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On the way towards Personal Learning Environments: Seven crucial aspects

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Summary
The practice of learning and teaching is not pre-determined, but always related to the tools and systems used in the process. The development and rising success of social software applications such as weblogs and wikis and so-called Personal Learning Environments (PLE) changes, enables and challenges learning with the Internet. PLE, especially in contrast to traditional Learning Management Systems (LMS), received significant attention and are about changing the paradigm of learning and teaching. This paper tries to underpin a better understanding of the underlying concepts of both approaches and, on the other hand, to emphasise the consequences and challenges of PLE and its rising usage for learning.

We have identified seven aspects where these changes are most obvious and/or important. To sum up, learning with PLE leads to changes concerning: (1) the role of the learner as active, self-directed creators of content; (2) personalisation with the support and data of community members; (3) learning content as an infinite “bazaar”; (4) the big role of social involvement; (5) the ownership of learner's data; (6) the meaning of self-organised learning for the culture of educational institutions and organisations, and (7) technological aspects of using social software tools and aggregation of multiple sources.

The vast number of tools, supporting collaboration on the web is an indicator that PLE and social software tools are not only a flash in the pan, but lead to a new notion of learning and a measure for sustainable competence development. Nevertheless, the existing approaches and ideas for PLE need further development and elaboration. With the discussion of the related shifts from LMS towards PLE and their challenges, this paper may serve as the basis for learners, teachers and educational institutions decisions for (or against) the technological concept of PLE, on a general level and taking into account its pedagogical implications.

Keywords
Virtual Learning System, Learning Management System, Personal Learning Environment, Social Software, PLE, LMS

Introduction: Different technological concepts for learning environments

The rapid technological progress influences the methods and possibilities of learning and teaching. With any new media technology, there has been contemporaneously a tendency to imitate existing educational paradigms (Geser 2007, 37). Besides the development of computer based trainings (CBT) and Web based trainings (WBT), which were the first attempts to support learning with computer and new media, the development of learning management systems (LMS) tried to simulate classroom learning with ICT. A LMS supports the management of learning content and learning activities, but with a focus on the traditional roles in a learning environment (teacher/learner).

In contrast to LMS, the Personal Learning Environments (PLE) are based on the idea of a user-centred learning approach, using Social Software tools. Social Software can be defined as software

that connects people and ensures collaboration and communication. The term Social Software can be used for describing a wide range of software applications, but it usually refers to some of the most recent developments in Web-based applications like Wikis, Weblogs, instant messaging (e.g. AIM[1], ICQ[2]), Social Bookmarking (e.g. del.icio.us[3]), media sharing (e.g. Flickr[4], YouTube[5]), social networking systems (e.g. MySpace[6], Facebook[7], LinkedIn[8]) (see Schaffert 2007) or so-called "location-aware services" (Plazes[9], Twitter[10], Jaiku[11])[12].

With the new possibilities of social interaction, the importance of content seems to decline to some extent. As a vast amount of content is already (out) there (in the internet), social interaction apparently becomes more important. The enormous amount of content that is currently available with applications such as the online encyclopaedia Wikipedia[13], social networking sites, or the Weblog index Technorati[14] with its more than 112 million indexed blogs serves as testimony. Social Software provides the flexibility that is needed particularly in informal and collaborative learning settings, where people with different prior knowledge, learning interests and learning activities learn collaboratively with or from others. This is the most important part of our daily learning activities. As a consequence, it is necessary to bring together pedagogical know-how and expertise about learning processes, taking today's established learning culture into account.

Based on the development of Social Software applications and the shift from the consumers to prosumers, the term and concept of "personal learning environments" (PLE) was introduced. According to Wikipedia, the term was first mentioned on a session at a JISC/CETIS conference in the year 2004 and a "virtual learning environment" vision of Scott Wilson can be seen as a first attempt to describe this new concept of a personal learning system interacting with Social Software applications and institutional services (cf. Wikipedia 2008).

Some authors see the PLE as the sum of all used tools (e-mail, browser, websites and applications) but according to a majority it is a technological realisation where Social Software applications and Web services are combined, e.g. as mash-up in a single portal for the purpose of learning. PLE are Web sites or services were learners are able to produce learning content or reflections and store documentations about their learning processes (e.g. Weblog postings). Furthermore, users should be able to aggregate data from their learning communities, e.g. through RSS feeds of interesting Weblogs. Examples for PLE applications are Netvibes[15] or WordPressMU[16] (a multi user Weblog), but also I-Google[17] or Flock[18] could serve as a PLE.

But even if these tools are handled or named as PLE, they are currently not able to connect and include interfaces to LMS or build on typically learning support as giving (automatic) recommendations for further learning steps according to prior knowledge and interests. Presently,

[1] http://www.aim.com/
[2] http://www.icq.com/
[3] http://del.icio.us/
[4] http://www.flickr.com/
[5] http://youtube.com/
[6] http://www.myspace.com/
[7] http://www.facebook.com/
[8] http://www.linkedin.com/
[9] http://plazes.com/
[10] http://twitter.com/
[11] http://www.jaiku.com/
[12] In recent times, social software is put on a par with Web 2.0. We would like to point out, that according to Koch and Richter (2007) the term "social software" relies on the human interaction (identity management, relationship management and information management) of the user, whereas Web 2.0 is related to the notion of users becoming active participants in the web. In other words, according to them, social software can be seen as a sub-class of Web 2.0, but it is not equal.
[13] http://www.wikipedia.org/
[14] http://www.technorati.com/
[15] http://www.netvibes.com/
[16] http://mu.wordpress.org/
[17] http://www.google.com/ig
[18] http://flock.com/

PLE is more a concept or vision, even if several projects deals with the development, for example the projects TENCompetence[19] or MATURE[20], both co-financed by the European Commission.

An Overview about seven crucial aspects for learning on the way from LMS towards PLE

Teachers and educational institutions have a special interest in supporting and fostering learning processes and activities of their learners. Especially if the institutions offer virtual learning phases to their students, the selection of tools and systems is an important factor. This decision may limit the learning and teaching processes, for example by the limited possibilities of interaction amongst the participants or by lacking of opportunities for learners to create their own content.

The decision to favour PLE for the actual learning processes while using LMS for purely administrative processes leads and influences (obviously) new learning and teaching settings.

Terry Anderson (2006) tries to point out the differences (and advantages) of PLE vs. LMS. He identifies six advantages, which are listed as: identity (learners have existence beyond formal school), ease of use (customisation by the user him/herself), control and responsibility of ownership (content belongs to the user), copyright and reuse (the owner and not the institution has to make these decisions), social presence (support of communication and "online culture") and capacity of speed and innovation (new applications evolve rapidly and new features invade the PLE conglomerate in the learning setting).

There are several others presentations, statements or discussion to be found in the Web or on conferences. The following table provides an overview about seven crucial aspects of the shift from LMS to PLE that we identified as important changes and challenges. The chosen aspects and arguments build on our review of publications, presentations and discussions which are ongoing and the crucial aspects the experts are discussing (e.g. Attwell 2007) and own investigations in the field of web-based innovations for learning (e.g. Schaffert, Bürger, Hilzensauer & Schaffert 2008.

Therefore we distinguish between technological concepts as LMS or PLE and learning or teaching concepts and methods. From our point of view LMS and PLE are both technological concepts that both allow several pedagogical methods or personal learning strategies. But as we will illustrate, the technological concepts limit or guide the concrete learning setting. So, this contribution can serve as basis for decision of learners, teachers or educational institutions for (or against) the technological concept PLE on a general, conceptual level and its pedagogical implications.

		LMS	PLE	challenges & shifts
1	role of learner	learner as consumer of pre-defined learning materials, dependent on the "creativity" of the teacher	active, self-directed, creator of content	shift from consumer to "prosumer", self organisation is possible AND necessary
2	personalisation	... is an arrangement of learning assignments and materials according to a (proposed or pre-defined) learner's model, based on an underlying expert system	... means to get information about learning opportunities and content from community members and learning services fitting to the learner's interests (via tags/RSS)	competence for usage of several tools and a self organisation is needed
3	content	developed by domain experts, special authors, tutors and/or teachers	the infinite "bazaar" of learning content in the Web, exploring learning opportunities and services	necessary competences to search, find and use appropriate sources (e.g. Weblogs)
4	social involvement	limited use of group work,	the community and the	community and

[19] http://www.tencompetence.org/
[20] http://mature-ip.eu/

		focus on the closed learner group (e.g. in the LMS), collaboration and exchange not primarily in the focus	social involvement (even in multiple communities) is the key for the learning process and the recommendations for learning opportunities	collaboration as the central learning opportunities
5	ownership	content is generally owned by the educational institutions or the students, due to technological reasons, this ownership can not always be realised	content is organised in multiple, Web-based tools, ownership is controlled by the learners themselves and/or (commercial) service providers	awareness of personal data is needed
6	educational & organisational culture	imitation of classroom learning, course-orientated, teacher-orientated features	self-organised learner in the focus	change of learning culture and perspective – move towards self organisation and self determination
7	technological aspects	classical learning content needs interoperability between LMS and data repositories	Social Software tools and aggregation of multiple sources	required interoperability between LMS and the Social Software

Table 1: An overview about seven crucial aspects of the shift from LMS to PLE

Within the following deliberations we would like to illustrate the possible changes and impacts concerning the learning setting.

1) The learner as "prosumer"

As mentioned in the introduction, the possibilities for self-direction and self-organisation of different learning activities within LMS are limited by the (pre-defined) educational settings of the virtual classes, for example if a discussion forum implemented. Similar to the World Wide Web in its first 10 years, the role of the learner is limited to being a "consumer": (S)he is able to browse, read and use materials (e.g. tests or educational games) but has no possibilities to being actively engaged in the production of (learning) content.

Within PLE, the active participation on (collaborative developed) content development, for example blog postings, contributions to Wiki pages or participation in discussion forums or commenting on Weblog posting from other community members, are the central idea of this new concept. Learners are not, as in the Web 2.0 discussion often emphasised, only consumers of learning materials, but become (also) producer of (learning) content. This new role can be called "prosumer".

Educational experts often refer to the constructivist learning theory when talking about a learner centred approaches focussing on the learner's interests and (informal) activities. Originally a philosophical approach, constructivism it also used and adapted to the field of learning. The constructive view on learning results in a design of a learning environment facilitating the construction of learner's own knowledge: "The ideas underlying constructivism suggest that we shift from designing learning environments that instruct to designing environments that influence the structure of autopoetic unities in ways that conserves organization and adaptation" (Knuth & Cunningham 1993, 167). Self-organised learning can be seen as an activity in which individuals are primarily responsible for their own planning, their performance and their evaluation of learning activities in order to attain specific learning goals. A related concept is called "self-directed learning". Malcolm Knowles describes this approach as a process "in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes" (1975, 18).

Whereas the concept of LMS limits the role of learners to the possibilities of the learning management system and the creativity of the teachers, the concept of PLE focuses on active, self-directed, creators of content. Hence, the "Web 2.0" shift from "consumer" to "prosumer" can be observed here.

Whereas the self organisation of learning is often seen as the base for competence development and lifelong learning abilities which should be started to be developed even in schools. What makes it difficult is that self organisation can not be assumed for every learner, even if she is an adult, the learner could need additional support, tutoring and perhaps training in self organising his/her learning. Besides the competencies, the need for self organisation challenges the reachability of target groups: Not only the computer and the Internet are factually exclude several groups or milieus from learning or education, the concept of "self organised learning" itself could be also seen as a concept fitting to middle class milieus and so excludes target groups that prefer teacher-centred approaches (cf. Bremer & Bittlingmayer 2008, Reinmann 2008).

2) A new perspective on personalisation

In LMS, the possibilities of personalisation are limited. For example a learner receives "success" to his/her special courses or classes. A deeper differentiation of instruction or learning materials or even personalisation is related to the teacher and his creative ideas, but very seldom implemented in a LMS.

Nevertheless, personalisation plays a bigger role in other concepts: Personalisation in e-learning is traditionally related to so-called intelligent tutor systems (ITS). Especially in the traditions of artificial intelligence, approaches were developed to "personalise" and "adapt" learning content to the learner's needs with the usage of expert systems. Technological solutions were developed in the fields of intelligent tutoring technologies or adaptive hypermedia technologies. E.g. the approach of "instructional design" is based on the idea of the possibility to support learning in well-dosed, sequenced instruction bits.

In Web based trainings (WBT) these instructions are adapted automatically in relation to prior learning, learning styles or learners preferences. Particularly in the domain of artificial intelligence the possibility of automated "content personalisation" is considered to be an automatic adaptation of the learning content to the learner's profile (facilitated by some intelligent reasoning). So-called "intelligent tutors" were built to support learning: "the server should appear to act as an intelligent tutor both with domain and pedagogical knowledge to conduct a learning session. It should use a presentation planner to select, prepare, and adapt the domain material to show to the student. It also must gradually build the student model during his session, in order to keep track of the student's actions and learning progress, detect and correct his/her errors and misconceptions, and possibly redirect the session accordingly" (Devedižić 2006, 32).

Within Learning Management Systems, personalisation plays a lesser role. With the introduction of the SCORM standardisation (SCORM 1.3, 2004), the first attempt to personalisation in LMS was undertaken. This enables the LMS to guide a learner through a pre-defined learning process. Users have to achieve a certain percentage of a test in order to access the next level. Having a closer look at this type of personalisation, is becomes apparent that this only leads to an even more rigid corset of pre-defined learning process.

These approaches for adapting learning content to learners' interest, needs and prior knowledge are not suitable for self-organised learning because with such intelligent tutoring systems, the possibilities are generally limited to structuring and organising learning steps.

Within PLE, "personalisation" focuses on activities and possibilities to arrange structure, tools, (external) aggregated materials, look-and-feel and so on. Personalisation means, to get information about learning opportunities and content from multiple communities and services fitting to the learner's interest. The sources of information are selected by the learner him- or herself. Self organisation of learning and a selection of appropriate learning (re)sources within PLE are not only an

opportunity for the learner. It is also a challenge to think about their competences and their (required) pre-knowledge: about using Social Software tools, coping with different learning strategies and their status of media literacy.

3) The bazaar of learning opportunities from peers and experts

In LMS, the roles of the participants are clearly defined and described and are central for the possibilities to act within the system: The content within LMS is developed by teachers, which are mainly experts of a special domain.

While several approaches exist that reason about the integration of information environments (e.g. digital libraries) and Learning Management Systems (McLean & Lynch 2003), none tackles the integration of information from Web 2.0 with Learning Management Systems, e.g., professional and user-generated content and community and user profiles on the Web with traditional e-learning standards. Nowadays, there are attempts to implement interfaces in LMS to external Web content and applications but these possibilities for integrating Social Software in LMS are in its infancy (cf. Daalsgard 2006).

Besides this, in PLE does not only contain (learning) content of experts or teachers: the community, "peers", other learners with same interests, "friends" or colleagues, or even not personally known persons build the base of the bazaar of learning opportunities. Here, PLE profit by the creation, offer and usage of Open Educational Resources: According to the Geser (2007, 20) "open" means therefore that the content (inclusively meta data) is provided free of charge, that the content is liberally licensed for re-use, favourable free from restrictions to modify, combine and re-purpose, that it is produced in open format and designed for easy re-use and developed and hosted with open source software (see also e.g. Schaffert & Geser 2008).

Nevertheless, the change from content that was developed by experts and/or teachers towards possibilities and challenges to make use of the bazaar of learning opportunities and content leads to the necessity of advanced self-organising and searching in the Web – in other words: media competent learners. But it has to be taken into account that there is a general discussion going on that the next generation of learners is not (as often claimed) media literate. Current research (cf. Schulmeister, 2008) claims that there is no "net generation" which deals differently with new technology. So actually, there are no digital natives requiring a different type of teaching. Nevertheless, users of the next generation will focus more on the different (learning) processes supported by technology rather than on technology itself.

The main challenge will be the integration of different learning settings, different learner groups and different sources. Within PLE, we assume that the integration can be implemented more flexible and almost seamlessly, whereas LMS hinder these evolutions.

4) Social involvement and the role of community

We do not claim that it is not possible to build and foster a strong collaboration among peers in an LMS, but this belongs not to the core idea of the technological concept: Collaboration and exchange of peers is not in the focus of the LMS concept. LMS offer the opportunity to add discussion forums and sometimes also collaborative (Wiki) spaces. The concept of LMS ignores or overlooks the role of other humans and the community.

Current learning theories and approaches emphasise the importance of social involvement for motivation, construction of knowledge, or as a source for support. For example, they play an important and central role in concepts based on constructivism: learning shall be a recursive, self-referential process and needs stimuli and challenge from others (Siebert 1998). For example, the approach of "community of practice" by Etienne Wenger (2004) is dealing with learning in social networks and interlinked structures of the World Wide Web. It is the combination of the following three elements that constitutes such a community of practice: (a) a shared domain or interest in which one does not necessarily need to know the others, (b) an engagement in joint activities and discussions,

to help each other, and to share information and (c) the presence of practitioners and the development of a shared repertoire of resources as experiences, stories, tools, and ways of addressing recurring problems. According to Wenger (2004), the development of these three elements in parallel cultivates a community of practice. The PLE uses these possibilities for communities and creates new forms of interaction and collaboration.

Within PLE, it is apparent that the connection to one or more learning communities serves as a key driver for learning. Speaking more technically, PLE always needs and builds on communities. They are needed for contributors, co-actors, and last, but not least, for someone to add /recommend (new) learning content and/or metadata to existing content.

5) Ownership and protection of learner's data

Ownership and protection of learner's data are important factors but only rarely taken into account. However, from our point of view, it should play an important role for the implementation of technology enhanced learning, especially in educational settings and for policies. For the shift from LMS to PLE, it is apparent that the problems concerning owner rights also change.

The learner's data within LMS are often sealed in these tools and can just insufficiently be (re-) extracted by the learner him-/herself. So, even as owner of the content and data, the learner has in fact limited possibilities; his/her data is under the control of the educational institution or organisation. PLE and their openness to the world, even within social networks like Elgg[21] or social networking sites like Facebook[22] (which have restricted access for public viewing) follow a different approach: Here, all data and other available information is nearly totally open to the world. As the users usually do not run their own Web server, they probably use (free of charge) Web services and free Web based tools. Neither the personal data nor the copyright of individually created content is protected by these service providers. This leads to the necessity to provide learners and users of PLE with the awareness of the protection of personal data, additionally the awareness to provide own back-ups and copies of the data, stored on services in the Web.

6) (Learning) culture in educational institutions and organisations as a consequence and enabler

As above mentioned, LMS contributes to traditional ways of organising learning and education: in lessons, courses, classes, from the perspective of administration and a focus on the teacher as an expert.

The concept of PLE concentrates on active learners who are responsible and have the opportunities to arrange their own learning environment: The usage of PLE or new forms of learning with Social Software in general can be characterised as self-directed, decentralised, dynamic, communicative, and situated within communities of practice, and learners are in the same sense consumers and producers of content.

So, educational institutions as well as vocational and on-the-job-training in the industry seem to be based on different requirements, which do not fit automatically into this notion of “E-Learning 2.0”, as introduced by Stephen Downes (2005) recently. As current research has shown, the change of a “learning culture” as a whole and a certain amount of openness in the whole enterprise can serve as fruitful ground for new (vocational) learning in enterprises. Enterprises, which have already adapted their company culture towards an open and free space for individual development and open learning, have recently been coined as “Enterprise 2.0” (Hilzensauer & Schaffert 2008).

[21] http://elgg.org/
[22] http://www.facebook.com

7) Technological challenges

Currently, the technological developments concentrate on (but are not limited to) the interchange between different, extra institutional data repositories. As there is a growing amount of freely available content, there is a necessity to link between these existing materials and to provide an accurate metadata structure. This implies that, in order to be standards compliant, both, the learning content and the learning management system, must ensure that resources, which are about to be connected, are compatible (IEEE 1990). But, as LMS are organised in a hierarchical structure, where authors (the so-called domain experts) decide which (external) content to link or aggregate, the challenge in this discussion is to provide a dynamic and flexible interface to set up and maintain the list of external resources. Talking about personalisation, the problem becomes crucial when authors want to provide materials, which should support different users in there different phases of the learning process. The challenge is to find a (technological and procedural) solution in order to support the learners effectively.

PLE, on the other hand, build on accessibility and usage of Social Software applications and tools and therefore need as well a channel for the interchange of information. Contrary to existing e-learning standards (LOM, SCOM, IMS-LD), the need for data exchange concentrates on more open standards like RSS, XML or RPC. Focusing on the advantages of Social Software tools for self-organised learning, there are several projects that try to combine the concept of LMS with the opportunities of PLE: The success of Social Software in combination with learning leads to questions about possibilities for integrating Social Software in existing stand alone systems (LMS) or to separate them as a number of distributed applications (Daalsgard 2006). Currently, most projects concentrate on integration with existing Learning Management Systems, others propose to implement loosely-coupled tools on top of existing Learning Management Systems; to augment them with Social Software tools as kinds of “overlay networks”.

Opening the Web2.0 for learning does not only mean that one gets access to a mass of articles but also to the knowledge of experts by exploring their bookmarks. However, suggesting this loose connection between two largely distinct worlds (i.e., the Web as an open environment and LMS as a closed system in which interoperability is ensured by a set of standards) entails an investigation into other ways for ensuring interoperability than currently implemented standards.

So, last, but not least, the shift or the inclusion of Social Software and the concept of PLE in existing LMS system also rises new questions and challenges of technological nature.

Outlook

To sum up, these seven aspects shown the fundamental differences of the conception of LMS and PLE and where new opportunities and challenges may lead. Whereas these challenges need – from our perspective – a rising awareness among the promoters of PLE, we also see that the current requirements of competence development, the call for supporting open educational practices and informal learning activities and a shift from rather static and instructor-based learning to a more user-oriented, socially-enhanced learning is needed. The support of PLE or Social Software in general is crucial for the individual competence development (Fiedler & Kieslinger 2006) but as we had discussed not be seen as fitting to all target groups and settings. Additionally, the knowledge society demands competencies and skills that require innovative educational practices based on open sharing and the evaluation of ideas, fostering creativity and teamwork among the learners, which can be provided by PLE.

The vast number of tools, supporting collaboration on the Web is an indicator that PLE and Social Software tools are not only a flash in the pan, but lead to a new notion of learning and a measure for sustainable competence development. Nevertheless, the existing approaches and ideas for PLE needs further development and elaboration, the current research and practice show several interesting feature which could be used in further realisations. These could be, but are not limited to ideas as semantic analysis of learning activities, tagging opportunities with a focus on appropriateness for learning, visualisation of communities and persons with similar (learning)

interests, new approaches to content and network analysis, and a technical integration of different LMS.

Last but not least, the reality of learning and educational practice is not only a technical question, "although changing technologies are key drivers in educational change" (Attwell 2007): The challenge for educational practice will be to develop, realise and establish new approaches for learning and didactical concepts which builds on the advantages of the concept of a PLE, they should not maintain a teacher-centred and passive approach of learning. The facilitating of open educational practices as the e-portfolio method is needed (cf. Attwell, Chrzaszcz, Hilzensauer, Hornung-Prähauser & Pallister 2007).

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