

Use These Tools, Your Mind Will Follow.

Learning in Immersive Micromedia & Microknowledge Environments

Research Paper for ALT-C 2006: The Next Generation
(Edinburgh, Scotland, September 4 – 6, 2006)

Martin Lindner

Research Studios Austria
Studio eLearning Environments
Technikerstraße 21 a
A-6020 Innsbruck
martin.lindner@researchstudio.at

Abstract

To contribute to the understanding of emerging “micro”-phenomena in the field of e-learning, this paper is introducing some new key terms and concepts: micromedia, microcontent, microknowledge, microlearning. It is argued that until now E-learning has been suffering from a special kind of Digital Divide: Web-based media are developing much faster than institutions, staff and learners can adapt. They are taking on a life of their own, calling for new roles and practices, and even new communities and personas. To understand the new Web, the traditional tool paradigm has to be complemented by a media paradigm. This new Web has to be conceptualized not only as a technological and educational infrastructure, but as a complex and dynamic ecosystem based on microcontent: very small pieces, loosely joined, permanently rearranging to form volatile (micro-)knowledge clouds, and making necessary new forms of microlearning.

Introduction: How dead is E-learning?

This paper argues that for an adequate understanding of future e-learning, a radical change of perspective is needed. It is not a matter of choosing or discarding digital networked technologies as *tools*, or as the plural of *medium* – it is a matter of recognizing them as *media* more generally, that is as an immersive and all-pervasive environment in the sense invoked by Marshall McLuhan. Becoming media, tools and technologies are taking on a life of their own and transform not only the character of content and user’s roles, but even of social and cultural structures.

Most concepts of computer-supported learning are still based on a tool-paradigm. A digital device, application or technology is seen as a medium for delivering precast instructional content faster, cheaper, better managed and better targeted.

But that just doesn’t work. In the last years it has been many times declared that “e-learning is dead” (e.g. Adkins 2003; Cross 2004; Leinonen 2004), both in corporate and academic contexts. Ironically, when the term “eLearning” had been coined in 1998, it initially had stood itself for an explicit counterdraft to the static, restricted and overly formalized “computer-based training”. But during the e-learning bubble it has widely just been transformed to something like Web-based Training plus Learning Management Systems (Cross 2004).

Both Jay Cross and Leinonen add to their rather harsh verdicts a traditional dialectical twist: “E-learning is dead! Long live e-learning!” There seems to be something like a tacit promise inhering within digital networked media that is inevitably leading to visions of a different “learning in a digital age” (Siemens 2005). And though e-learning as we know it may not have been a success story, these visions have to be taken earnestly. The problem is how to translate them into practice.

And it is not only about visions, but also about pure pragmatic necessity. Undeniably there is a “loss of education[al] quality” that is being mourned by the partisans of the pre-digital world (Hirshheim 2005). But there simply is no way back. As we will all be even more immersed in the digital media environment, there just is no choice. People must learn, and as digital media have become ubiquitous, they must learn to learn using digital media – or not learn at all (Neuhold/Lindner 2006).

One main aspect of this is fragmentation. We have to learn to live – and learn – in a micromedia cosmos: Content, attention, communications, roles, even of (pre-digital) communities and identities ... all seems to be falling into digital fragments, loosely joined, that are permanently rearranging to form a multitude of new patterns, tasks and threads.

This paper will first have a look at the technological characteristics and properties of “microcontent” and “micromedia” – two terms only recently coined as a reaction to significant changes in the way digital content is produced, received, used and re-used over the Web. It will be argued that from this some important conclusions can be drawn regarding the changing nature of processes of (micro-)knowledge acquisition and (micro-)learning.

Special attention will be turned to the changing effects of micromedia on learner’s roles and attitudes – not only, and not in the first instance, relating to “geeks”, the “digital natives” or the “Net Generation”, but to the “digital immigrants” of all ages which seem to be still representing the mainstream of knowledge workers – and (at least in Austria) students too.

The next section will take a deeper view of some exemplary technologies and concepts representing the general trend towards microcontent-based communication and information, beyond the usual discussion of blogs, wikis and podcasting. Arguing from a perspective of “Computational Humanities”, interesting theoretical applications of some new web-based applications and technologies will be outlined.

The last section will turn back to the educational field to discuss emerging concepts of “e-learning 2.0”, “nanolearning” and “microchunk learning” and to sketch out some consequences for future (micro-)knowledge acquisition and (micro-)learning. The paper will conclude with a summary and a look at prospects for future developments.

1. “Micromedia” and “microcontent”: Some definitions

1.1 “Micromedia”

Currently, “micromedia” has been associated with two, relatively independent definitions. Lev Manovich, a leading theorist in digital media studies, distinguishes two movements: One that is driven by broadband and multimedia technologies “toward ‘more’ – more resolution, better color, better visual fidelity, more bandwidth, more immersion”, and one that is on the contrary “characterized by low resolution, low fidelity, and slow speeds” (Manovich 2000).

Manovich prophesized that what he called “minimalist media or *micro-media*” would “not only successfully compete with macro-media but may even overtake it in popularity”. In this perspective, micromedia is not just a poor, less satisfactory early stage of rich “macromedia”, but a remarkably stable cultural form of its own right that has just been moving “from platform to platform”, from earliest PCs to early game consoles, from the early Internet to web-enabled cell phones.

The main advantage seems to be its casual quality. Because they do not demand the full attention and involvement of the user, micromedia can be easily integrated in complex multitasking media environments.

A more recent, quite influential definition of micromedia is provided in the context of the so-called “Web 2.0” (see the Wikipedia-entry of the same title for an introduction) and the parallel development toward a highly dynamic, open and fragmented digital “attention economy”. In this sense, “micromedia” are digital atomized media “that can be consumed in unbundled microchunks and aggregated and reconstructed in hyperefficient ways.” (Haque 2005)

Both perspectives are compatible. While Manovich was looking at technological constraints of micromedia devices to discover an independent segment of digital media culture, Haque is noticing the emerging new habits and practices of broadband users who are simultaneously using many applications, looking for information of different kinds and following multiple communication threads. And both are emphasizing the future key role of mobile phones.

2. Microcontent

In “micromedia” environments, content necessarily becomes “microcontent”. This complementary term has been coined in 2003 describe the same phenomenon from a pragmatic IT-perspective:

“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 digital content today. We've discovered in the last few years that navigating the web in meme-sized chunks is the natural idiom of the Internet.” (Dash 2002)

Anil Dash is a programmer and Vice President of a company whose innovative products (*Movable Type*, *True Type*) have been largely responsible for the weblog-boom between 2002 and 2005. But the importance of the “microcontent”-concept goes far beyond blogs – they just were (and still are to some extent) something like the main laboratory of the newly emerging, microcontent-based media landscape of the “Web 2.0”. “Microcontent” refers to basic, usually very small units of digital information that are not locked in “documents” or “web pages”, individually addressible via “permalinks” and therefore allowing use and re-use in much more loosely structured and volatile (macro-)containers and (macro-)contexts (Dash 2002, Spivack 2003, Lindner 2005, Leene 2005).

2. Mainstream micro-learners

“There is a world of difference between the modern home environment of integrated electric [digital] information and the classroom [respectively the office].” (McLuhan/Fiore 2001)

McLuhan, the founding father of media studies, made this diagnosis in 1967. His remarks about the impact of “electric media” on education and the turn to “everyday learning” appear prescient in the context of more recent publications on “digital minds”, the “Net Generation” or digital knowledge workers (e.g. Negroponte 1995, Tapscott 1997, Prensky 2001 and 2004, Alexander 2004, Oblinger/Oblinger 2005, Jones et. al. 2005, Levy 2004, Johnson-Eilola 2005).

The authors agree in that one of the main characteristics of students and workers is an ever diminishing attention span. They are used to receiving information really fast. They like to multitask. They prefer graphics or text chunks that can be scanned at one glance and random, hypermedial access to information. They function best when networked. They want to be engaged, expect instant feedback and quickly lose interest when forced to remain passive. And the borders between private life and work, and games and ‘serious work’, get blurred.

Such assertions are being borne out in everyday experience, and can be connected to the micromedia trend. But those patterns of a new digital life- and workstyle are in no way exclusive to geeks, hackers and “digital natives”. The virtuosos of “life hacking” and the “re-mix culture” are a minority within the “Net Generation”. In Austria at least, the majority of users still don’t know any HTML, are not very skilled at navigating and searching the Web and lacking the kind of digital literacy needed for blogging. The same goes obviously for the average Microsoft Office worker – he is still quite different from the type of advanced “symbolic-analytic worker” Johnson-Eilola (2005) describes as not merely using, but *inhabiting* information.

The interesting thing is that the micromedia experience is not limited to digital natives. Most of the characteristics listed above can also be applied to the mainstream of students and digital workers, who are checking the e-mail-box more than once per day, are searching with *Google*, are using cell phones for lots of short calls to keep in permanent contact with their peers, or are just keeping more than one window open on the PC. The transition to digital micromedia environments is fully under way.

The so-called “information overload” is not so much a problem of “too much information”. It is the consequence of the clash of old media behavioral patterns and new kinds of micro-chunked, multi-channeled digital information.

The difference between the mainstream and the avant-garde of media users (who are better called media beings) is mostly that the latter are not just experiencing the general fragmentation of information and communication, but also develop positive strategies to cope with this: re-framing, re-constructing and re-using microcontent, integrating it into new kinds of patterns and threads. But increasingly this has not just been left to individual media competencies. In the last years a new wave of new online applications and services to support this has emerged.

3. Micromedia Technologies

To escape the hype-speak of the net-visionaries one has to look closely at the level where things really are happening. And this is not in the first place “the people”, as is often stated, but applications and interfaces: “Use your media tool, your mind will follow,” to bend a famous pop culture-quote. Not only are communities “built by software”, as a renowned software developer has put it (Spolsky 2003), but to a large degree, identities, knowledge and learning experiences too.

In the last years educational theory has been staggering behind the dynamical changes of Web technologies and practices. The real innovations in Computational Humanities or Cultural Informatics have been made by small teams of programmers experimenting with technologies with wide theoretical implications: the blogosphere, wiki-based collaborative texts, “folksonomies” and the like. These plain and simple online applications, interfaces and services not only “put the users in the center” but in fact transform the user through small software implementation details that result in big differences in the way the community (the individual, the knowledge worker, the learner ...) develops, behaves, and feels.

The focus on microcontent is the common denominator. A closer look on the main groups of applications shows some fundamental characteristics of the new micromedia environments that have to be understood to create new kinds of microlearning experiences.

(a) “Point of Presence”: The basic interface metaphors of the Web are about to change. Up to now we have still “pages” that are “read” and “sites” and “portals” that are “visited”. Web-shops and marketplaces supplement this by a rudimentary personalized cockpit-type of

interface, where users do not have to “go there and get it”, but feel like “being in control”. But the immersive “Web 2.0” interfaces take another radical step further: a point of presence, to borrow a term from network technology. Now users experience data really like a digital extension of mind: like being surrounded by a cloud of microcontent dynamically gathering and re-structuring in every moment. In the “Come to Me Web” (Vander Wal 2006) the desired information/communication/content is brought to the screen in an instant. And as the screen itself is changing from a window or a cockpit’s radar screen to a projection screen of the digital mind, this is obviously changing the role of future learners in a fundamental way.

(b) “Digital Life Aggregators”: The new point-of-presence-interfaces are typically designed with much white space. They are blank, because the users are expected to “write themselves into existence”, as David Weinberger (2002b) has put it. And now it is not only writing anymore, but doing a collage of quotations, links and annotations. New software applications support these practices. They encourage users to aggregate and re-mix all kinds of microcontent, from texts to pictures and audio-clips. The general tendency of micromedia seems points to a fundamental shift in the external and internal representation of the self, from being controlled and stable (like in a homepage) to taking on a vague and dynamic shape (like in a weblog).

(c) “Micro-conversations”: From the beginning, “social” applications like newsgroups and e-mail have been the real “killer applications” of the Web. “The Web is a conversation”, as Weinberger (2002) has put it. “Social Software” (see Allen 2004) was developed that is supposed to extend people’s social abilities and needs into the virtual world. But even “Friend Of A Friend”(FOAF)-services like *MySpace* or *LinkedIn* that are building on this metaphor are only as “social” as the early “live webcams”, uploading one photo every fifteen minutes, were “live”. Social software is not an extension of real world relationships and entities. “Online conversations” are made of digital texts with links, written and read by individuals being alone and staring at a screen. Even if one is communicating with one’s own family via social software, it feels different and creates new and different roles and personas. From a micromedia point of view it is therefore more interesting to ask exactly how the asymmetric threads of loosely connected micro-statements from different sources get to form networked “conversations”. From that new ways of designing and re-framing microcontent into more complex patterns could be derived.

(d) “Ubiquitous Web”: A new ecosystem is created, as microcontent-based media rip the traditional containers – digital “documents”, “web pages” and databases – into pieces (Weinberger 2002a). In this respect “multitasking” is not simply a bad habit of online addicts, but a natural reaction to the multiple options of consuming, producing and re-using microcontent on the web. And it is not restricted to the networked PC: The “attention crisis” is a symptom of the multimedia lifestyle that is already realizing an “ubiquitous Web”, integrating the PC, the Web, audiovisual media and, increasingly, mobile phones (Rheingold 2003). Different media and platforms converge into one digital wireless environment accessible from different devices and platforms. Microlearning will have to address this new environment.

(e) “Background media”: From the micromedia perspective, web-enabled phones play a most interesting part in this. They are “background devices” (Schick 2005) that seem to create a different layer of the mediasphere. While the user’s focus is elsewhere, they are always there, in a state of latency, until a call or an SMS is coming in and one can make the choice to bring it into the foreground. This is pointing to a new way of experiencing information, beyond the old push/pull-model (for a discussion see Hagel/Seely-Brown 2005), and relevant also to the Web. In a way the essence of microcontent and micromedia can be studied best when looking

at mobile content: How does it have to be designed, connected and clustered to form a rich information or knowledge environment? At present there is little semantically rich mobile microcontent to speak of, mainly because of the “walled garden”-strategies of mobile service providers and the extreme diversity of mobile operating systems. In opposition to the situation in the Web, mobile e-learning here actually plays the role of a precursor. Projects and applications like *Yiibu* (www.yiibu.com) or *Knowledge Pulse* (www.knowledgepulse.com) try to build on the new characteristics of mobile micromedia.

(e) “Knowledge Clouds”: In a micromedia environment the character of information and knowledge itself is changing. Fixed macro-structures get replaced by loosely coupled, open and dynamic micro-structures that form different kinds of semantic patterns. It can be compared to the difference between a book, made up of complex, highly structured and specific argumentation threads, and publishing an unordered collection of short excerpts and notes lying around the author’s desk. The “texts” are being formed on the spot, here and now, while with every change of context and every re-use not only the fragment itself is getting semantically enriched, but the whole semiosphere is charged with new meaning. This basic cognitive and cultural mechanism can be modeled by new micromedia technologies to create “InfoClouds” (Vander Wal 2003). The resulting “metaweb” finally leads to a new form of externalized knowledge centered not in the mind of the knower, but “in the Web”. This is the common denominator of techno-cultural concepts like “The Wisdom of Crowds” and “folksonomies”. The resulting microknowledge is instant, connective and “messy knowledge” (Downes 2005b, Siemens 2004, Price 2005).

4. Microlearning concepts and strategies

4.1 Microlearning, Nanolearning, E-learning 2.0

Microlearning is a term used in the e-learning context for a learner’s short interaction with a learning matter broken down to very small bits of content. At present this term is not clearly defined. Learning processes that have been called “microlearning” can cover a span from a few seconds (e.g., in mobile learning) to 15 minutes (e.g., learning objects sent as e-mails). The notion of microlearning raises the question of adequate pedagogy and didactics. In a wider sense the term that can be used to describe the way more and more people are actually doing informal learning and gaining knowledge in Microcontent and Micromedia/Multitasking environments, increasingly based on Web 2.0 and Wireless Web technologies.

Microlearning in that sense is closely related to the concept of “E-learning 2.0” as it has been brilliantly formulated by Downes (2005a), but as a term/buzzword has been much disputed. The rather small difference lies in a perspective that is focusing on microcontent as a definable elementary unit of the new micromedia ecosystem. It is not so much questioning supposed cognitive or social structures, but the semantic structures and the didactical concepts emerging from the interplay of micro-technologies and the use of micromedia.

“Microlearning content” is different from the old concept of “learning objects”. It is rather the ‘drops in the sea of information’ than the old and famous ‘Lego building block’ concept Hodgins (2001) and others had been simultaneously (and contradictory) been using.

Microlearning is especially different from the old e-learning concepts of “Just-in-time learning” and “Learning on demand” that even the pioneers of e-learning (like Jonathon Levy, Wayne Hodgins, Jay Cross, Sam Adkins) fused with anticipation of future media practices. And at least partly this is still the case in the recent attempt of Masie (2005) to introduce “Nano Learning”. But Masie is probably right in insisting that this is a new

“learning trend”, as the atomization of learning beyond the learning object (Menell 2005) seems to be a necessary consequence from the evolution of digital media environments.

4.2 Microlearning Spaces: “Die LMS Die!”

The space for living, working and learning created by microcontent-based media makes it very difficult to introduce the walled, static, macro-structured and control-orientated Learning Management Systems (LMS) that both academic and corporate institutions still prefer. Even much more loosely structured and learner-centered architectures of Personal Learning Environments (PLEs) that have recently been proposed are still trying to separate kind of separate “learnlands” from the “Wild Web” – be it on the desktop (e.g., the PLE project at Bolton University) or on the campus (e.g., Brown 2005). The ELGG platform is special in being a kind of blog-based social software PLE tailored for educational purposes, and on one hand is modeled after successful Web 2.0 applications and on the other, allows integration with structured Open Source LMSs. Notable is also the integration of an e-portfolio-feature that is not meant to measure student achievement but is a pre-configured space that should do what blogs do out there in the Wild Web: gradually building up a digital body of knowledge.

In the upcoming micromedia environment, in which all educational systems are embedded and will have to compete, there always will remain a structural tension. Basically LMS/PLE platforms may work if (a) used to sustain the community/connectivity of a very intensive, but short-term “real world”-course, or (b) if they are the virtual extension of very dedicated “communities of subject” (as is the case with the ELGG community itself), or (c) if they are – in a corporate context – a fully integrated part of a wider workplace-related Intranet and therefore do not feel like a separated “learning space”. But the basic question still remains: To what degree a microlearning environment can, or should, be pre-structured and kept separate, and at which point locking the microcontent in and blocking the micromedia-flow will lead to the dead and deserted ecosystem of the average *Blackboard* LMS. It has even been radically argued that any such artificially constructed environments are misguided from the start: The headline Blackall (2005) used is “Die LMS Die! You Too, PLE!”

The resulting very intense and important discussion is far too complex to summarize here (Blackall 2005, Cormier 2005, Wilson 2005a and 2005b). Blackall’s position has been acknowledged by Stephen Downes as a logical consequence of the E-learning 2.0 approach, though it is not clear, how open a knowledge/learning environment could or should get in different corporate or educational contexts. In general, though, educational platforms will always work only to the degree the free flow of microcontent in and out of the system is enabled and encouraged.

5. Future prospects for microlearning

Microlearning is not a special educational strategy in the first place, but something necessarily happening in converging micromedia environments. People are not swimming in data, like Hodgins (2001) suggested, but in microcontent. To the degree people are leaving their desktop to live and work on the Web they cannot help but microlearn. That is why *Google* has sometimes been called the most effective e-learning tool yet.

This informal microlearning has to be taken as a precondition for all future designs of e-learning experiences. Some of these will still be macro-structured, relying on courses and/or

on Learning Object repositories of some kind. But in any case they will be only successful if they are integrated into the “real digital world” of the Web as seamlessly as possible.

This micromedia ecosystem can be thought of as falling into different layers, the basic one being that of “wild microcontent” (Lindner 2005), as opposed to more structured layers like the attempts being made at creating intuitive standards for “structured content” or “microformats” (Rieger 2005, for discussion see Boyd 2005). What kind of role learning objects in the traditional sense can play in such an environment is intensely discussed (Downes 2005a, Wilson 2005b).

Microlearning will have to be casual, transcending the outdated push vs. pull paradigm. If one is swimming in microcontent, setting the focus of attention is less a matter of pulling or pushing, but of bringing microcontent from the background to the foreground, or the reverse. Microlearning will have to be more than sending a multiple-choice drill to mobile phones on the one hand or just dissolving learning as a whole as ubiquitous informal learning, on the other. To find appropriate designs for interfaces and flows, spaces and paths, patterns of re-framing and reconstruction for future microlearning experiences a lot of analytical and experimental work will have to be done.

And finally, microlearning will have to be based on a new, deeper understanding of microknowledge that has to start from the findings of Weinberger (2002), Siemens (2004) and Downes (2005b) about the connective nature of digital knowledge and then further progressing to the “clouds of knowing” (Edwards 2005). Microknowledge and Microlearning rely on fast circulation and a permanent process of semantical enrichment:

“It's not content, or even context, but process that gets us where we are going. ... Smallness is increasingly important in all data flows, and learning is simply another kind of dataflow. ... Knowledge vapor is simply learning liberated, in its smallest possible components.” (Parkin 2005)

Research leading to this paper has been part of an action programme of the Austrian Federal Ministry of Economics and Labour and has been supported by the Tyrolean Future Foundation.

References

Adkins, S. (2003) We are the Problem: We are selling Snake Oil. [Entry in weblog "Learning Circuit"] Retrieved February 16, 2006 from http://www.internetttime.com/scgi-bin/mt-fatback.cgi?__mode=view&entry_id=1014

Alexander, B. (2004) Going Nomadic: Mobile Learning in Higher Education. *Educause Review*, **39**, 5 (September/October 2004), 28–35. Retrieved February 16, 2006 from <http://www.educause.edu/pub/er/erm04/erm0451.asp>

Alexander, B. (2006) Web 2.0: A New Wave of Innovation for Teaching and Learning? *Educause Review*, **41**, 2 (March/April 2006): 32–44.

Allen, C. (2004) Tracing the Evolution of Social Software [Entry in weblog "Life with alacrity"]. Retrieved February 16, 2006 from http://www.lifewithalacrity.com/2004/10/tracing_the_evo.html

Blackall, L. (2005) Die LMS die! You too PLE! [Entry in weblog "Teach and learn Online"]. Retrieved at February 16, 2006 from <http://teachandlearnonline.blogspot.com/2005/11/die-lms-die-you-too-ple.html>

Boyd, S. (2005) Microformats v Structured Blogging: A Small War With Big Consequences [Entry in the weblog "Get Real"]. Retrieved at February 18, 2006 from http://getreal.corante.com/archives/2005/10/10/microformats_v_structured_blogging_a_small_war_with_big_consequences.php

Brown, M. (2005) Learning Spaces. In: Oblinger, D. and Oblinger, J. (Eds) (2005), *Educating the Net Generation*. An Educause e-Book. Chapter 12, 174-195. Retrieved February 16, 2006 from <http://www.educause.edu/ir/library/pdf/pub7101.pdf>

Cormier, D. (2005) What is this whole school thing about anyway? [Entry in "Dave's educational Blog"]. Retrieved on February 19, 2006 at <http://davecormier.com/edblog/?p=31>

Cross, J. (2004) An Informal History of eLearning. *On the Horizon*, **12** (2004), 3, 103 - 110.

Dash, A. (2002), Introducing the Microcontent Client. Retrieved February 16, 2006 from http://www.anildash.com/magazine/2002/11/introducing_the.html

Downes, S. (2005a) E-learning 2.0 [10/17/2005]. *eLearn Magazine* (10/17/2005) [Feature] Retrieved February 16, 2006 from <http://elearnmag.org/subpage.cfm?section=articles&article=29-1>

Downes, S. (2005b) An Introduction to Connective Knowledge. Retrieved February 16, 2006 from <http://www.downes.ca/cgi-bin/page.cgi?post=33034>

Edwards, Phil (2005) The Cloud of Knowing [Entry in weblog "Apparently ..."] Retrieved February 16, 2006 from <http://phenomenologic.blogspot.com/2005/06/cloud-of-knowing.html>

Hagel, J. and Seely-Brown, J. (2005) From Push to Pull - Emerging Models for Mobilizing Resources [Working Paper]. Retrieved at February 12, 2006 from <http://www.johnseelybrown.com/pushmepullyou4.72.pdf>

Haque, U. (2005) The New Economics of Media. Micromedia, Connected Consumption, and the Snowball Effect [especially slides 32 – 35, 51]. Retrieved February 16, 2006 from <http://www.bubblegeneration.com/resources/mediaeconomics.ppt>

Hirshheim, R. (2005) The Internet-Based Education Bandwagon: Look Before You Leap. *Communications of the ACM*. **48**, 7, 97-101.

Hodgins, H. W. (2001). The future of learning objects. In: Wiley, D. A. (Ed.) (2001), *The Instructional Use of Learning Objects* [eBook, online version]. Retrieved February 16, 2006 from <http://reusability.org/read/chapters/hodgins.doc>.

Johnson-Eilola, J. (2005) *Datacloud. Toward a New Theory of Online Work*. Cresskill, NJ: Hampton Press.

Jones, M. G., Harmon, S. W. & O'Grady-Jones, M. K. (2005) Developing the Digital Mind: Challenges and Solutions in Teaching and Learning. *Teacher Education Journal of South Carolina*, 2004-2005, 17 -24.

Leene, A. (2005) Microcontent is Everywhere. Retrieved February 16, 2006 from <http://www.sivas.com/microcontent/microlearning2005/microlearning.pdf>

Leinonen, T. (2004), E-learning Is Dead - Long Live E-learning. Retrieved February 16, 2006 from http://www.uiah.fi/page_exhibition.asp?path=1866,1917,2728,3352,6184,6770

Levy, J. (2001) The Ecosystem of eLearning 2005. White Paper for the Docent and Richardson Webinar (October 23, 2001). Retrieved February 16, 2006 from http://www.people.cornell.edu/pages/jl63/Ecosystem_of_eLearning_2005102401.doc

Levy, J. (2004) Putting Knowledge Workers' Knowledge to Work. *Distance Learning*, **1**, 2 (April 2004), 35 - 36. Retrieved February 2006 from <http://www.people.cornell.edu/pages/jl63/KnowledgeWorkersKnowledge.USDLA.pdf>

Lindner, M. (2005) Wild Microcontent [Entry in the weblog "mediatope"]. Retrieved at February 18, 2006 from <http://phaidon.philo.at/martin/archives/000318.html>

Manovich, L. (2000), Beyond Broadband: Macromedia and micro-media. In: Lovink, G. (Ed.) (2000): *net.congestion reader*. De Balie: Amsterdam. Digital version retrieved on February 8, 2006 from http://www.manovich.net/docs/macro_micro.doc

Masie, E. (2005) Nano Learning [Podcast transcript]. Retrieved on February 18, 2006 from http://www.masie.com/15/podcasts/15_u_podcast27.pdf

McLuhan, M. (1964) *Understanding Media: The Extensions of Man*. McGraw-Hill: New York, NY.

McLuhan, M. and Fiore, Q. (2001 [1967]) *The Medium is the Massage. An Inventory of Effects*. Produced by Jerome Angel. Ginko Press: Corte Madera, CA.

Menell, B. (2005) Atomization of Learning (Beyond the Learning Object) [Entry in weblog "Learning 2.0"]. Retrieved at February 5, 2006 from <http://learning20.blogspot.com/2005/11/atomization-of-learning-beyond.html>

Negroponete, N. (1995) Being Digital. Knopf: New York.

Neuhold, E. and Lindner M. (2006) Quo Vadis, eLearning? In Hug, T., Lindner, M. and Bruck, P. A. (Eds.) (2006) Microlearning: Emerging Concepts, Practices and Technologies after e-Learning. Proceedings of Microlearning 2005. Learning & Working in New Media (Innsbruck/Austria, June 2005), Innsbruck University Press: Innsbruck, 19-22.

Oblinger, D. and Oblinger, J. (Eds) (2005), Educating the Net Generation. An Educause e-Book. Retrieved February 6, 2006 from <http://www.educause.edu/ir/library/pdf/pub7101.pdf>

Parkin, G. (2005) Learning from vaporware: how small is the future? [Entry in weblog "Parkin's Lot"] Retrieved February 11, 2006 from <http://parkinlot.blogspot.com/2005/09/learning-from-vaporware-how-small-is.html>

Price, J. (2005) Object-Centered Sociality, or the Act of Being Kicked [Entry in the weblog "Smelly Knowledge"]. Retrieved on February 16, 2006 at <http://www.zappazoom.com/node/24>

Prensky, M. (2001) Digital Natives, Digital Immigrants. *On the Horizon*, **9**, 5, October 2001. Online version retrieved February 16, 2006, from <http://www.marcprensky.com/writing/default.asp>

Prensky, M. (2004) The Emerging Online Life Of The Digital Native. Retrieved on February 16, 2006 from http://www.marcprensky.com/writing/Prensky-The_Emerging_Online_Life_of_the_Digital_Native-03.pdf

Rheingold H. 2003. Smart Mobs: The Next Social Revolution Transforming Cultures and Communities in the Age of Instant Access. New York, NY: Basic Books.

Rieger, B. (2005) Structured Content [Entry in the weblog of www.yiibu.com]. Retrieved January 21, 2006 from <http://yiibu.com/content/structured-content/>

Schick, C. (2005) What are the true qualities of mobility? Retrieved February 16, 2006 from http://cognections.typepad.com/lifeblog/2005/09/what_are_the_tr.html

Siemens, G. (2004), Connectivism: A Learning Theory for the Digital Age. Retrieved February 16, 2006 from <http://www.elearnspace.org/Articles/connectivism.htm>

Spolsky, J. (2003), Building Communities with Software. Retrieved February 16, 2006 at <http://www.joelonsoftware.com/articles/BuildingCommunitieswithSo.html>

Tapscott, D. (1997) Growing Up Digital: The Rise of the Net Generation. McGraw-Hill: New York, NY.

Tosh, D. (2006) PLE's – Are they what the ePortfolio promised to be? [Entry in Tosh's elgg-weblog] Retrieved on February 19, 2006 at <http://elgg.net/dtosh/weblog/7365.html>

Spivack, N. (2003) The Birth of the Metaweb [Entry in weblog "Minding the Planet"]. Retrieved February 16, 2006 from http://novaspivack.typepad.com/nova_spivacks_weblog/2003/12/the_birth_of_th.html

Vander Wal, T. (2003) Welcome to the Personal Info Cloud [Entry in weblog "Personal Infocloud"]. Retrieved February 16, 2006 from http://www.personalinfocloud.com/2003/10/welcome_to_the_.html

Vander Wal, T. (2006) The Come To Me Web [Entry in weblog "Personal Infocloud"]. Retrieved February 16, 2006 from http://www.personalinfocloud.com/2006/01/the_come_to_me_.html

Weinberger, D. (2002a). Small Pieces, Loosely Joined. A Unified Theory of the Web. Cambridge, MA: Perseus Publishing.

Weinberger, D. (2002b) Bone Dry Future [Entry in weblog "JoHo - The Blog"]. http://www.hyperorg.com/blogger/archive/2002_01_01_archive.html#8939753

Wilson, S. (2005a) The VLE of the Future [Entry in weblog "Scott's Workblog"]. Retrieved at February 16, 2006 from <http://www.cetis.ac.uk/members/scott/blogview?entry=20050117150356>

Wilson, S. (2005b) Learning Resources – A (Personal) Educational View From UK. Retrieved on February 2, 2006 from http://www.theknownet.com/writing/elearning2.0/entries/scott_wilson_on_using_resources/s cottwilson-eduresources.pdf/attach/scottwilson-eduresources.pdf