in which gameplay took place in a closed environment coordinated through client programs, the game's follower was designed to function on a web browser and contain the possibility of interfacing with other learning environments and technologies such as mobile devices. The 3D modeling software created for the project was designed with future projects in mind.

This article describes only the designing process and the early stages of production. The finished product will be available for schools in the fall of 2006.

4.1. Background

The year 2006 marks the 200th birthday of J. V. Snellman, a legendary Finnish statesman and philosopher who acted in several political roles during his lifetime. The theme of the jubilee is to celebrate the national identity of Finland and this theme is illustrated through the colorful personal history of Snellman himself. All citizens and especially the younger population are encouraged to participate in various events throughout the year. Virtual Snellman, a virtual learning environment situated in the year 1822, is part of these pursuits. The central idea behind Virtual Snellman is to create a virtual learning environment that contains a wealth of information about Snellman and his contemporaries and to transport the player into their historical surroundings. The learning environment will also contain exciting game-elements such as various objectives and goals, role-playing and colorful characters, and an exciting plot. Students will be able to develop strategic thinking as well as problem solving and decision making skills. Furthermore, the learning environment will enable the student to be a part of a group and interact with his or her social network.

This Snellman-themed learning environment will be realized as a game in order to attract younger players. The purpose of the game will be to introduce students to fascinating historical materials in an exciting way and thus make the learning experience a captivating one.

A game-like environment will offer the player the opportunity to shape the learning experience to suit his or her interests. A game that emphasizes action will make the relationship between the individual player and the information imparted by the game an active process in which interaction and communal goals are raised above the gathering of factual knowledge.

4.2. Objectives

The objective of the Snellman project is to construct a virtual learning environment that is inspiring and rich in opportunities. The learning environment contains a wealth of information which is contextualized in the form of a virtual world. Learning in this environment occurs by exploring the virtual space, problem solving, and interacting with others.

4.2.1 The Core Questions of Content Production

In the design stages of the Snellman game, the following central questions have to be addressed before and during production:

1. What does a game have to be like in order to attract and maintain the interest of the target audience?
2. What kind of control mechanism is suitable for the target audience in a 3D environment?
3. How to utilize the enormous amount of historical data in a manner that does not transform the game into a mere reading experience?

4.3. Interfacing

One of the important goals of realizing the Snellman game is to make sure the application can be transported to other networks and is able to utilize different learning environments through, for instance, mobile devices. The use of mobile technology raises a number of questions in terms of production. How central a role should mobile devices assume in gameplay? In what way should information acquired via mobile devices mesh with the virtual environment?

How much do the locations of present-day buildings in Oulu differ from the year 1822 and can disparate materials acquired through the use of mobile devices be utilized at all? Could one utilize mobile devices in ways other than gathering information about locations in present-day Oulu? Should this information play a central role or should it remain an added feature?

4.4. Requirements

During preproduction, the requirements and demands of the target audience have been carefully mapped. In addition, the design group has compiled a list containing technical requirements for production, content, game design, audiovisual style, and the storyboard.

4.4.1 General Properties

The Snellman game was assigned the following properties:

1. A virtual environment where the action takes place
2. Three dimensional, modular, visually impressive
3. Content respectful of the theme
4. Interfacing: mobile devices, other systems

4.4.2 Requirements Relating to Gameplay

The following chart illustrates a preliminary list of requirements for a viable game.

Requirement	Arguments and Examples
Replayability	Must not lack in content even if played through a number of times
Expandability	Possibility to expand the environment in the future Sequels, further levels and scenarios
Rich in relevant information	Full of interesting details about Snellman's life Not merely an encyclopedia
Visual appeal and ambiance	Competent audiovisuals attract young gamers Able to convey factual knowledge to the target audience
Educational	Exploration, observation, analysis Not only performance but atmospheric as well
Appealing to young gamers	A genuine game, not a mere application Goals, challenges, and rewards must be clearly visible
Easy to learn	Everyone should be able to play the game Low threshold but challenging enough

4.4.3 Activities in the Environment

The learning environment consists of virtual spaces where the activities take place and information is imparted. A virtual space might be a room, the scene of an historical event, or some other space that contains the necessary selection of tools, characters, and activities.

- creating the space and circumstances
- modeling the events
- setting up the objectives and related activities
- emphasizing interaction

Virtual model of the city center
- an environment the user can explore freely
- information, observations, and materials located in (say) a printing press
- a space where the user can store information

4.4.4 Information

The educational objectives of the Snellman game set demands for the historical information present in the game environment. Despite its game-like qualities, information conveyed by the environment takes center stage. However, the objective of the project is not to produce a Snellman databank. The information presented in the game can be viewed as both raw material for gameplay and educational material for students.

1. Information must be based on historical facts
   (a) A critical approach to sources
   (b) Ensuring the authenticity of the material
2. There must be a sufficient amount of information
   (a) Collecting, recording, and transforming the material into a presentable form
   (b) Arranging the material into suitable blocks
3. Information must be accessible
   (a) The material must be placed into the game environment
   (b) Interactivity
4. Information must be presented in an interesting manner
   (a) Game-like qualities
   (b) Choosing perspectives and the manner of presentation

Proper presentation of the information requires that the environment is modeled after Snellman's era; specifically, the year 1822. The objective of designing the learning environment is to create a virtual space that contains all the relevant information. This information is based on historical fact, arranged in a suitable manner to cover relevant topics, easy to approach, and presented in an exciting way.

The game is intended mostly for younger gamers and therefore the information must not be in text-book or encyclopedic form. The user must be able to experiment, explore, and engage the subject matter in a vivid manner. Creating these effects through various activities and experiences can be achieved by faithfully modeling Snellman's era and being true to its historical features.

4.4.5 Information Created by the User

Content created by the users themselves is a current topic that has generated lots of interest in gaming and virtual communities. The reason for the popularity of this feature of gaming can be explained by the individual user's desire to star in his or her own storyline and leave a mark on the given environment.

- information is generated collectively
- question and answer wiki
- conversation and interaction with other players
- A user-specific registered character makes it possible for him or her to voice opinions, address questions, leaves signposts for future gamers, and discusses observations about gameplay with others; this makes the information presented in the environment yet more meaningful.
- The user can submit acquired information to his or her own e-mail account for future use or augment a previous answer given in response to a problem presented by the game at a later date by using (say) an entry code supplied by the game.

Content created by users can also present significant risks. If the content is not controlled in the proper manner, there is a danger that the environment will be filled with inappropriate materials.

Utilizing Games for Educational Purposes: A Summary of the Project

How to present information to young students in a meaningful and exciting way? How to bring books to life? Snellman, for instance, has been the subject of a 12,000 page, 24 volume series of books and a biography exceeding a thousands pages. Young students do not favor written materials of this sort. Is it possible to deliver the same information using games?

The learning process involved in gaming often proceeds in concordance with gameplay. Games require and develop various problem solving faculties and learning strategies. Children associate learning with the class room situation and thus games offer, as it were, a covert way of delivering information.

One can teach various useful skills and demonstrate societal values through games. Games involving strategy and simulation have the strength of creating opportunities for experimentation and cultivating a hands-on approach to learning. Games involve learning everyday skills through direct experience and repetition. Furthermore, games evolve language, computer, and media skills and can instruct students in historical facts and values. Modern games also provide learners experience in social interaction and various learning methods.

Central to the experience is the player's immersion into the world of the game. In digital games, the act of moving through space is of great importance, perhaps even more important than the plot of the game or social interaction with others during gameplay. Because of this, these games emphasize exploration and discovery, finding and utilizing various objects and bits of information. It is important that the player feels at home in this virtual space as the experience as a whole is composed to a large extent of the interaction between the player and his or her environment.
Behind games, there is usually a fictional world where the player can act free from the restrictions of the real world. Gaming is a multidimensional activity and is largely dictated by the prerequisites of both game and player. The world that is opened up through games enables the player to perform feats that are simply impossible to execute in the real world. Succeeding in these virtual tasks strengthens the players' ego and self-esteem. Games are played for the pleasure they produce and the experiences they offer. Games present a difficult situation for teachers and parents. Due to the fast pace of modern culture, teachers and parents find it difficult to keep up with progress. With games, problems such as commercialism and the excessive consumption of games present conflicting scenarios. Games and computer networks can become a problem if they displace social interaction in the real world. Excess violence in games is often, and rightly so, emphasized in the media as well.

Teachers and schools can no longer view themselves simply as distributors of information. The focus of education is shifting towards the task of understanding a computerized digital world that contains great amounts of noisy information. The functions of games and learning environments are converging and more often than not learning in this setting occurs in a less self-conscious manner using modern digital instruments to explore and test the large quantities of information available to young students. Active learning such as this produces a learning experience that the student will remember for a very long time. Learning, in this sense, consists to a large extent of adapting and processing information to suit a great variety of different contexts. Experience has shown that young students are drawn to game-like learning environments and find in them the necessary motivation to undertake the study of a given subject. Retrieving strategically placed bits of information produces a clear picture of the subject as a whole, provides an enjoyable gaming experience, and, most importantly, inspires learning.

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A Semantic Service-based micro-learning framework
(Semantics for Microlearning*)

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Abstract: Microlearning deals with relatively short small learning units and short-term focused activities. The applicability and impact of this novel learning technology can be greatly increased by incorporating rich semantics to the description of the subject learning units. In this paper Microlearning is put into the contest of the Semantic Web and Semantic Web Services with the aim of detailing a solid framework and reference SOA that uses the communication facilities of an ESB. The ultimate goal is to evaluate the applicability of the approach to the necessities and requirements posed by Microlearning.

1. Introduction

The advancements in computer science in general, and in knowledge management in particular have provoked a dramatic change on how knowledge is distributed and acquired. On top of this, our current society requires individuals to continue learning in case they want to have access to interesting jobs and follow a brilliant career. However, the time available to acquire new knowledge is not always as much as would be required or at least not at once. Thus, the concepts and ideas around microlearning, microcontent and microknowledge are developed with the aim of bridging this gap.

Microlearning tries to allow people to learn better, more effectively and in an easier, more enjoyable manner. This goal is achieved by means of breaking information into smaller units, administered at smaller steps than in traditional learning, using interspaces between different activities (Bruck, 2005).

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A number of points of view and understandings have posed that try to give definition that set the pillars of what microlearning, microcontent and microknowledge mean. However, so far there seems not to be a general agreement or common understanding about the precise meaning of these concepts. What is common to all of them is that they seek, in a variety of ways, to integrate learning into everyday life (Hug, 2005).

For the time being and as far as this paper concerns the following definitions will be adopted.

> *"Microlearning deals with relatively short small learning units and short-term focused activities"* (Hug, 2005a).

> *"Microcontent refers to small, granular pieces of content, to simplex semantic units or to small-sized semiotic entities"* (Hug, 2005a).

Thus, microlearning can be understood as learning from microcontent – from *„small pieces, loosely joined"* (Weinberger, 2002).

The requirements posed by the microlearning technology require novel approaches. Two main characteristics need to be taken under consideration when designing systems and applications:

- **Rich metadata descriptions.** Microcontent and learning objects in general need to make use of rich metadata descriptions based on Semantic Web technology so they can be easily discovered and composed.
- **Storing and discovery.** Current approaches to storing learning units are based on repositories (Azuma, 2005) where the microcontent and the metadata describing them, if any, are stored. However, the search of microcontent and learning objects in general, requires more dynamic techniques where relevant content can be published directly on the Web and located by means capable search engines (Arroyo, 2005).
- **Ubiquitous and Service based.** The dynamic nature of microcontent poses special requirements on the infrastructure required to deliver contents (Fischer, 2005). It this direction (Web) Services provide the perfect paradigm to encapsulate rich learning unit descriptions and locate them using traditional (Web) Service discovery techniques.

By this means a new approach to design microlearning applications independently of the technology and application domain can be envisioned. In the following the main ideas and principles behind this approach are presented, together with a use case where the whole setting and technology are being applied. The aim is to demonstrate the viability of the whole approach and set the architectural basis for new applications of the microlearning technology.

The paper is organized as follows. Section 2 provides a detailed overview of the architectural context and motivation. It presents and briefly depicts the core ideas behind the Service paradigm, its application to a SOA and the implications of using Web services. Furthermore, the communication requirements of a SOA are put into the context of a ESB and the whole setting complemented by the addition of the Semantic Web technologies. Section 3 introduces the overall architectural model taking care of depicting the main building blocks and their role in the architecture. Section 4, presents LUISA, an EU IST project where the whole approach is applied and tested. Finally, Section 5 resumes the work and provides an overview of future steps to be taken.

2. Architectural context and motivation

The aim of this section is to put into context the LUISA architecture. It provides the background knowledge and perspective that justify the directions and decisions taken. In the following a brief overview of the main architectural concepts to be used, namely, Services, Web Services, Semantic Web Services, Service Oriented Architecture (SOA), Semantic Service Oriented Architecture (SSOA), Enterprise Service Bus (ESB), Semantic Enterprise Service Bus (SESB) and Learning Objects (LO) are presented.

2.1 Services

Roughly speaking a service *is a piece of software that implements some well-defined functionality that can be consumed by clients (e.g. other services), regardless the application or business model. Services communicate with each other by means of message exchanges.*

The main advantages provided by the use of services revolve around its interoperability, loose coupling, isolation, compos ability and machine processability.

- **Interoperability.** Interoperability aims at providing seamless connections among software applications. Services allow programs written in different languages, deployed over different platforms and using different protocols to communicate with each other thus favoring interoperability.
- **Loose coupling.** Decoupling or loose coupling refers to the degree of mutual dependency among services. Services expose rich and well-defined message interfaces which allow them to communicate with other services reducing mutual dependencies.
- **Isolation.** It deals with the ability to modify services or their details not impacting other services that might interact with them. Service consumers are abstracted from details of service implementation and location.
- **Compos ability.** Service composition approaches the problem of the creation and provision of complex value-added services out of simpler ones with the aim of achieving new functionality. Services can be easily composed with each other in order to achieve more complex operations and sophisticated added-value services (Mahmoud, 2005).
- **Machine processability.** Deals with the ability of computers to process service descriptions. Thanks to the use of agreed specifications computers can lively process services descriptions favoring their interoperability, loose coupling, isolation and compos ability among others.

2.2 Service Oriented Architecture (SOA)

SOA is an architectural style for building software applications that use services available in a network such as the web as main building blocks (Khushraj et al., 2004). The ultimate goal of SOA is to promote loose coupling while increases interoperability among software components so that they can be reused.

Figure 1 shows the evolution in software architectures. It starts back in 1970 with the monolithic architectures ending nowadays when SOA represent the ultimate architectural paradigm. The evolution path clearly shows an aim for decreasing decoupling while increasing interoperability with stronger emphasis on standardized approaches.

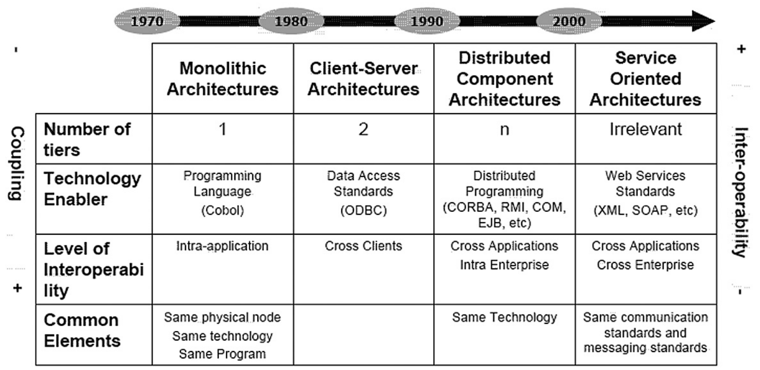

Figure 1: Software architectures evolution[1]

The ultimate aim of a SOA is that of providing ubiquitous and autonomous sets of services that dynamically interoperate to achieve common goals. In this direction a SOA provides a vendor-neutral communications framework with the potential to implement highly interoperable service descriptions and message structures.

2.3 Web Services (WS)

According to the W3C a Web Service (Alonso et al., 2003) is *a software system designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a machine-processable format (specifically WSDL). Other systems interact with the Web Service in a manner prescribed by its description using SOAP messages, typically conveyed using HTTP with an XML serialization in conjunction with other Web-related standards.*

In simple terms, Web Services are software machinery accessible via the Web. A Web Service can provide any type of functionality, ranging from mere information providers (such as stock quotes, weather forecasts, or news aggregation) to more elaborate ones that may have some impact in the real world (such as book sellers, plane ticket sellers, or e-banking), basically any functionality offered by the current Web can be envisioned as a Web Service.

1 Keller, S. and Aegert, C.: „Service Oriented Architectures“

Web Services are the most used way to realize the service and SOA paradigm. In contrast to Services, Web Service due tackle implementation details being linked to concrete specifications and protocols (WSDL, SOAP, XML and HTTP). As far as SOA concerns, it is important to notice that SOA and Web Services are two different things, but Web Services are currently the preferred standards-based way to realize SOA (Alonso et al., 2003). Other alternatives such as REST (Costello) are available for describing and implementing services.

2.4 Semantic Web Services (SWS)

The main drawback of traditional Web Services is their lack proper support for machine processable semantics. This lack makes necessary human intervention to actually discover, combine, and execute Services. The goal is to minimize any human intervention, so the integration of business logics can be done in a task-driven way and with the least support from the user side.

The combination of Semantic Web technology [(Berners-Lee, 1999) (Berners-Lee et al. 2001)], namely ontologies, and Web Services, has been termed Semantic Web Services. Semantic Web Services are defined as "Self-contained, self-describing, semantically marked-up software resources that can be published, discovered, composed and executed across the Web in a task driven semi-automatic way" (Arroyo et al., 2004).

The Semantic Web in general and Ontologies in particular offer the means to describe the capabilities of Services, the protocol used and the data interchanged while communicating, and the business models in a shared vocabulary that can be understood and/or aligned as required. Such a shared functional description is the key element towards the vision of Semantic Web Services and in particular, sets the foundational basis to realize the semantic Web Service usage process. Such process is made of seven different phases, namely: discovery, negotiation, composition, mediation, execution, monitoring, and compensation.

In a nutshell, Semantic Web Services will allow the development and execution of a higher level of Services that will solve increasingly complex tasks by making available new composed Services. The goal is to minimize any human intervention, so the usage process of Semantic Web Services can be done in a semi-automatic way.

2.5 Semantic Service Oriented Architecture (SSOA)

SOAs present insufficient support when the services that compose them use heterogeneous terminologies for representing the business model they serve. By combining the architectural principles of an SOA, with the machine understandability and processability of the Semantic Web, this limitation can be easily overcome, thus giving birth to a new architectural paradigm termed Semantic Service Oriented Architecture (SSOA).
An SSOA represent the next natural step in the evolution of SOA where the main building blocks are Semantic Web Services. Every SSOA encloses the same foundational principles of a traditional SOA, plus the incorporation of semantic support. By these means resources using heterogeneous terminologies and understandings can be shared among different systems and platforms enabling the agile discovery, negotiation, composition and interoperation of services in a task-driven way.
In a nutshell, a SSOA is a robust and complete architectural style where Semantic Web Services are the core building block.

2.6 Enterprise Service Bus (ESB)

Enterprise Service Bus (ESB) represents a new type of application integration middleware that provides foundational services for more complex service-oriented architectures via an event-driven and XML-based messaging engine, the bus.
ESB provides support for data transformation, intelligent routing and communication mediation, resource connection via adapters or specific communication protocols, process coordination or orchestration, management of security and quality of services aspects while guaranteeing message delivery. The result is a more flexible approach to application integration that solves in a very simple way the synchronization requirements across two or more applications.
ESB facilitates an abstraction layer which allows exploiting the value of messaging while keeping a simple architectural model. It acts as a lightweight, ubiquitous integration backbone through which software services and application components flow (Farges).

In a nutshell, an ESB represents the backbone that transports and routes messages enabling the standards-based integration in a Service-Oriented Architecture. Figure 2 shows a schematic of an ESB that nicely integrates multiplatform, enterprise and custom applications together with heterogeneous data sources into a common channel that provides intelligent routing and advanced communication facilities among others.

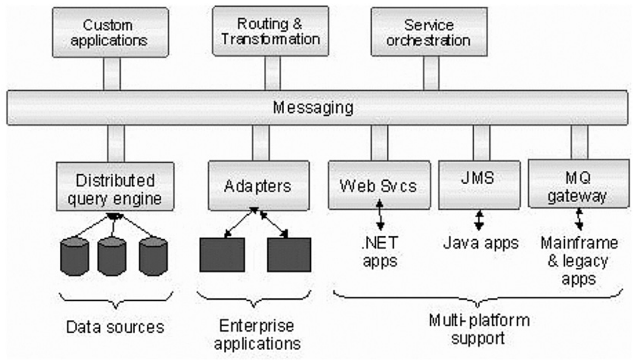

Figure 2: ESB schematic

The main advantage of using ESBs as underlying communication infrastructure is that it abstracts Services from a strong coupling in terms of reference and time (Fensel, 2004) as posed by current communication paradigm based on message exchanges.

2.7 Semantic Enterprise Service Bus (SESB)

Same as in the case of SSOA, Semantic Enterprise Service Bus (SEBS) combine the benefits of the Semantic Web with the event driven, intelligent routing and communication mediation facilities available in plain ESBs. SEBS represents the perfect communication infrastructure for SSOAs as it includes native semantic support. This supports translates in the seamless integration of semantically heterogeneous applications (e.g. services) into a shared communication mechanism that provides all the means for the reliable, asynchronous and flexible delivery of information.

A number of approaches exist (sTuples (Martín-Recuerda et al., 2006), Triple Space Computing, Semantic Web Spaces [(Martín-Recuerda et al., 2006), (Tolksdorf et al., 2004) (Tolksdorf et al. 2005) (Tolksdorf et al., 2005a)] and CSpaces [(Martín-Recuerda et al., 2006) that tackle the problem of realizing complete SEBS. However, none of them provides a solid and complete implementation of the concepts and ideas behind SEBS. Thus, one of the main tasks in this WP, besides defining a complete LUISA reference architecture, will be explore the status and applicability of current initiatives to LUISA. In case none of them suit the project architectural requirements, LUISA will considering realizing a minimal SEBS that serves and fulfils the communication requirements of a fully-fledged SSOA.

3. A layered architectural model

The reference architecture follows a layered model where layers are piled on top of each other building a stack (see Figure 3). Each layer comprises a number of SWS that realize the layer functionality providing support to the ones building of top. Additionally, each one of the layers is also defined as a SWS that communicates with others by means of message exchanges. By these means a fully-fledged SSOA is defined.
In the following the layers that comprise the architectural specification are briefly depicted:

- **Persistence layer:** Encloses a number of services that detail a light weight framework for simple storage management. In this layer the basic LO together with the semantically enhanced metadata that describes them are kept.
- **Semantic Layer:** Defines the main building blocks that implement the semantic support of the framework. It builds on top of the storage layer comprising a reasoning engine that supports mediation among heterogeneous SWS and the LO they interface.
- **SWS layer:** Depicts a number of well defined services that put in place the functionality that enables the publication, discovery, negotiation, choreography, orchestration and execution of SWS and the LOs they interface. This layer builds on top of the basic semantic layer.
- **Communication layer:** Comprises an ESB service that provides a sharable mechanism to manage messages guarantying its delivery and mediation. It facilitates the functionality that allows the architecture to communicate with other systems and internally between the SWS that build it. Every other layer in the architecture makes use of this one for service-to-service communication.

In addition to these main layers two more levels of abstraction have been added to the framework that helps realizing a fully fledged framework and reference architecture.

2 Taken from: Ibarra, F: "The Enterprise Service Bus: Building Enterprise SOA", http://dev2dev.bea.com/pub/a/2004/12/soa_ibarra.html (accessed Oct, 2006)

- **Ontologies:** In order to enriching LO-metadata with machine processable semantics the WSMO ontology has been augmented accommodating the specific requirements of LO. This architectural building block does not comprise a service by itself but rather a necessary artefact for the richer description of LO.
- **Tooling Support:** The enhancement of syntactic metadata describing LO with semantic annotations requires proper tooling support that eases the task. Thus, a LO annotation tool is made available as part of the architecture that fulfils this purpose.

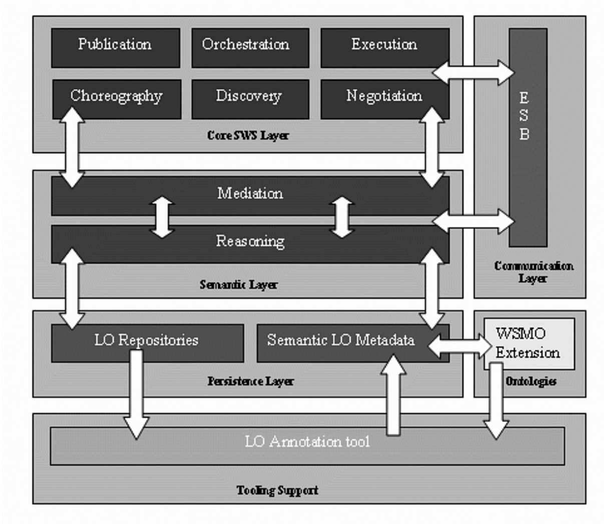

Figure 3: Layered architecture

4. LUISA: Learning content management system Using Innovative Semantic Web Services Architecture

The concept, standards and technology of learning object has resulted in increasing levels of transportability of learning contents across platforms. Nonetheless, the promise of reuse of learning objects depends on the provision of the Web infrastructure that enables semantic interoperability for the discovery, selection, composition and negotiation of learning objects. Such an infrastructure requires rich semantics in learning

object metadata and consistent Learning Management Systems (LMS) and Learning Object Repositories (LOR). Semantic Web Services (SWS) are a candidate architecture for such needs that provides the required richness in description and semantic interoperability facilities. Ontologies can be used for the description of learning needs and learning object metadata, and mediation facilities can be used both for the distribution of services and also as a mechanism for flexible semantic interoperability.
The main aim of LUISA is that of developing the reference architecture and providing relevant evaluation case studies for a SWS-based framework that enables the construction of advanced learning technology tools and systems that re-use learning objects and learning designs. SWS components integrated with existing LMS technology will open new possibilities in the design of learning experiences or the selection of existing ones, once they are registered in a semantic LOR.
The architecture presented in the previous section sets the conceptual basis for the work to be conducted in LUISA and which meets the afore mentioned requirements and characteristics.

5. Conclusions and future work

This paper presented the description of reference architecture for the development of microlearning applications and their deployment on different settings regardless of the application domain. The paper tries to adopt the point of view of the instructor as far as it takes under consideration the discovery and composition of microcontents with the aim of building a whole micro course, but also of the learner who will consume the contents in a ubiquitous environment.
As future steps, the ideas presented in this work will be implemented and tested as part of the EU-funded project LUISA, which tries to apply and combine Semantic Web and Semantic Web Services technologies to eLearning in general.

6. Acknowledgements

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Learning Organizational Memory and Microlearning
(Semantics for Microlearning)

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Abstract: this article, present several scenarios showing the pertinence of the concept of microlearning. It also describes the main requirements for structuring microlearning sessions and in particular the definition of micro-content. We also present an environment designed in another context. The objective is to show the elements that could be updated for enhancing the system with microlearning scenarios.

1. Introduction

Microlearning is a new concept dealing with the constant need to learn and the difficulty to access the right information when it is necessary. These difficulties are coming from the large amount of information and its non adaptation to learner's profile and agenda. Microlearning community claims that people can learn better, more effectively and in an easier and more enjoyable manner if information is broken down into smaller and attractive units and if learning takes the shape of small steps.

In this way, pedagogical micro-content can better support microlearning steps. It has to be based on a simple technology that can be run on all web-based platforms and devices, including web-enabled phones, personal assistant and TV. Micro-content contains a very limited amount of information compared with other forms of classical contents due to several constraints: (i) physical device limitations (screen size, interaction), (ii) limitation of cognitive effort due to short time dedicated to learning sequences.

Micro-content can be either self-contained, individually referable, allowing its reuse in different structured macro-contexts and macro-containers, or it can be filtered from macro-content with specific algorithms generally based on device limitations. In conclusion, micro-content can be considered as a kind of learning object requiring some dedicated metadata.

In the Information System context, the "Semantic Learning Organization" (SLO) is an emerging concept that extends the notion of learning organization in a semantic dimension. A SLO must be considered as a learning organization in which learning activities are mediated and enhanced through a shared knowledge representation of the domain and context of the organization.
Within the project MEMORAe we developed an environment based on the concept of organizational memory in which pedagogical content is broken down into notions to learn. This environment has been designed and evaluated, and is dedicated to be used by a SLO. In such a system notions are linked together according to a pedagogical scenario in order to guide learners during their training. Learning content is indexed on notions described and organized by the means of ontology. Learners can acquire these notions by doing different tasks (solving problem or exercise, reading examples, definitions …). Learning content can be expressed according different formats and for different access supports, that is why they are also indexed by corresponding metadata.
In this article, we first present several microlearning scenarios; some of them are related to mobile learning. Then we present some requirements for microlearning and in particular the definition of micro-content. Finally, we describe the most important results of the project MEMORAe (which in French stands for Organizational Memory dedicated to eLearning). Our objective is to show how the resource indexing process used in the project could be adapted for storing specific micro-content. Its environment could be enhanced with scenarios based on microlearning sequences.

2. Scenarios of microlearning

Microlearning can be seen as a contextual lifelong learning process. Microlearning activities rely on the access to learning resources which may happen at anytime, anywhere and with the support of any device. These activities generally requires a short sequences and do not intend deep cognitive implication.

The first scenario describe a secretary having a break of 15 minutes and willing to know more about a text editor, for example the use of the format option. She has to access for a while to relevant resources displayed on a computer screen. In the case she is not in her office but has her PDA, she can access the same content but with resources adapted to the specific screen of this device.

Other scenarios directly involve the use of mobile devices. The specificity of the PDA may confer to it the right device for microlearning. In (Trifanova and Ronchetti, 2005) and [Kadyte, 2005], the PDA is presented as the best device for supporting the learning of a language and that may efficiently help the preparation of an exam.

All steps required to achieve a learning objective can be organized around episodes concerning notions to acquire and a microlearning environment must enable learners to record in history, episodes they have already visited. They can access the following episode as soon as they have several minutes free. Several episodes may be required to present the same notion; in this case they are linked into a sequence. It would also be interesting to have different sequences to offer to learners. They could choose the more appropriate one according to the context (time, device) or their preferences (presentation, example, course, exercise…).

In these scenarios, learners could follow, step by step predefined training paths of independent episodes organized around notions to acquire. Micro-content used in these kinds of scenarios need specific meta-data to be described and indexed.

3. Microlearning Requirements

Microlearning is an alternative to respond to two major problems concerning learning:

- The overflow and complexity of information,
- The time and place to learn.

Microlearning uses continuous improvements of ICT technology performance. It proposes to structure information into sequences, small and well linked units which take little time. The power of microlearning results from the repeated use of inter-spaces over time. The assumption is that this enables individuals to manage their information acquisition and thus to reach their personal objectives and those of the organization they work in (Bruck, 2005). According to this, we can't realize microlearning without micro-content which necessitates metadata adapted: how to choose one micro-content rather than another one?

3.1 Micro-content

We can find many definitions of micro-content (MC) but according to microwiki[1], MC is a (very) small unit of digital information that is self-contained, individually referable/addressable, allowing use/re-use in different loosely structured macro-contexts and macro-containers.

- MC is small: It contains a very limited amount of information compared with other forms of cultural "content". The reasons are physical limitations (screen size, interface complexity) and cognitive limitations (limited attention span of PC and Web users, but also of media users in general).
- MC is individually referable and addressable: It is defined or at least definable by a set of formally declared metadata (like a specific URL / permalink, a time-stamp, an author name, an IP address, connection data, a subject line, a tag or keyword …).
- MC is self-contained: It is a unit of information that can stand for itself not only formally (through metadata) but also semantically. It can clearly be separated from its macro-context. It is not locked into a macro-text or into an application. It is focused around a single idea or small set of related ideas. It is accompanied and defined by explicit or implicit metadata.
- MC is reusable: It is content set free to separate and form new patterns, in the mind of the user, on the screen of a device or within the processing logic of an application. It is "small pieces loosely joined", enabling new technologies of aggregation and syndication and new socio-cultural practices. It allows new "fuzzy" forms of texts, new open patterns of sign, new collaborative practices of communication.

According to the Ltsc working group on Learning Object Metadata[2], Learning Objects (LO) are defined as any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning. Examples of technology supported learning include computer-based training systems, interactive learning environments, intelligent computer-aided instruction systems, distance learning systems, and collaborative learning environments. Examples of Learning Objects include multimedia content, instructional content, learning objectives, instructional software and software tools, and persons, organizations, or events referenced during technology supported learning.

1 http://www.microlearning.org/MicroWiki.html (accessed Oct, 2006)
2 http://ltsc.ieee.org/wg12/ (accessed Oct, 2006)

According to (Hall 2001), LO, also called *Reusable Learning Objects*, are rather philosophies for how content can be created and deployed. LO refer to self-contained chunks of training content that can be assembled with other Learning Objects to create courses and curricula, much the same way a child's Lego blocks are assembled to create all types of structures.

Learning Objects are designed to be used in multiple training contexts, aim at increasing the flexibility of training, and make course updating much easier to manage. When a learning object is updated, the change appears in any course using that learning object.

Because micro-content and learning object are both self-contained chunks of training that can be associated to others MC or LO, we can say that micro-content is a kind of digital learning object which is small information, knowledge dedicated. We can call it microlearning object.

3.2 Metadata for Microlearning

In order to be accessed or to be reused, a micro-content necessitates adapted metadata. According to (Hug 2005), different definitions of Microlearning are brought forth by different interpretations of particular dimensions such as:

- Time: relativity 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, etc.,
- Mediality: face-to-face, mono-media vs. multimedia, information object or learning object, etc.,
- Learning type: repetitive, activist, reflective, pragmatist, corporate learning, learning by example, etc.

We think these dimensions must be considered in order to define MC metadata. Because MC is a kind of LO, we were interested in the Learning Object Metadata (LOM). The LOM standards will focus on the minimal set of attributes needed to enable LO to be managed, located, and evaluated. The IEEE Learning Object Metadata

Draft defines eight meaningful categories of descriptors[3]:

- General: groups the general information that describes LO as a whole: Identifier, Catalog, Entry, Title, Language, Description, Keyword, Coverage, Structure, Aggregation Level.
- LifeCycle: features related to the life cycle of the resource, like Version or Status.
- MetaMetaData: origin and edition of the metadata.
- Technical: this category describes the technical requirements and characteristics of LO: format, size, location, requirement (OrComposite, Type), installation remarks, Other Platform requirement, duration).
- Educational: this category describes the key educational or pedagogic characteristics of LO: Interactivity Type (active, expositive, mixed document), Learning Resource Type (exercise, diagram, graph, experiment, table, slide…), Interactive Level, Semantic density, Intended End User Role, Context, Typical Ange Range, Difficluty, Typical Learning Time, description, Language.
- Rights: this category describes the intellectual property rights and conditions of use LO;
- Relation: this category defines the relationship between one LO and others, if any;
- Annotation: comments on the educational use of LO and information on when and by whom the comments were created.

The categories Technical and Educational seem to correspond particularly to microlearning requirements. In the same way, sequences could be described by the means of descriptors Aggregation Level and Relation. However, it should be interesting to define a sequence as an entity. Even if all these descriptors are important; we think they must not be used in such a way because we do not agree, for example, to associate various activity types like exercise or exam, with data representation like diagram, figure or graph in the same set (Learning Resource Type). Moreover, because micro-content is a very small unit concerning a piece of knowledge, we think it is meaningful to index it by this one: Keywords are not sufficient. For example, how to access MC concerning the format option of an editor and to choose the part about paragraph rather than column? It is important, when you have small time to learn to have access to this kind of information in order to better reach your objective: (general) format option, paragraph format option, or column format option?

3 http://ltsc.ieee.org/wg12/files/LOM_1484_12_1_v1_Final_Draft.pdf (accessed Oct, 2006)

Finally, in order to index MC, we think it is necessary at least to define and organize by the means of ontology:

- Descriptors from the LOM.
- Knowledge to acquire.

Both are necessary to access the right MC at anytime and anyplace.

4. The project MEMORAe

4.1 Presentation

Numerous learning resources may be used during eLearning. eLearning becomes part of a complex organizational conduct, in which lacks of required knowledge trigger the search for appropriate contents. Different approaches may be adopted to exploit such contents. They can be stored in learning objects repositories and then reused, combined and adapted in different contexts. They can also be selected and organized in learning memories that are directly accessed by learners. These approaches offer a goal-driven organizational learning.
Within the project MEMORAe our goal is to let learners directly access the resources of a course memory. Following a knowledge engineering approach, we organise the resources in a learning organizational memory based on ontologies (Abel, Barry, Benayache, Chaput, Lenne, & Moulin, 2004). In fact, it is a course memory, where a course is seen as an organization. This memory is different from a classical organizational memory because its goal is to provide pedagogically users with content. This content is the result of two pieces of work: (1) the capitalization of knowledge, information and learning resources relating to the learning context (a course unit), (2) a pedagogical work concerning the choice and the organization of this capitalization.

The pedagogical content is composed of the notions to learn, the links between these notions and the learning resources they index. Notions are not only chosen because they are related to the course unit, they are also the result of a reflection on the course itself. Resources have to be selected relying on pedagogical goals. The choice of their indexing terms is related to this goal too. It is not an automatic indexing. The course manager is responsible for the relevance of the links. It is not because a document treats of a notion to acquire that it will be necessary indexed by this notion. The choice is explicit, that is to say that the document must have been evaluated as sufficiently adapted to the learning of this notion. These choices are part of the pedagogical scenario the course manager wants to implement.

The learning organizational memory we propose aims at facilitating knowledge organization and management for a given course or training, and at clarifying competencies it permits to acquire.

In order to give learners direct access to the memory, part of the instructional design work has to be made earlier. The advantage is that the memory is ready to be used by learners, provided that pedagogical and didactical choices made earlier are acceptable. This can therefore lead to a loss of flexibility, but we make the assumption that these choices can at least be shared by a teacher community, that could act as a "community of practice" (Wenger, 1998).

Within the project MEMORAe, we realized two pilot applications to evaluate our propositions. The first one concerns NF01, a course on algorithms and programming at the University of Technology of Compiègne and the second one concerns B31.1, a course on applied mathematics at the University of Picardy (France).

4.2 The MEMORAe model

The MEMORAe model relies on the expected use of the memory: eLearning. We mainly tried to:

- Determine and present the notions to learn and resources describing these notions.
- Offer a natural and easy access to the memory contents.

For this purpose, we were interested on the one hand in ontologies to represent the notions to learn and their links (definition of a common vocabulary) and on the other hand in Topic Maps (XTM, 2001) as representation formalism facilitating navigation and access to the learning resources. The ontology structure is also used to navigate among the concepts as in a roadmap. The learner has to reach the learning resources that are appropriate for him.

For navigating through the memory, the end-users (learners, teachers, etc.) need a shared vocabulary and knowledge structured. That is why we decided to model the memory with ontologies. From the different ontology types defined by Van Heijst (Van Heijst, Schreiber & Wielinga, 1997), *generic ontologies, domain ontologies*, *application ontologies and meta-ontologies,* we only use the second and third categories. We have to consider two aspects for modelling the memory and building ontologies (Breuker &

Muntjewerff, 1999). First the domain of training has its own characteristics. Secondly, it must be linked to the application domain of a particular training program. The first ontology (domain ontology) we have to specify, describes the concepts of the «training» domain (cf. figure 1). They can be users' types (teacher, administrative), documents types (book, slides for oral presentation, web page, site, etc.), and media types (text, image, audio, and video). They can also be pedagogical characteristics (activity type) and they can refer to point of view (annotation).

The second ontology (application ontology) specifies the organization of theoretical notions which are studied during training session. In the example of B31.1 course, some notions like "set" or "infinite set" are explained. It is possible, but not mandatory, to consider "infinite set" and "finite set" as sub-concepts of the concept "set" and to define the relation "has cardinality" between the concepts "finite set" and "cardinal" (in this case they are the domain and range value of this relation). According the Ontospec method (Kassel, 2005), concepts can be specialized according to "semantic axes". For example, the concept "set" is specialized according to three axes: finite/infinite, countable/uncountable, subset/superset (cf. figure 2).

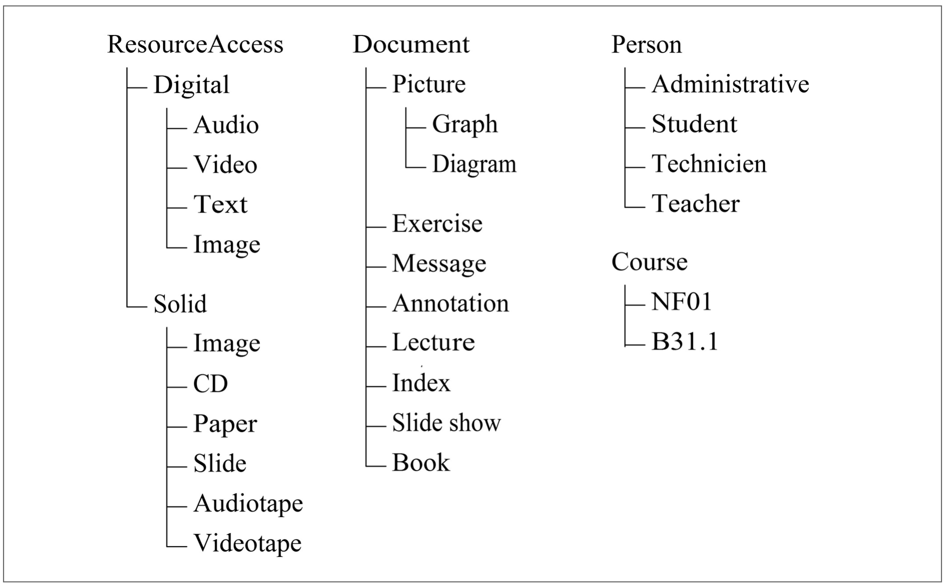

Figure 1: Elements of domain ontology

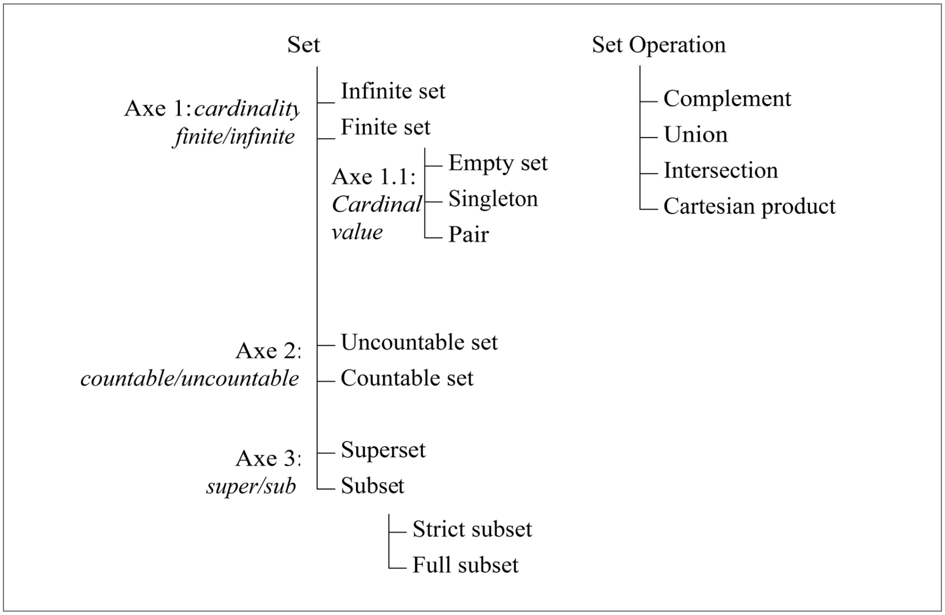

Figure 2: Specializations of the "set" notion

These ontologies are not independent; the second one is necessarily attached to the first one. For example, to express that a document is an introduction to "infinite set" we join the two concepts "introduction" and "infinite set" that do not belong to the same ontology. Pedagogical relations like "prerequisite" or "uses" that occur between concepts of the application ontology are defined in the domain ontology. However, specific roles can belong to the application ontology (for example for the B31.1 application, "has-cardinality").

4.3 The E-MEMORAe Environment

Within the framework of MEMORAe we developed a first prototype: the environment E-MEMORAe[4] .Our objectives within E-MEMORAe are to help the users of the memory to acquire the notions of a given course. To this end, the users have to navigate through the application ontology that is related to the course, and to access to the indexed resources thanks to this ontology.

4 http://www.hds.utc.fr/memorae/ (accessed Oct, 2006)

The general principle is to propose to the learner, at each step, either precise information on what he is searching for, or graphically displayed links that allow him to continue its navigation through the memory. He has no need to use the keyboard in order to formulate a request, even if the environment allows doing it.
To be more precise, the user interface (figure 3) proposes:

- Entry points (left of the screen) allowing to start the navigation with a given concept: an entry point provides a direct access to a concept of the memory and consequently to the part of the memory dedicated to notions. The person who is in charge of the course has to define the notions that (s)he considers as essential.
- Resources (bottom of the screen) which contents are related to the current concept: they are ordered by type (books, course notes, sites, examples, comments[5], etc.). Starting from a notion, an entry point or a notion reached by the mean of the ontology, the user can directly access to associated resources. Descriptions of these resources help the user to choose among them.
- A short definition of the current notion: it enables the learner to get a preview of the notion and allows him (her) to decide if he has to work it or not.
- An history of the navigation: it enables the learner to remind and to be aware of the path he followed before. Of course, (s)he can get back to a previously studied notion if (s)he wants to.

Least but not last, the part of the ontology describing the current resource is displayed at the centre of the screen.

If the learner wants to access to a notion that is not an entry point, he has to choose the entry point that he thinks as being the closest point from the searched notion.

4.4 E-MEMORAe usability

We defined a usability test[6] in order to see how students use the E-MEMORAe environment. Such a test enables to evaluate learning and memorizing facilities, and the usability of the environment. It also enables to evaluate the types of errors and the satisfaction of the user.

5 The comments are the only elements of the memory that the user can modify as (s)he wants. An a posteriori control is made by the editorial committee in order to keep them or not.

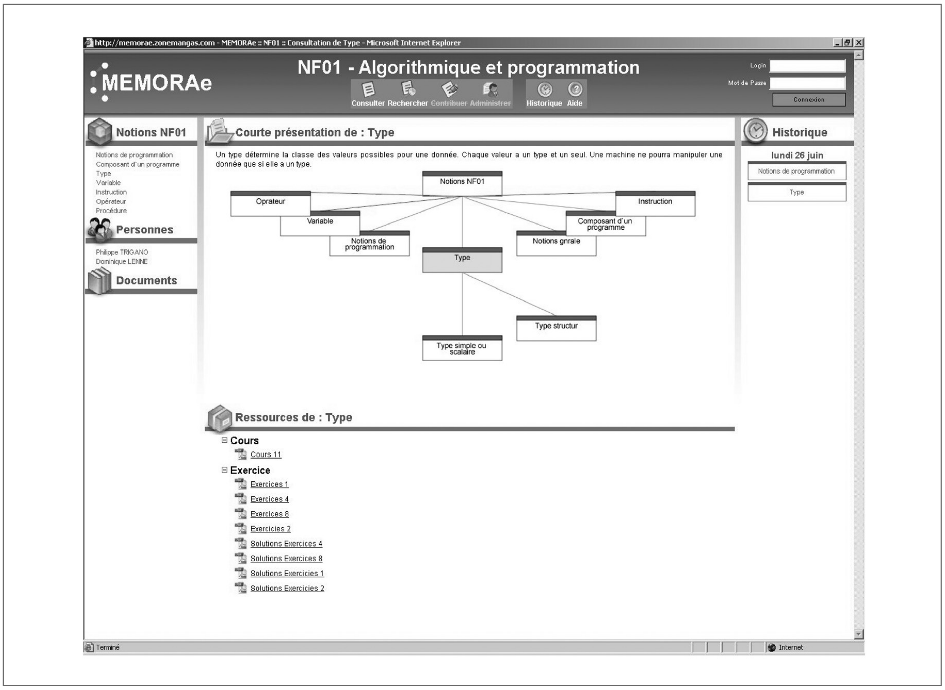

Figure 3: Navigation in the memory

Our objective was to see how E-MEMORAe enables the learners to discover alone new notions to learn. For verifying the understanding of these notions, the learners have to solve some problems concerning these notions and respond to a QCM.
With this test, we can verify the pertinence of our hypothesis on the following points: (i) structuring the content of training by an ontology; (ii) index resources on ontology concepts; (iii) displaying the hierarchy of concepts for facilitating the navigation through the resources; (iv) offering a list of entry points for giving a quick access to the main notions of the course.

The experiments took place at the University of Picardy and the University of Compiègne (France) and were concerning the students attending a master course of

6 http://www.usabilis.com/gb/whatis/usability.htm (accessed Oct, 2006)

statistics or algorithm. Students of the course of statistics were proposed to solve a problem requiring some notions unknown by the students. Students of the course of algorithm were proposed a QCM. They had to use the E-MEMORAe environment to discover the missing knowledge for solving the problem or respond to the QCM.
For each student, the history of the navigation was stored in the memory. We could analyze the way to reach important notions and the resources employed.
After these first experiments, we can conclude that using ontology to index and structure the content of training is a good choice: a majority of students appreciated it. The results obtained by the students show that a majority of them were able to find the indispensable knowledge to solve it in a limited time.

5. Using E-MEMORAe for microlearning

Using the E-MEMORAe environment, it is possible to organize and structure a course around notions to acquire by the means of ontology (application ontology). These notions index resources which currently may be small or big units. In a microlearning context, only the very small capitalized units would be used. However, they must be logically organized in sequences. A priori, the application ontology must not be updated with concepts because even small the units are concerning the same domain.
In order to better index resources, information concerning the generic training domain (domain ontology) is used. Types of documents, types of support and pedagogical characteristics are occurring in this ontology. It must be completed with concepts dedicated to the microlearning context. For example, it would be necessary to add sub-ontology concerning time (subjective time, measurable time, etc), form (fragment, episodes, etc.), mediality (mono-media, multi-media, etc.), device support (PDA, PC, etc.).
A difficulty is to enable the building of sequences of episodes and the resources they involve. A solution could consist in cutting down into small units a bigger one. However, new specific sequences must be envisaged.

The E-MEMORAe environment enables to record the history of notions and resources already accessed. Thus learner can better organize and attend their training. They can consult different resources of different or same type about a same notion, access to a narrow notion, etc. Microlearning requests a more structured organisation of resources because the training path, based on sequences seems more linear.

6. Conclusion

Within the project MEMORAe we developed an environment based on the concept of organizational memory in which pedagogical content refers to the notions to learn. Notions are linked together and organized by the means of an ontology. Documents and resources are indexed on the concept of this ontology but also on a domain ontology. From this experience, we examined the elements which could be reused and those which would need to be updated if the environment were used in a microlearning context. The main issue is the extension of the domain ontology.

We also tried to define the most interesting conditions of microlearning. First, some specific learning scenarios seem better adapted and we presented several of them. Then, the use of mobile devices seems unavoidable because they are very well adapted to situations favorable to microlearning.

We have also presented some particular requirements and in particular the definition of micro-content. This kind of content can be extracted from standard content but it needs to be repackaged in order to fit the technical conditions of microlearning. The creation of new content specifically designed seems completely indispensable.

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Personal metadata for cataloguing microcontent – linking to large ontologies?
(Semantics for Microlearning)

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Abstract: Microlearning objects can be related by means of freely created annotations or tagging. Although such solution can help with filtering and searching, it is not enough for formalizing microlearning towards the semantic Web approach. In this paper, we propose the use of upper ontologies and more concretely, OpenCyc, to provide the required formal semantics needed by the semantic Web.

1. Microlearning

The tools to create microcontent have made easier to generate and publish information based on one's personal, subjective view of the world. Microlearning approaches may benefit from reusing microcontents in informal learning settings (Chisholm, 2005). This in turn calls for a reconsideration of how to find postings in common microcontent systems (Langreiter and Bolka, 2005). However, the volume of microcontent items being generated daily needs mechanisms to categorize them so that they can be more easily selected through information filtering technology. Standard metadata specifications as IEEE LOM could be used for that purpose, and public ontologies or taxonomies could be used for categorization. Furthermore, the subjective character of blogs and other microcontent systems suggests that kinds of "personal annotations" are required to retain the essence of microcontent which contrasts with approaches to metadata in which typically an information science professional or an specialized expert categorizes the content using common standards.
An approach to create a more personal and loosely organized cataloguing is „tagging" (as known from **del.icio.us** and Flickr). An arbitrary number of tags (lightweight keywords) can be assigned to every bookmark posted. 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 (Langreiter and Bolka, 2005). Tagging can be organized through the metaphor of *folksonomies,* which have the required characteristics to integrate seamlessly with microcontent creation systems as blogs. Folksonomies are defined[1] as *"collaboratively generated, open-ended labeling system that enables Internet users to categorize content such as Web pages, online photographs, and Web links. The freely chosen labels – called also tags – help to improve search engine's effectiveness because content is categorized using a familiar, accessible, and shared vocabulary".*

In spite of its flexibility, tagging and folksonomies are not enough for becoming the raw material for a Semantic Web approach (Berners-Lee et al., 2001) for filtering and personalizing microcontent. The missing element is the formal approach provided by ontologies. Ontologies provide an explicit, shared representation of a domain providing unambiguous definitions for the main concepts and relations describing the phenomena under consideration (Gruber, 1995). Description logics (Baader et al., 2003) are well-known and thoroughly studied knowledge representations that can be used to develop formal ontologies and systems that use them, enabling reasoning services of a diverse kind. Formal ontologies thus provide a foundation for representing the diverse aspects of virtual communities and the artifacts they deal with in terms of ontologies, which would eventually result in advanced tools that are aware of the structural and cultural issues that are part of a community. Ontologies can be expressed in Web markup languages for ease of processing and interoperability. Notably, the OWL language has reached the status of W3C recommendation, and several tools are yet available to edit or process OWL representations. Thus, the problem with bringing the Semantic Web to microlearning can be approached by bridging with the actual practice of tagging to the formal annotations provided by logical ontological languages. This can be seen as a form of providing normative usage semantics to microcontent (Sánchez-Alonso and Sicilia, 2005). The key issue is doing that in a form that still retains the informal and easy way to tagging. This paper describes a possible approach for that issue that uses public large ontologies as the way to connect informal to formal semantics.
The rest of this paper is structured as follows. Section 2 deals with the form of micro-annotations and their interpretation in common interfaces. Then, Section 3 describes how such tags can be linked to large ontologies for reuse of common, shared semantics. Finally, conclusions and outlook are provided in Section 4.

1 http://en.wikipedia.org/wiki/Folksonomy (accessed Oct, 2006)

2. Typing in micro-annotations

The concept of annotation in the Semantic Web refers to the creation of semantic metadata, which essentially entails the creation of some statements that use the concepts and relations of one or several domain ontologies.

Euzenat (2002) formalized semantic annotation in the context of the Semantic Web as follows: from two sets of objects, documents and formal representations, two functions can be created: a *function from document to formal representations*, called annotation and a function from formal representations to documents called index. Thus, formal metadata is a requirement. According to the Wikipedia, "a folksonomy is a collaboratively generated, open-ended labeling system that enables Internet users to categorize content such as Web pages, online photographs, and Web links. The freely chosen labels – called tags – help to improve search engine's effectiveness because content is categorized using a familiar, accessible, and shared vocabulary". The flexibility of tagging is clearly incompatible with the approach to annotation in consistent and formal ways in the Semantic Web. However, a strategy for proving stricter semantics to tagging could be based on the following aspects:

- Provide easy ways for more detailed tagging.
- Provide mappings from folksonomies (systems of tags) to formal ontology.

This section deals with the first aspect. To illustrate the strategy, an example from del.icio.us, shown in figure 1, will be used.

Figure 1: An example of tagging in del.icio.us

Tagging consists of placing a content (or reference to it) under a label. This entails that a single predicate is used, that in description logics form could be understood as a property of a class named generically InternetResource in the following form:

$\forall$*classifiedIn.Tag.* This only provides a basic definition, but it introduces the restriction that the tagging process has an implicit meaning. An alternative may be that of using different "predicates". This is not a new concept, since it has been applied in research at least since the seminal work of Trigg (1986). Further, annotation tools like the *Annotea* technology (Kahan et al., 2002) can be easily integrated to carry RDF annotations as those to shared repositories in an easy way, integrated in popular browsers.
This basic enhancement has important implications for learning design, since the semantics of the different predicates can be used to aid in different pedagogies. For example, a position biased to reflective learning will seek for criticizes. Tag predicates. For example, the popular critical article of Wiley[2] on learning objects would be described with that predicate and thus make available to tools that are looking for controversial contents on a given topic. The interface in figure 1 will need to reflect the kind of predicate somewhat, e.g. several "common tag" clouds.

Further, predicates could be extended to link InternetResource instances, and not only as a mean to connect resources to tags. This way, for example, the same criticizes predicate could be applied to two microcontents, one replying to the other in a critical way – which is a very common pattern in weblogs. In figure 1 these links could be showed as decorations of the way links are displayed.

3. From tags to ontologies: linking to upper ontologies

The simple mechanism of differentiated predicates described above can then be complemented by other more complex approaches that add full formal semantics to tagging. A non-intrusive approach for this could be that of linking tags to concepts (or other ontology elements as instances) in shared ontologies. For a maximum reuse, large, commonsense ontologies and ontological semantic lexicons such as OntoWordNet described by Gangemi, Guarino, Masolo, Oltramari (2003) and W3C (2004) are obvious

2 http://opencontent.org/blog/archives/230 (accessed Oct, 2006)

candidates, even though a combination with more specific domain ontologies also could be used.

OpenCyc[3] is the open source version of the Cyc Knowledge Base (Lenat, 1994), which contains over one hundred thousands atomic terms. It is provided with an associated efficient inference engine, and it attempts to provide a comprehensive upper ontology of "commonsense" knowledge. In what follows, OpenCyc is used as an example of the potential of the approach proposed.

The non-intrusive approach can be summarized in the following:

- The tagging capabilities of the systems are retained, with the predicate typing described above.
- A separate tool is provided to connect tags in the available folksonomies to elements in the upper ontology.
- The tag-to-ontology connections are used for building "clouds" and/or finding related items.

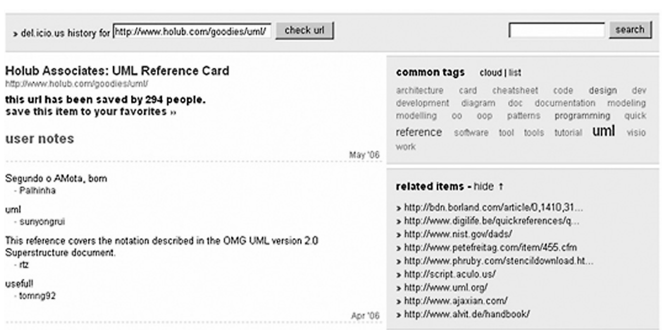

Figure 2: Another example of tagging in del.icio.us

The approach has the advantage that common microcontent creators can still use the easy tagging mechanism, and the formal mapping to the ontology can be done by other users, or even by specialists. Figure 2 shows an example of the approach. First, the *uml* tag can be directly mapped to the OpenCyc individual **oc_UnifiedModelingLanguage**,

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3 http://www.opencyc.org/ (accessed Oct, 2006)

since they represent the language. This simple mapping (in this case, an equivalence), entails that the subsumers of the OpenCyc term, as oc_ComputerLanguage, could be used for finding related items.

In another direction, provided that a predicate oc_umlElement exists, there could be also navigation to links that explain different aspects of the language, as oc_umlClass or oc_umlInstance. Once this connection is made, the problem on how to traverse the ontology and/or find related links is a matter of user interface tactics in ontology browsing (García-Barriocanal and Sicilia, 2003). These kinds of mappings are a way to provide indirect formal semantics to informal folksonomies or collections of tags.

4. Conclusions and Future Work

The classification and organization of microcontent is one of the main challenges in turning microlearning into an effective pedagogy. Folksonomies and tagging can be used as subjective, informal classifications created openly by link collectors or micro-content creators. However, they do not provide the required formal semantics that Semantic Web applications need to build richer and more advanced information seeking technologies. A practical and non-intrusive approach to bringing a degree of formal semantics to tagging has been sketched in this paper. The approach is based on the use of predicate types, and the separate linking of tags to formal ontology elements.

Future work will continue in the direction of fully specifying the kind of annotations and mappings sketched here, and also in the direction of studying the user interface techniques that better fit the informal way of creating or collecting microcontents in current systems as weblogs.

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From *microcontents* to micro-learning objects – which semantics are required?
(Semantics for Microlearning)

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Abstract: Microlearning has been considered as a specific pedagogical approach that focuses on the use of *microcontents* as a special, small and subjective account of the concept of "learning resource". In other direction, the learning object paradigm focuses on the reuse of learning resources by means of metadata. At first glance, both approaches may be considered as complementary. However, the micro approach to learning (arguably) emphasizes subjective views, quick creation of information and a degree of casualness. This entails that the creation of metadata should follow the same philosophy, which would eventually result in a specific style or idiom in the creation of learning objects. Further, the micro approach would result in a much larger cardinality of the set of available learning objects, which also poses challenges to the current architecture of repositories and specifications. This paper provides an initial discussion on some of these issues, aimed at fostering further work in the intersection of both paradigms.

1. Introduction

The paradigm of *microlearning*, as the application of pedagogical design techniques based in the use of *microcontents*, poses new challenges both to the current architecture for the storage and retrieval of educational resources and to the consideration of specific established pedagogies (Tscherteu, 2005). Some authors have argued about its complementary character (Eichenauer, 2005). In any case, microlearning as an emerging research stream provides several new trends like a specific model for learning distinct from existing styles and models, among others.

The concept of "learning object" (McGreal, 2005) has become widespread in the last years as the key structuring concept for learning resources – described by metadata records. In principle, a microcontent piece with educational purpose plus metadata describing both the piece itself and its educational usages may be considered as a regular learning object. However, the microcontent vision entails that those descriptions should come from subjective personal views of the world, e.g. those views offered by blog authors.

Consequently, the description, storage and retrieval of "micro-learning objects" should follow some principles that are in coherence with the concrete creation of context of microcontents. For example, micro-metadata would have the requirement to be easy to edit – just as blog posts are. Further, microcontent results in a proliferation of micro-metadata records to a volume that requires a careful consideration from the technical perspective.

The objective of this paper is that of discussing the specificities of the creation of learning objects based on microcontent, providing a point of departure for further elaboration and discussion on the implications of the approach and style of microcontent in their application to reuse for educational needs.

The rest of this paper is structured as follows. Section 2 discusses a definition of microcontent with regards to its relationship to the concept of learning object, providing a number of proposed principles for a practice of turning microcontents into metadata-described learning objects. Then, Section 3 discusses the use of the IMS DRI (2003) specification for repositories in the context of microlearning. Section 4 turns attention to the most important semantic descriptions that should be commonly available to describe microcontents – and the ways in which the annotations could be provided. Finally, conclusions and outlook are provided in Section 5.

2. Are microcontents learning objects?

This is a hard definitional problem, since both terms, "learning object" and "microcontent" are to some extent fuzzily defined. Let's start our discussion from the "version 1.0" definition provided in the *microlearning* Web site[1].

1 http://www.microlearning.org

A (very) small unit of digital information that is self-contained, individually referable/addressable, allowing use/re-use in different loosely structured macro-contexts and macro-containers. (See also content)

(1) **MC is small**: It contains a very limited amount of information compared with other forms of cultural "content". The reasons are physical limitations (screen size, interface complexity: see Micromedia) and cognitive limitations (limited attention span of PC and Web users, but also of media users in general).

(2) **MC is individually referable and addressable**: It is defined or at least definable by a set of formally declared metadata (like a specific URL / permalink, a timestamp, an author name, an IP address, connection data, a subject line, a tag or keyword …). Microcontent is the element that forms the metaweb.

(3) **MC is self-contained**: It is a unit of information that can stand for itself not only formally (through metadata) but also semantically. It can clearly be separated from its macro-context. It is not locked into a macro-text or – important for Web 2.0 – into an application. It is focused around a single idea or small set of related ideas (>> meme). It is accompanied and defined by explicit or implicit metadata.

(4) **MC is reusable and remixable**: It is content set free to separate and form new patterns, in the mind of the user, on the screen of a device or within the processing logic of an application. It is "small pieces loosely joined", enabling new technologies of aggregation and syndication and new sociocultural practices (> Web 2.0, social software). It allows new "fuzzy" forms of texts, new open patterns of sign, new collaborative practices of communication and semiosis.

Self-containment and relative small size were two characteristics used by Polsani (2003) in his definition and discussion of learning objects: "a Learning Object is an independent and self-standing unit of learning content that is predisposed to reuse in multiple instructional contexts". If we use terminology of learning objects to describe microcontents, a first important principle can be established:

Principle #1 Microcontents – when described as learning objects – result in aggregation level 1 learning objects as defined by LOM (i.e. they do not *have parts).*

Further restrictions could be put in the general description.

Principle #2 *Micrometadata* will have a subset of the metadata requirements targeted at microcontents, removing any unnecessary or rarely applicable metadata element.

This second principle entails that structured metadata – e.g. content aggregation metadata as in IMS CP (2005)– is not applicable.

Principle #3 *Micrometadata* will at least include identification information to accomplish for individual referability and addressability.

This third principle is a direct consequence of the definition above.

Principle #4 *Micrometadata* should provide easily editable descriptions that enable software tools to provide services of loose composition, selection and filtering.

These proposed principles are of course arguable and subject to refinement or replacement, but they serve as an initial proposal to frame microcontent in the broader existing conceptual framework of learning objects.

3. Is the IMS DRI adequate for micro-content?

The architecture of the IMS DRI Phase 1 specification version 1.0 (IMS 2003) aims to "provide recommendations for the interoperation of the most common repository functions". If we consider microcontent as a concrete kind of learning objects, the specification is, at least in principle, relevant also to microlearning scenarios. IMS DRI 1.0 allows for the definition of metadata-only repositories: "Repositories may hold actual assets or the meta-data that describe assets". This would be the most common case for microcontent, since the content items would likely be stored at the user facilities (blog, Wiki, etc.) while repositories for search would only store descriptions (or even references to the places in which the descriptions are actually stored).

DRI defines the interactions between core functional components (resource utilizers and repositories) that support interoperability, including:

- SEARCH, GATHER, (ALERT)/EXPOSE
- REQUEST/DELIVER
- SUBMIT/STORE

Note: ALERT is a core function, but is not addressed within this version of the DRI specification.

The DRI Project Group is focusing on these core interoperability functions within the functional architecture. The following functional diagram of the IMS DRI specification depicts the core interaction addressed (the rest of the elements are blurred since they are not covered by Phase 1).

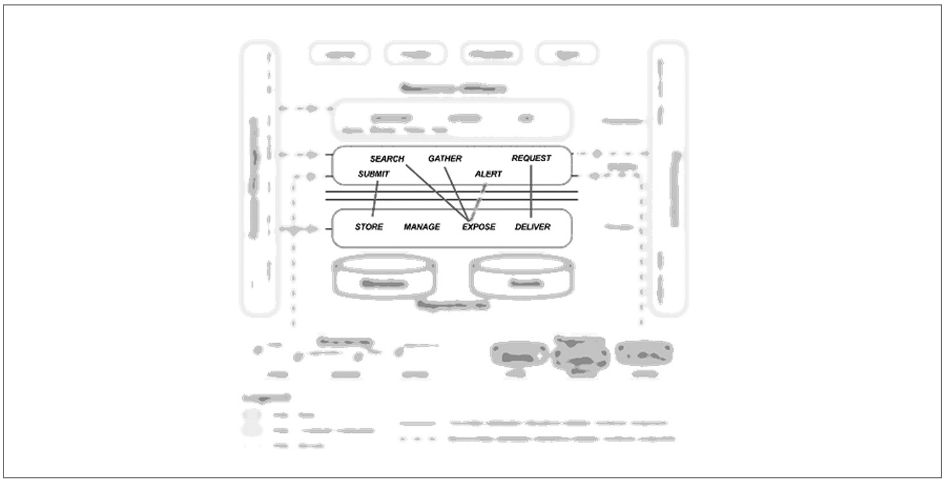

Figure 1: IMS DRI first phase functional model

The Search reference model defines the searching of the meta-data associated with content exposed by repositories. Compatibility of SEARCH/EXPOSE in semantic repositories must be provided by some kind of mediation layer. This raises the need for additional elements:

- A *Query mediator*, which takes as input either Z39.50 or XQuery queries and transform it to a search in the internal format of the semantic repository.
- A *Semantic-Search* function to directly search in semantic terms.

The following diagram depicts the overall functional architecture resulting from the analysis of the IMS DRI specification (only the relevant portions of the DRI 1.0 functions are depicted).

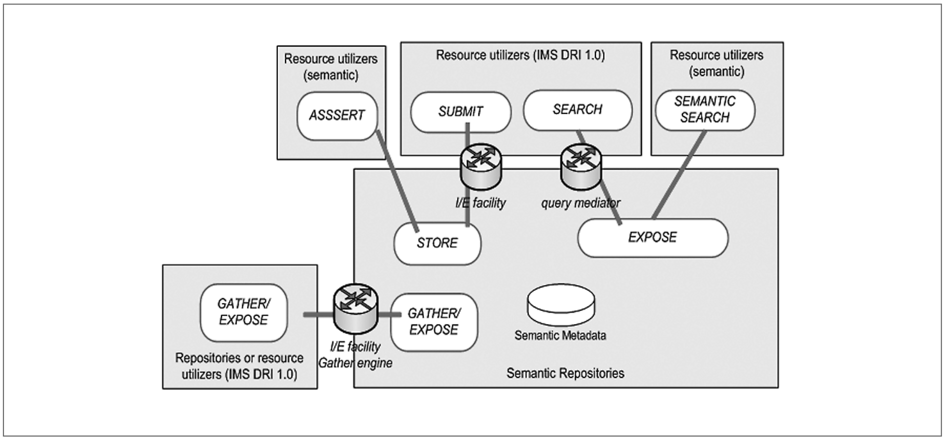

Figure 2: IMS DRI combined with a semantic repository

The conventional search, gather and submit functions require specific components to bridge from the non-semantic to the semantic representation.

The functional semantic architecture described above can be applied to micro-learning objects, but there are several issues that are especially relevant to microlearning settings:

– The ASSERT functions should follow the principles stated in the above section.
– Metadata ASSERTED should be considered in different ways depending on the author. Author information in LOM metadata is provided in the *Meta-Metadata* category. The important thing here is that metadata provided by the author of the microcontent must be provided with a differentiated relevance. Since microcontents are in many cases created in highly personal environments as blogs, the author's metadata must be supposed to reflect the original intentions and the world view required to properly understand the microcontent.
– The requirements on full content packaging as mandated by the IMS CP specification is to "heavyweight" for microcontents. Other lighter options must be devised.
– Query languages as XQuery are too specific of the document's structure, so that alternative languages must be investigated.
– Folksonomies as shared emergent conceptualizations (Gruber, 2005) provide the

adequate mean to annotate microcontents, since they are created in an environment in which a degree of subjectivity is a feature. However, the provision of computational semantics that are interoperable require a higher degree of abstractness and less subjectivity. The "linking to upper ontology" approach described elsewhere in application to other areas of knowledge (Sicilia et al., 2004) could provide a mechanism to bring the two worlds together.

In the following section, further discussion on the DRI SEARCH/EXPOSE function will be described, from the perspective of semantic location of (micro-)contents.

4. Which semantics are required to SEARCH/EXPOSE microcontents?

The SEARCH/EXPOSE functionality basically provides a way to ask for resources that fulfill some given requirements. The response is actually metadata referring to the resources, not the resources themselves, which can be later asked through REQUEST/DELIVER.

Current learning management systems (LMS) and learning object repositories (Nash, 2005) based on standards are not oriented to the strict computational semantics requirements reflected in the above requirements. While they are of course useful search tools for educators, the economic gains in reusability require the support of automation to have rapid access to the resources that are candidates to fulfill strictly formulated objectives. In fact, standards of learning object metadata as LOM arguably fail to meet requirement the requirements of intelligent search since they are based on natural language text, which provides little options for automated processing based on complex need descriptions (Sánchez and Sicilia, 2005).

If we would like to provide microcontents with computational semantics while preserving their informal nature and the ways of creating them, a number of consideration must be made. They are summarized in the following list of requirements.

1. Informal, easy metadata creation. A technical solution to annotation that integrates well with the informal and loosely structured ways of creating microcontents.
2. Explicit linking to the author's semantic metadata. This is required since authorship in microcontent is a key element that may even be used for the functionality of search, this is for example, a consequence of the popularity of some personal blogs.

3. Transparently bridging the gap from folksonomies to formal ontologies. This retains the ease of use and open collaborative nature of folksonomies while truly enabling software agents to deal with semantic metadata.
4. Tools considering micro-pedagogy. To date, no specific tools considering content structures as microcontents are are available. However, building a bridge that communicates the learning object perspective and the microlearning side seems an obvious, necessary and not excessively costly task.
5. Mechanisms for reuse and federation of micro-metadata. An example to follow could be that of the MERLOT's federated search technology[2].

5. Conclusions and outlook

Microcontents can be considered as fine granularity learning objects that are created in concrete environments that have some inherent subjectivity, and that are in many cases informal, not following a strong educational intention. Thus, the practice of creating metadata and using them for search has some specific characteristics. This paper has identified some of these potential characteristics, and examined microcontents in the framework of existing architectural repository specifications. This has lead to some reflections on which semantics would be required for microcontents to be effective and preserve their properties.

Much work is required both in the technical and conceptual aspects discussed in this paper. On the technical side, mechanisms for the semantic search, selection and aggregation of microcontents are required if we want to really exploit the benefits of metadata (Koper, 2004). Further, tools for the "micro-annotation" of microcontents for popular technologies (blogs, Wikis, etc.) should be developed and studied from different perspectives – including human computer interaction. On the conceptual side, the main open problem is how to embed micro-pedagogies or micro-didactics into usable ontologies, so that software tools can be developed to aid humans in the setting of microlearning contexts – but for this, studies on learning theories must come before actual ontology engineering.

2 http://fedsearch.merlot.org/search.jsp (accessed Oct, 2006)

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Deploying Recommender Systems for Microcontent: An approach using Social Network Theory
(Semantics for Microlearning)

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Abstract: The concept of microcontent poses a new set of challenges for the design of recommender systems that can assist the users to accomplish a broad set of complex informational tasks as well as to evaluate the importance of information resources such as microcontent structures. In this paper we formulate an approach by using an adaptation of the hubs and authorities model, in order to study the deployment of a recommender system for a microcontent structure such as Wikipedia.

1. Introduction

The concept of microcontent (Weinberger, 2002) apart from its implications for the field of eLearning (Hug, 2005), poses a set of challenges for the design of tools and services that can support and enhance apart from the eLearning process a broader spectrum of informational activities such as discovery of relevant pieces of information and support for social navigation (Dieberger et al., 2005).

On the other hand the enormous evolution of the World Wide Web (WWW) to the "lingua-franca" of content authoring, dissemination and accessibility has increased the volume of information available to the users. However, this also implies a cognitive load to those that want to use the web to support a set of informational activities and tasks, such as in the case of seeking learning resources (e.g. books). Studies of this cognitive load, which is addressed in the literature as information overload (Losee Jr, 1989), can be seen in several fields such as community design and in particular newsgroups (Borchers, Herlocker, Konstan, & Reidl, 1998), consumer behavior and marketing (Meyer, 1998), and to a large extent the web itself.

Modern search engines (e.g. Google – (Brin & Page, 1998)) can address cases of information overload where a resource is filtered by its popularity in a hypertextual context. However those search engines fail in cases where the hypertextual popularity is not correlated with the social context of the entities that produce this resource and are responsible for it.

Since the level of appropriateness of an informational resource to user's criteria is something that is characterized by a high level of cognitive complexity and cannot be extracted mechanically, a set of hybrid methods need to be established in order to make this kind of filtering more efficient to the eyes of the user. Such kind of methods is the family of collaborative filtering (CF) which has been developed to a set of systems that, based on collaborative filtering algorithms, provides recommendations to the users about the appropriateness of the content to their contextual needs (Shardanand & Maes, 1995).

In this paper we address the implications of microcontent to the design of recommender systems that extend the classical blackbox model and rely heavily on the socio-structural properties of the information resources in order to provide an indication of authoritativeness and trustworthiness to the user.

We consider the Hubs and Authorities model originally introduced by Kleinberg (Kleinberg, 1999b) as a departure point for the design of a recommender system capable of exploiting the advances that a microcontent structure provides. To this end our paper is organized as follows: Section (2) reviews the current state of recommender systems and the implications of microcontent to the current design of such systems. Section (3) explains the Hubs and Authorities model and how this can be incorporated in a recommender system. Finally, Section (4) conducts a case study in Wikipedia by using the hubs and authorities model, and Section (5) concludes with some remarks for future research.

2. Recommender Systems for Content and Microcontent

The use of recommender systems has been greatly advocated in electronic commerce (Shaffer et al., 1999), and several popular electronic marketplaces such as Amazon.com have incorporated recommender systems in order to be able to provide the consumers adapted interfaces, based on their preferences and needs. However, a more important aspect of recommender systems (or collaborative filtering) is the application of such techniques to online communities where filtering becomes a transposition of the word of mouth (Brown & Reingen, 1987).
Grouplens (Resnick et al., 1994) was the first implementation of a recommender system that applied collaborative filtering in the context of a community, thus delivering recommendations based on the ratings provided by community members. Since the introduction of Grouplens, several implementations of recommender systems have emerged, based on the same architecture (e.g. Movielens etc.) .

However, microcontent poses some challenges for the design of recommender systems that can be deployed on microcontent structures. In particular, we can identify the following issues when it comes to designing a recommender system for microcontent:

- **Expression of boundary and level of analysis:** Unlike traditional recommender systems, whereas recommendations are on concrete and explicitly defined objects such as movies, messages or documents, a critical issue is the definition of boundary and level of analysis to which the rating will be associated.
- **Expression of preferences and association with objects:** The subjectivity of rating scales is something that has been also discussed in the recommender systems community (Herlocker et al., 2004), however, people evaluate based on memories which can be subjective with the overall quality of the object. For instance, let us consider the evaluation of a learning module. Someone considers some of the parts positively, however, the guidance of the instructor was very poor or the learning material was of bad quality. Furthermore, the course may have been designed for learners with different learning needs. Therefore some parts were already known to the user and he/she received zero utility out of this. When it comes to the evaluation of the module, the user may consider the above in order to provide a rating based on his satisfaction/dissatisfaction. Will the rating scale be enough to capture the full range of the evaluation that the user wants to provide? Can the rating scale be associated with a part or all of the structure?

- **Aggregation of preferences and provision of the recommendation:** Shall we consider the association of the different modules when providing a recommendation? How does the social structure play a role to the recommendation? For instance, someone has taken a course on Object Oriented Design with Java and he has denoted that he has extensively taken courses on Object Oriented design with C++. Will his opinion count more than someone who has taken this course as a beginner? How can we weigh their ratings and preferences in order to provide a valuable recommendation?

Traditional Recommender Systems	Recommender Systems for MicroContent
Fixed Boundary: Recommendation can be explicit about books and courses limited to the lowest item (e.g. a book or a course and not part of a book or part of a course)	*Non Defined Boundary:* E.g. recommendations about a part of a book or a coure.
Explicit Preferences: Votes and preferences are mirrored to the book. Rating scales are the same for every item.	*Implicit Preferences:* Votes about parts of the book or the course (e.g. bad introduction, bad examples). Impact of rating scales on different parts.
Provision of Recommendation: Black box aggregation (item based filtering, nearest neighbor)	*Provision of Recommendation:* Aggregation based on hubness and authoritativeness of the evaluator. Use of the social structure and the semantic associations to influence the metrics.

Table 1: Aspects of traditional recommender systems and recommender systems for microcontent.

Aggregation is an important part of the function of a recommender system because the quality of the provided recommendation is much dependent on the way the collabora-

tive filtering algorithm calculates the similarity/dissimilarity of the user's profile with the data already gathered. However, user interaction is something that relies on both explicit and implicit data (not directly obtained) and may contain noise (Pescovitz, 2000).
The above constitutes our discussion agenda for the design of recommendation systems with emphasis to microcontent. We continue our approach with the introduction of concepts from social networks and in particular metrics of importance and prominence. We discuss an adaptation of the Hubs and Authorities model which can be used in the design of a recommender system for microstructures.

3. Hubs, Authorities and Social Networks

The importance of social networks for the study of learning communities and recommender systems has been advocated by many researchers (Downes, 2005; Rafaeli & Sudweeks, 1997) especially on an "a-posteriori" level of analysis of the social interactions that are formed through them. From its early introduction by Moreno (Moreno, 1953), Social Network Analysis (Scott, 2000) aims to unravel patterns of interactions between group members, which play a major role in the behavior of each individual, thus becoming an important indicator of the overall group activity.
Social network analysis develops the theoretical foundations for a set of measures of prominence such as centrality (Freeman, 1979; Friedkin, 1991) based on basic graph theoretic measures such as the inner and outer degree of a node.

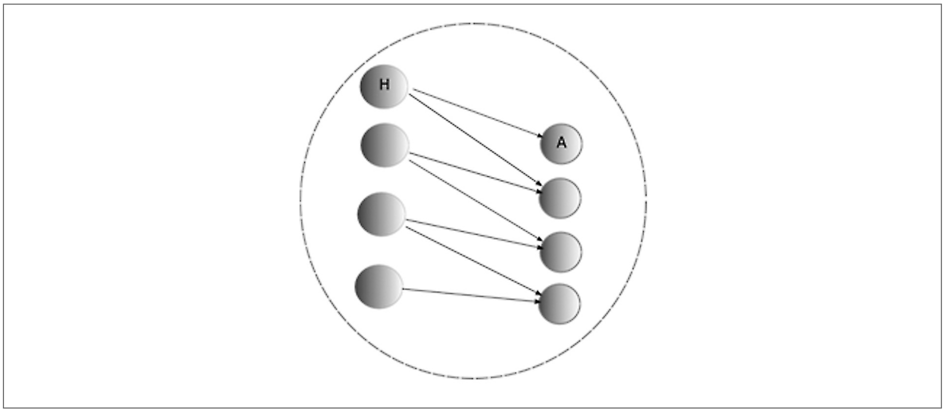

Figure 1: Hubs and Authorities on a topic boundary.

Furthermore, the concept of ranking has been studied in social networks long before the popular Pagerank algorithm was introduced (Page et al., 1998). In particular Katz (Katz, 1953) and later Hubbel (Hubbell, 1965) proposed models of ranking based on path counting and weight propagation over the network[1].

Kleinberg's work (Kleinberg, 1999a) has considered the transposition of authoritativeness over the nodes that have a relatively high inner degree – popularity. As can be seen in figure 1, hubs are characterized by a high level of outer-degree. That is the amount of links/connections departing from them is much higher than the amount of links/connections pointing to them. Taking into account the boundary of a topic, if a node is pointed by many hubs, it is considered as an authority, since flow is directed from many nodes to a single one.

In our approach we consider an adaptation of this model in order to interconnect two different graphs. In particular we consider the structural graph which contains the interactions between users and contributors of the content as well as any other kind of social interactions (e.g. ratings on raters etc). There is also a resource graph that considers the associations between the microcontent entities (e.g. topics, examples, forum posts etc.). Authoritativeness is attributed by the structural graph and hubness by the resource graph. The reason that we derive authoritativeness by the structural graph rather than the resource graph is that we start considering that all the content has the same importance factor initially set to zero. As long as someone attributes authority over the content by using it or rating it positively then this authoritativeness is transposed in the content.

Having provided the above we consider the deployment of a recommender system based on the above principles for a microcontent structure such as Wikipedia.

4. A case Study in Wikipedia

Although discussed above, the hubs and authorities model can be still quite confusing when it comes to incorporation on a recommender system. In relation with our approach in section 2 we consider an example of microcontent such as the articles that constitute a topic in the popular web based encyclopedia Wikipedia.

1 We are not going to elaborate further on graph theoretic aspects of those measures since we are only interested to the ideas that underline their development.

Wikipedia is based on Wiki software (Cunningham) and is considered to be one of the most successful collaborative editing projects on the web since it currently contains over 1 million articles[2] and has an extensive community of contributors contributing content and improving the quality of the articles.

Wikipedia is a voluntary project and since it facilitates a large amount of social interactions over a common affiliation, we consider it as an interesting example to discuss hubness and authoritativeness. In our case we consider the following social interactions:

- When a contributor edits content that has been submitted by someone else then it establishes a tie with him/her. This is depicted by an acceptance factor which represents the percentage of the content of the previous contributor that is visible afterwards.
- Every contributor that has a single or more contribution to the article establishes a relational tie with the other content contributors of the article. Evidence of participation in common projects strengthens this tie.

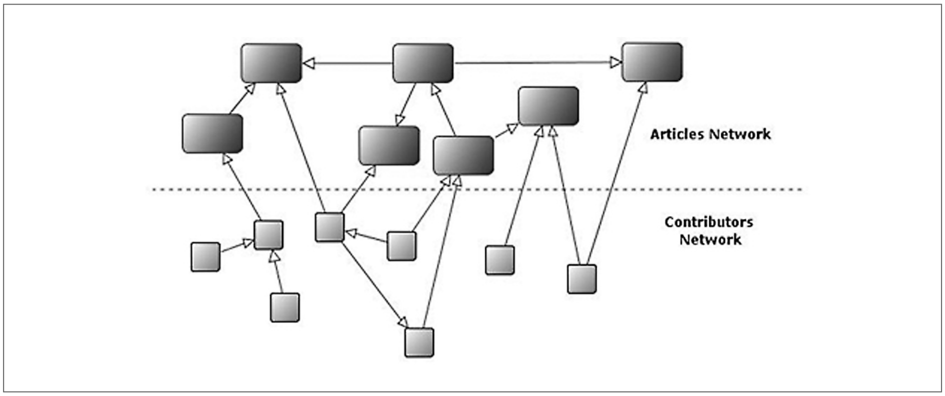

Figure 2: Network layers in the wiki publication model. Contributors are linked together by working on common projects (articles) in the same topic.

2 Statistics and data for the English Language Wikipedia. For further information about the current size of the wikipedia the reader can visit : http://en.wikipedia.org/wiki/Wikipedia:Statistics (Last access date 30th of May, 2006

As can be seen in figure 2 we define two different networks: the articles network and the contributors network.

- **The Articles Network:** Every article in Wikipedia contains references to other articles as well as external references. A set of links used for classification purposes is also available in most of the active articles of the encyclopedia. Every article represents a vertex in the article network and the internal connections between the articles the edges of the network.
- **The Contributors Network:** Wikipedia is a collaborative writing effort which means that an article has multiple contributors. We assume that a contributor establishes a relationship with another contributor if they work on the same article. In the resulted weighted network each contributor is represented by a vertex, and their social ties (positive or negative) are represented by an edge denoting the sequence of their social interaction.

Supposedly that we want to introduce a collaborative filtering system in Wikipedia that can evaluate the trustworthiness of the articles contributed. Based on the above formalization we can initialize a discussion on the following cases by using the hubs and authorities model discussed in Section 3:

- **High Article Hubness and low Contributor Authoritativeness:** In that case an article that directs to many others e.g. an index of the municipalities in Europe has been authored by contributors with low authoritativeness. This can misguide the reader so the articles that are linked from this article can also have a low degree of authoritativeness. So the article is not recommended for reading.
- **High Article Hubness and High Contributor Authoritativeness:** An important article has been written by experts on the field so the article is recommended for reading.
- **Low Article Hubness and low Contributor Authoritativeness:** A not so important article has been contributed by non experts so the article is not recommended.
- **Low Article Hubness and High Contributor Authoritativeness:** A not so popular article is written by experts on the field. This is one of the important cases in Wikipedia where a serious piece of work is not visible to others.

5. Conclusions and Future Research

We have presented the hubs and authorities model as a formal framework for the design of recommender systems for microcontent such as Wikipedia content. However this work is only based on some theoretical considerations therefore a number of research questions still stay open such as:

- Design of rating scales for different parts of the same structure
- Cases where negative authoritativeness influences negatively significant content.
- Evaluation of this class of recommender systems. Current recommender systems are evaluated using a set of guidelines (Herlocker et al, 2004). However as aforementioned, in our approach recommender systems for microcontent rely heavily on the socio-structural context whereas evaluation of those factors needs to be done very carefully.

Furthermore evaluation of that kind of model with data elicitated from a large sample from the Wikipedia is also an important matter.

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The value approach on microcontent and microlearning
(Semantics for Microlearning)

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Abstract: Microcontents as learning resources are special in that they are created informally and have a subjective, personal orientation. This entails that the organizational *value* justification – considering costs and benefits – for microcontents differs from the notions of value associated to conventional learning resources as courses or modules, which were purposefully created or acquired from third parties. Outside the context of an organization, the value of microcontents can only be assessed through social filtering, be it relative to a concrete community of interest or relative to an open Web group. The concept of value in microcontents is important as a measurement instrument and also as a way to assess the actual contribution of microcontents to learning.

1. Introduction

We understand microlearning primarily as learning from microcontent[1] – from *„small pieces, loosely joined"* (Weinberger 2002). Microcontents can be considered as a special kind of learning object, even though their typical usage scenario would be that of informal or *ad hoc* learning rather than planned conventional courses. These differences in the pedagogical approach of microlearning are of course important, but the economical paradigm is a second, relevant aspect that must be considered. Here we will deal with the economical specificities of a micro-learning object approach. By economical we mean relative to the justification of the paradigm with regards to cost-benefit in a broad sense. The following quote (Downes, 2001) clearly illustrates the essence of the economic justification of learning objects:

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

> Now for the premise: the world does not need thousands of similar descriptions of sine wave functions available online. Rather, what the world needs is one, or maybe a dozen at most, descriptions of sine wave functions available online. The reasons are manifest. If some educational content, such as a description of sine wave functions, is available online, then it is available worldwide. Even if only one such piece of educational content were created, it could be accessed by each of the thousands of educational institutions teaching the same material. Moreover, educational content is not inexpensive to produce. Even a plain web page, authored by a mathematics professor, can cost hundreds of dollars. Include graphics and a little animation and the price is double. Add an interactive exercise and the price is quadrupled.

Such core idea can be applied in two contexts that deserve separate attention: (a) inside a given organization, and (b) when learning objects are considered as open access resources. In the former case, value propositions for learning objects can be stated in terms of the internal constructs (Lytras & Sicilia, 2005). In the latter case, inquiry is required in how existing mechanisms for trust and collaborative filtering can be scaled to microcontent production. This paper presents some ideas on both directions, aimed at provoking further discussion on justification models for reuse in microlearning. This paper takes a "Semantic Web" standpoint in that semantic metadata of some kind describing the microcontents is a requirement if an effective location and targeting of microcontents is to be achieved.

The rest of this paper first provides some reflections on the value of microcontent in organizational settings (Section 2), and then sketches the problem of assessing the value of microcontents for personal usage (Section 3). Conclusions and outlook are provided in Section 4.

2. The value of microcontents in organizational settings

Learning object value in the organizational setting is dependent on the value paradigm adopted (Cronk & Fitzgerald, 1999), which may vary from cost-benefit analysis or return of investment measures to more qualitative and multidimensional frameworks including concepts like utility, alignment with strategy, and organizational impact. In any case, those approaches would result in the linking of the effects of using learning objects within the organizational framework. Then, the value of a learning object can be approached from two complementary perspectives (Lytras & Sicilia, 2005):

- The actual value "created" directly or indirectly by its use in learning activities inside the organization.
- The "potential" value of a learning object with regards to a given organizational need.

It should be noted that while the first aspect emphasizes a kind of post-hoc measuring or assessment process, the second one is actually centered on the adequacy of resources for the accomplishment of short or far-reaching organizational goals.

Should specific characteristics of microcontents be considered? The following is a list of issues that can be considered:

1. The **cost of creation or use of microcontents could in some cases be considered as zero**, since they are in most cases created informally. However, it is controversial if the planned creation of microcontent as just another business process could be easily adopted by organizations.
2. In any case, the cost of **creation of metadata to deal with microcontents and relate them to some organizational domains may be considered a cost item**[2], e.g. some specialized knowledge workers could do the job just as it is common to elaborate press summaries in many institutions. These knowledge workers would then be assessing tacitly the "potential" value of micro-contents, with regards to some conceptions of the organization's objectives or needs.
3. Further, it is not enough to select microcontents, but to **target them to the profile and work activity of concrete employees**. This bears some resemblance to "knowledge gap analysis", but in the case of microcontents is much more informal and of a much lower level "granularity".
4. The **benefits of microcontents created outside the company are casual**, since their discovery is not planned or expected, but occurs as part of the information seeking tasks of employees.
5. The ways to measure the value actually created by a piece of microcontent require some **assessment of it carried out by the employee, and thus subjective**.

2 At least in today's state of practice, in which metadata is not provided for most microcontent items.

These and other issues suggest that an organizational consideration of micro-learning requires a micro-social model as that described by Hargadon (2002). Figure 1 depicts an sketch of the main elements of such view.

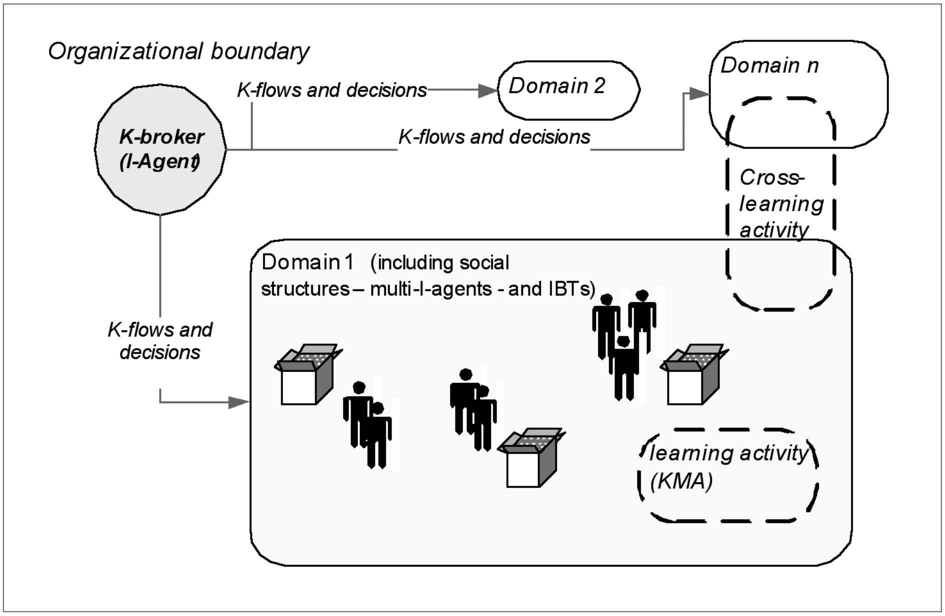

Figure 1: Overall view of Hargadon's elements

In Hargadon's view, the processes are considered in domains of interest inside the organization, and inside them, social networks are the main construct, and local learning activities occur. The concept of knowledge brokers as agents that disseminate knowledge across domains is required for cross-fertilization and eventual transfer of techniques and methods. Microlearning under such a model would be a domain-specific process, and the social network inside each domain would be the agency that selects, creates and targets microcontent locally. This in turn leads to a view of microcontent value tied to the values and objectives of each domain. For example, in the "quality" domain, microcontents useful for acquiring quality assurance techniques could be spontaneously catalogued by the interested people in the domain. Then, the value assessed – that can be expressed for example in terms of ratings – is locally determined, and has the capability of influencing the way the domain behaves. In fact, this informal, social categorization of casual contents is a practice yet existent in many organizations, since it is embedded in the "portal culture", in which some news and documents are put for the "general interest" and not as part of planned, pre-scheduled learning activities.

3. On the personal value of microcontents

Outside the organizational context, value becomes a matter of subjective value. A model of social networks of interest as the one sketched above for organizations could be used, but in this case, conflicts and divergence of interest may be more significant, which suggests other ways to assess value.

Of course a pure "collaborative filtering" approach based on ratings could be used (Konstan et al., 1997), but this by no means entails that ratings would indicate the quality of the microcontent. Such position will be flawed because of the inherent divergences of value for different people that are interested in different matters or have different objectives. In economic thinking, this is a consequence of the principle of explanatory value-subjectivism. This can be explained in the following terms[3]:

> […] *explanatory value-subjectivism*, which simply means that in explaining someone's actions, you appeal to their evaluations, not yours – just as in explaining someone's actions you appeal to their beliefs and not yours. If you see someone walking out on a bridge, and you know the bridge is unsafe and is likely to collapse, but they don't know that, then in interpreting why they're doing what they're doing you shouldn't attribute to them your belief that the bridge is unsafe if they don't have that belief. If you try to explain their action by appealing to your belief that the bridge is unsafe, your explanation isn't going to be any good. […]So explanatory value-subjectivism doesn't say anything one way or the other about whether there is such a thing as objective value; it just says that if you're going to explain people's actions, you explain them in terms of their desires, not yours.

Then, ratings can never be used to sanction the "quality" of a piece of open access microcontent – at least in an objective way. Nonetheless, the process of finding "simi-

3 Quoted from: Economics and Its Ethical Assumptions by Roderick T. Long, available at http://www.mises.org/story/2103

lar interests" in people – which is the objective of collaborative filtering – may still be useful. The problem is that for general Web users, it is not feasible, since it would need a database of ratings were users would be recognizable (even is they use nicks to preserve anonymity).
Peer reviews as in the MERLOT repository (Cafolla, 2002) is a good approach for "conventional" learning objects, but it does not scale for microcontents, which constitute a big volume of items.

The above discussion suggests that microcontent value is essentially subjective, so value assessment would be always considered subjective. A possible direction for exploration is that of social network analysis through exploring linking. These can be combined with algorithms as Google's PageRank (García and Sicilia, 2005) to combine the tacit information in linking with the social approach of web sites as *LinkedIn* that have brought together millions of people that are willing to provide information on their contacts for the purpose of finding jobs, people and business opportunities.

4. Provocative thoughts

It seems that in the next years we will face a new era of "content" primer for learning. It seems that the formal or structured approaches to learning content will go beyond the "well defined" linking of "well defined" objects. In Lytras and Pouloudi (2006) this is expressed in the mode of "level of a-priori structure". In the world of the distributed intelligence of the semantic web we have a key challenge to exploit the "unstructured" micro-contents as well as the "structured" microcenters. *(figure 2)*

5. Conclusions and outlook

This paper has discussed the concept of value of microcontents in the organizational and personal contexts. Some important open questions have been sketched, aimed at starting discussion and providing arguments to the microlearning approach.
This paper has attempted to provide an initial ground for discussing value approaches to micro-learning objects, but further work should deal with the comparison and details of different approaches to microcontent value.

Locus of Knowledge

ARTIFACT	INDIVIDUAL	TEAM	ORGANIZATION
1. Documents Repository Data Warehousing	2. Yellow Pages of Experts Expertise Profiles & Databases	3. Work Flow Systems Collaborative Work Systems Project Deliverables Repository Team Profiles	4. Enterprise Application Integration Best Practices, FAQS Knowledge Maps Knowledge Brokers OLAP
5. Collaborative Filtering Intranets & Search Engine	6. Electronic Discussion Forums	7. Virtual Teams Group Ware Systems Chat/ Conferencing List Servers E-mail	8. Teleconference Intranets Extranets CRM Search Engines Data Mining Help Desk Applications
9. Learning Objects Base Learning Templates Base Metadata Mgmt system Learning Scenarios Builder	10. Semantics Competences Description Learning Expertise Profiles	11. Expert Systems for Personalization Lessons Learned FAQS	12. Profiling System Lessons Learned Programs FAQS Learning Infrastructure
13. Search Engine Keywords Extract	14. Annotations Needs Assessment Tool Motivation System Evaluation System	15. Role Playing Games Business Simulation Brainstorming	16. Benchmarking Business Intelligence

Figure 2: A knowledge management support framework from a learning perspective. Source: Lytras and Pouloudi (2006)

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7. URLs:

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AIS SIG on Semantic Web and Information Systems, http://www.sigsemis.org

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